



## Environment at **UNSW**

As a global leader in environmental sciences, UNSW Sydney is at the forefront of research and the development of practical solutions to the world's most daunting challenges.

These research capabilities have the potential to reduce waste through enhancing the recycling of unwanted materials, promoting a circular economy and creating jobs and industries in metropolitan, rural and regional areas.

Particular strengths include our research into climate change, environmental policy and natural resource management, with many of our academics providing solutions and advice to government, industry and not-for-profit organisations.

Beyond waste solutions, UNSW also has enormous capacity in fresh and marine water projects, climate change, and strong links into biodiversity management.



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## Transforming the waste economy SMaRT@UNSW – creating jobs and reducing waste through recycling science and microfactory technology.

The SMaRT Centre has developed green microfactory technologies capable of turning many types of common waste streams into new feedstock for manufacturing and into new, saleable products.

The SMaRT Centre's microfactory technology promises to create new jobs across metropolitan, rural and regional Australia. It has a track record of commercialising recycling technology such as its 'green steel' innovation.

The SMaRT Centre is currently partnering with industry and non-government organisations, however moving the technology away from the laboratory bench to become scalable in the marketplace requires government and industry support.

Government support and incentives are particularly important to encourage business to adopt recycling technology.

"The growing waste crisis has brought into sharp focus that Australia's waste is Australia's problem, at the same time that consumers are seeking to reduce environmental impacts and create more sustainable outcomes across all areas of our society. We now have the technology to do that but broad support across government and business is required for it to be commercially viable."

**Professor Sahajwala**  
Director, UNSW's Centre for Sustainable Materials Research and Technology (SMaRT).

### Transformation of waste into resources: SMaRT Centre's microfactory technology can:

- Turn **old clothes and textiles** into flat panels for buildings
- Turn **coffee grounds and used coffee cups** into stools, 'coffee' tables and building materials
- Turn **wood waste** and used timber into flat panels for building
- Turn **e-waste** (electronic) items such as printers, phones and computers into feedstocks for 3D printers from the plastics recovered and valuable metal alloys
- Turn **mixed waste plastic** into feedstocks for 3D printers for use in new plastic manufacturing
- Create engineered stone-like products including bench tops and tiles from **glass, mixed waste, wood and plastic**
- Recycle aluminium from **coffee capsules**

### Market opportunities and products:

- Green ceramics
- Acoustic tiles
- Building products such as flat panels
- Designer furniture (tables and seats)
- 3D filaments for making spare parts and new high-value products
- Green aluminium from recycled coffee capsules

### Microfactory environmental benefits:

- Reduces overall levels of pollution
- Reduces waste transport impacts
- Reduces need for creation of virgin feedstock

### Microfactory economic and social benefits:

- Can be located at small sites such as waste tips, manufacturing sites or where waste stockpiles are located
- Suited to rural and regional locations
- Creates new jobs, supply chains and manufacturing solutions
- Creates a revenue stream for the operator - modelling shows return of investment in about three years
- Enhances the creation of a true **circular economy**
- UNSW's microfactories can operate on sites as small as 50 square metres and are able to exploit multiple input streams and waste wherever it may be found. The SMaRT Centre is hoping to partner with a number of small businesses and councils.

### In short, the technology creates new jobs and reduces waste.

Microfactory technology delivers sustainability, job creation and economic revenue. It has the potential to play an important role in meeting the national waste crisis, meeting EPA waste and circular economy goals and enhancing Australia's reputation as a hub of innovation.

## Breakthroughs in the management of marine systems – the work of Professor Emma Johnston

Professor Emma Johnston AO, Dean of Science, is a marine ecologist who has made influential contributions to our understanding of the community ecology of marine life, both within Australia and globally.

By applying ecological principles to the study of human impacts on marine life, she has created a highly original program of research that not only progresses our fundamental knowledge in ecology, but also provides recommendations to enable significant improvement in the management of marine systems.

Professor Johnston's research breaks new ground in developing field-based experiments examining interactions between pollution, disturbance and community dynamics in marine ecosystems.

Professor Johnston is a leader in the global development of molecular approaches to biomonitoring the biodiversity and functioning of estuarine ecosystems. Her work helps identify public health risks and damage to agriculture, fisheries and Australia's port facilities. Her detailed, robust understandings of biological invasion have enabled governments and policy makers to prioritise management actions.

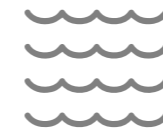
Her research into the mechanisms by which humans are changing the temporal ecology of marine ecosystems has proven critical to the re-design of environmental management required by rapid climate-induced ecological change.



### An interdisciplinary approach

Professor Johnston leads a dynamic team of scientists from industry, museums, CSIRO, state government and natural resource management agencies in the development of a much-needed national system of estuarine health monitoring. The team is now leading the way for the next-generation of molecular tools for the observation of toxicant impacts on ecosystem structure and function.

