RESOURCE EFFICIENCY AND NATURE-BASED SOLUTIONS FOR SUSTAINABLE DEVELOPMENT

- ENERGY
- ATMOSPHERE
- FOOD SECURITY
- WATER QUALITY
- MINERALS AND METALS

Africa is rich in natural resources, yet natural resource depletion is a critical concern for the continent's economic development and growing population. UCT is a leader in research that focuses on resource efficiency to maximise social value and minimise waste, drive sustainable development through responsible mineral beneficiation, and leverages nature to protect and restore ecosystems on our continent. Our research aims to develop innovative technologies and practices to reduce resource consumption and waste, while promoting renewable energy and food security.

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Energy

Most African nations remain heavily reliant on fossil fuels and South Africa is more coal-dependant than any industrialised economy. At the same time, the country and continent face growing energy demands and environmental challenges. UCT's research in renewable energy plays a pivotal role in developing sustainable and clean energy solutions tailored to our region's unique needs. By fostering innovation and understanding the diverse renewable resources available in Africa, UCT contributes to mitigating climate change, increasing energy access and driving socio-economic development on the continent.

ENERGY SYSTEMS RESEARCH GROUP (ESRG)

ESRG combines energy and economic systems modelling with policy analysis and field-based research. The research group aims to generate and enhance knowledge of energy systems at sectoral, regional, national and sub-continental scales, focused on the country and the SADC region. Their work has had significant policy impact supporting South Africa and the region towards a net-zero future.

Atmosphere

Africa faces unique challenges related to climate change, air quality and the impact of atmospheric conditions on various sectors, including agriculture and health. UCT's atmospheric research contributes to understanding and mitigating these challenges. This work offers insights into regional climate patterns and air quality which are vital for sustainable development and public health in Africa.

CLIMATE SYSTEM ANALYSIS GROUP (CSAG)

CSAG is one of the leading climate research groups in Africa. It is uniquely positioned to target critical knowledge needs and contribute to a broad spectrum of climate change activities. CSAG focuses on the generation of robust, relevant, regional climate change information while advancing an understanding of the dynamics and processes that drive the coupled climate system. The unit strongly focuses on climate modelling and climate change studies, but also has numerous projects that deal with atmospheric research issues pertinent to the country and region.

MARINE BIOGEOCHEMISTRY LAB (UCT-MBL)

The **UCT-MBL**, the only one of its kind in Africa, is a world-class oceanic and atmospheric biogeochemistry laboratory established to address large- and small-scale research questions in earth science, particularly those that leverage South Africa's geographic advantage. The lab is equipped with cutting-edge infrastructure that is available to support high-quality, high-visibility and high-impact research and to train the next generation of South African earth scientists.

Food security

In Africa, in both cities and rural areas, food system challenges pose significant obstacles. The rise in diet-related non-communicable diseases further emphasises the urgency of addressing food security issues. Research at UCT reveals the intricate intersections between the built environment, infrastructure and issues of poverty and inequality, providing a holistic perspective on the complex dynamics that influence food and nutrition outcomes.

URBAN FOOD RESEARCH UNIT (UFRU)

The **UFRU** research group, based at the African Centre for Cities, was established in response to the growing interest in urban food systems and their links to sustainable urban development. One key project is The Nourished Child, co-led by researchers from City University in London and Stellenbosch University in South Africa, with UNICEF as one of the partners. The project aim is to define and communicate what a systems approach to improving the quality of diet among children under five and women of childbearing age would look like in urban settings, to address the burden of malnutrition.

Water quality

Africa faces the pressing challenges of climate change and rapid urbanisation which have significant impact on water availability, quality and resilience. UCT's research in this field addresses the urgent need for water-sensitive approaches that can meet current and future demands while considering the complex dynamics of climate change and urbanisation. This reflects the university's commitment to finding innovative, sustainable and resilient solutions to safeguard water resources in Africa. These play a pivotal role in public health, agriculture and overall ecosystem health.

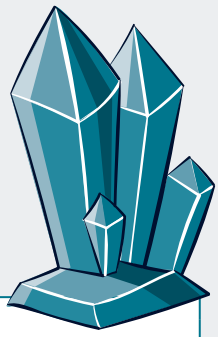
FUTURE WATER INSTITUTE

Future Water conducts engaged research on water-sensitive approaches that sustain society's current and future water needs. It is driven by the urgent need to enhance capacity for managing water scarcity and building resilience; to innovate so that water supply meets demand; and to ensure technically sound, socially acceptable and sustainable water management policies and practices. A flagship initiative is the Water Hub, an experimental facility at an abandoned water treatment plant. In partnership with the local municipality and regional government the hub is focused on research, demonstration, training and recreation. It is the first of its kind to exhibit state-of-the-art techniques and technologies suitable for the African context.

CENTRE FOR BIOPROCESS ENGINEERING RESEARCH (CeBER)

South Africa is a water-scarce environment, so access to water is key, whether considering urban, mining or industrial use. In the industrial sector it forms part of the licence to operate. Added to this, many wastewater streams carry valuable resources that can be recovered and repurposed. Together, these present a major incentive for new approaches to wastewater. **CeBER** has developed the wastewater biorefinery proof of concept focused on domestic wastewater and sanitation, industrial wastewater and mine water.

Minerals and metals



Africa faces significant challenges related to mineral extraction and soil degradation. Unsustainable mining practices can lead to environmental degradation, habitat loss and social issues, underscoring the need for responsible resource management. UCT is a leader in South Africa on sustainable mining practices from a social, economic, legal and environmental point of view.

MINERAL LAW IN AFRICA (MLiA)

The **MLiA** Research Chair is a hotbed for the evaluation and re-conceptualisation of key legal systems in Africa, where extractive industries direct the countries' economies, or have the potential to do so in future. MLiA accumulates and disseminates knowledge and information about mineral law systems in various African countries. Its research interests include environmental concerns, socio-economic matters, transformation of mining industries, mining tax, mining waste, investment interests and land issues. Researchers at the chair seek to provide equitable and practical solutions to the problem of balancing competing interests in the mining industry.

MINERALS TO METALS (MtM)

Minerals and metals fundamentally underpin every aspect of modern society. However, the global mining industry is facing increasingly complex, multi-faceted internal and external challenges that require innovative, integrated and interdisciplinary approaches to address them. The **MtM** initiative aims to do just that; it plays a leading role in the global minerals industry by creating a multidisciplinary and premier research organisation in the area of minerals beneficiation. Research into the minerals value chain is one of the core activities of the initiative, founded on an understanding of process flowsheets, underpinned by fundamental chemical engineering principles.

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