The outcomes of Professor Johnston's research have been widely used by government departments and agencies to inform their management approaches, either directly or as part of the evidence base for policy development.



## Water research expertise

### Global Water Institute

**The UNSW Global Water Institute (UNSW-GWI) is a world-leader in water research, innovation and problem solving.**

UNSW-GWI is a multi-disciplinary powerhouse comprising over 400 researchers, staff and PhD students from seven faculties and 13 specialist centres across UNSW. The Institute is founded on UNSW's history of excellence in water and research and its application to industry and public policy.

Global water issues have never been so prominent and the demand for solutions never so high. UNSW's researchers, who have had major impacts on water management practice in Australia and overseas, are committed to the urgent protection of this essential resource in perpetuity.

### Rivers and wetlands research

For more than 30 years, **Professor Richard Kingsford** (pictured right) has surveyed waterbirds in rivers and wetlands. His research has had a profound impact on water management practice in Australia and overseas.

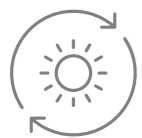
Professor Kingsford's research has been adopted by government agencies as part of water management plans for several major Australian wetlands. This includes internationally important wetlands listed under the Ramsar Convention (for example Macquarie Marshes) and water systems including the Murray-Darling and Lake Eyre Basins.

**With active government and industry support UNSW-GWI can fast-track goals of:**

- Addressing regional water issues - drought and access to good quality water
- Water and wastewater treatment and sanitation
- Coastal and estuarine management
- Partnering with government to trial and apply innovative water technologies
- Arresting the rapid loss of aquatic biodiversity and ecosystem decline
- Public health and social science
- More efficient irrigation to meet the growing demand for food
- Adapting to the effects of climate change
- Sourcing renewable hydropower sustainably
- Education and capacity building

**UNSW-GWI connects research to water policy development and on-ground management.**





## Excellence in climate research

The **Climate Change Research Centre (CRCC)** is a world-class research institute focused on climate system science to help better understand, predict, and adapt to climate variability and climate change.

It is one of the largest university climate research facilities in Australia, and is administered within the School of Biological, Earth and Environmental Sciences (BEES) at UNSW Science.

The CCRC has key expertise on the Earth's climate with a focus on atmospheric, oceanic and terrestrial processes. It applies scientific principles to pressing questions on climate dynamics, global climate change, and weather extremes. Researchers engage in public outreach and advise government, businesses and industry sectors on climate science and the causes and impact of global warming.

### Climate science that counts

The CCRC plays a key role in investigating the influences that have the greatest impacts on Australia. The Centre's extensive research in ocean science has helped us understand the significant role the El Niño Southern Oscillation, Indian Ocean Dipole and Southern Ocean circulation play in droughts and our seasonal and long-term climate.

The Centre has worked with multiple government agencies including the Office of Environment and Heritage and Sydney Water to improve regional projections of climate change impacts in areas of high importance to NSW through the NARcliM project. Its policy relevant research is helping NSW adapt to a warmer climate, understand changing air quality in our cities, prepare big business for climate related economic impacts, explain intensifying bushfire behaviour and explore the impacts a warming climate has on our health system from a physical and mental perspective.

### With the active support of government and industry, the CCRC can fast-track:

- Partnerships to expand research into climate impacts and risk assessment
- Collaborations with state and federal governments for policy-relevant research, including the role of different energy technologies in shaping future greenhouse gas emissions
- Work with schools and communities to communicate the value and impact of climate science

### Advancing climate sciences

Via the CCRC, UNSW leads the **ARC Centre of Excellence for Climate Extremes (CLEX)**, a multi-university initiative to advance fundamental climate science in Australia. CLEX is led by UNSW scientist **Professor Andy Pitman** and aims to understand what triggers extreme events and integrate this into climate modelling systems.

Current research involves examining extreme rainfall, heatwaves and cold air breakouts, drought, climate variability and teleconnections.

Professor Pitman is an international expert on terrestrial processes in climate models, model evaluation and earth systems approaches to understanding climate change. As a lead author for the Intergovernmental Panel on Climate Change (IPCC) Assessment reports he was recognised for his contribution by the award of the Nobel Peace Prize to the IPCC in 2007. He has helped improve Australian climate models and created strong partnerships across disparate areas of the Australian and international climate science communities.

### CCRC research expertise:

- Climate
- Oceanography
- Atmospheric science
- Ecosystems
- Carbon cycle
- Terrestrial processes
- Climate impacts
- Energy policy
- Climate model evaluation
- Paleoclimatology



## Biodiversity management expertise

A wide range of UNSW scientists from the School of BEES, including Professor David Keith and Professor David Eldridge, are working to safeguard our ecosystems through improved biodiversity management and ultimately create a sustainable future for our ecosystems and the diverse life that populates them.



### PLANT ECOLOGY - Professor David Keith

Professor Keith is a world-leading plant ecologist specialising in the management of species populations and ecological communities, risk assessment for biodiversity conservation and fire ecology.

He is a serving member of the Australian Threatened Species Scientific Committee and the standards committees for the International Union for Conservation of Nature's Red List of Threatened Species and Red List of Ecosystems.

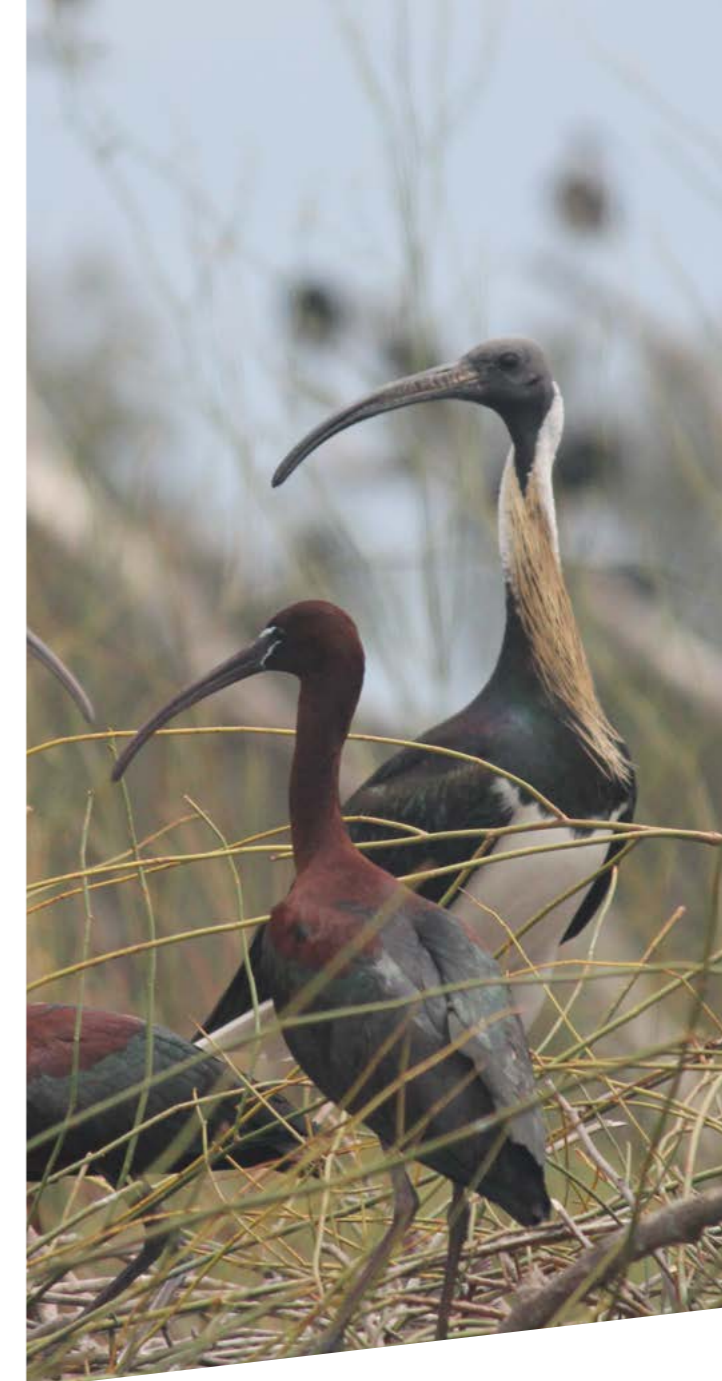


### DRYLAND SCIENCE - Professor David Eldridge

Professor Eldridge is head of UNSW's Arid Ecology Lab and holds the position of Senior Principal Research Scientist with the NSW Office of Environment and Heritage. His applied research focuses on semi-arid woodlands of

eastern Australia, with the goal of understanding more about the impacts of human induced land uses in drylands and the links between land-use change and environmental change.

Drylands are critically important because they support about 40% of the global human population, are used extensively for pastoralism, are often centres of human conflict and are likely to experience substantial changes in land use due to predicted changes in climate.



## UNSW: A global leader in environmental sciences

UNSW scientists are highly committed to the protection of the natural world by finding solutions to the world's major environmental problems and meeting current challenges in biodiversity and sustainability.

Many academics currently work closely with state and federal government, the CSIRO and agencies for management of our environment.

UNSW's strengths place it in a central position to collaborate with government and industry to find positive outcomes for the environmental challenges we face within Australia and internationally.

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