“Trends in Climate Change, Sustainability and Green Economy Research at CHEC Institutions”

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List of Abbreviations

AALP	African Agriculture Leadership Programme
ACAP	Agreement on the Conservation of Albatrosses and Petrels
ACC	African Center for Cities
ACCESS	Applied Centre for Climate & Earth Systems Science
ACDI	African Climate and Development Initiative
ACFH	African Climate Finance Hub
ADU	Animal Demography Unit
AES	Animal Evolution & Systematics Group
AFD	Agence Française de Développement
AFT	African Fellowship Trust
AgMIP	The Agricultural Model Inter-comparison and improvement Project
AMCOST	African Ministers Council on Water and Technology
AMCOW	African Ministers Conference on Water
AMTL	Adaptronics Advanced Manufacturing Technology Laboratory
ARC	Agricultural Research Council
ASSA	Academy of Sciences of South Africa
AU	African Union
AUMRN	African Urban Metabolism Research Network
BMBF	Bundesministerium fur Bildung und Forschung
BMGF	Bill & Melinda Gates Foundation
BMUB	Building and Nuclear Safety
CBiS	Centre for Business in Society
CCS	Carbon Capture and Storage
CDKN	Climate Development Knowledge Network
CDPES	Centre for Distributed Power and Electronic Systems
CeBER	Centre for Bioprocessing Engineering Research
CEOHR	Centre for Environmental and Occupational Health Research
Cerecam	Centre for Research in Computational and Applied Mechanics
CETRA	Centre for Tourism Research in Africa
CFMS	Centre for Film & Media Studies
CHEC	Cape Higher Education Consortium

CIB	Centre for Invasion Biology
CIDA	Canadian International Development Agency
CIFF	Children Investment Fund Foundation
CITANDA	Centre for Information Technology and National Development in Africa
CNRS	Centre national de la recherche scientifique
CNSP	Community Nutrition Security Project
CoCT	The City of Cape Town
CoMSIRU	The Concrete Materials & Structural Integrity Research Unit
CORC	Community Organization Resource Centre
CPUT	Cape Peninsula University of Technology
CRES	Centre for Renewable and Sustainable Energy Studies
CSAEMS	Centre for Substation Automation and Energy Management Systems
CSAG	Climate Systems Analysis Group
CSC	Centre for Studies in Complexity
CSIR	Council for Scientific and Industrial Research
CSIRO	Commonwealth Science and Industrial Research Organisation
CSP	Concentrating Solar Power
CWP	Community Work Programme
CWRR	the Centre for Water Resources Research
CWSR	Centre for Water and Sanitation Research
CWSS	Community Water Supply and Sanitation Unit
DAAD	The German Academic Exchange Service
DAFF	Department of Agriculture, Forestry and Fisheries
DCCMS	Malawi Department for Climate Change and Meteorological Services
DEA	Department for Environment Affairs
DEADP	The Western Cape Department of Environmental Affairs and Development Planning
DECC	UK Department for Energy and Climate Change
DEDAT	The Western Cape Provincial Department of Economic Development and Tourism
DESIS	Design for Social Innovation and Sustainability
DfID	Department for International Cooperation
DFID	UK Department of International Development
DGRU	Democratic Governance & Rights Unit
DOA	The Western Cape Department of Agriculture
DPRU	Development Policy Research Unit

DROP	Development and Rule of Law Programme
DRWH	domestic rainwater harvesting
DST	Department of Science and Technology
DTI	Department of Trade and Industry
DTU	Technical University of Denmark
DWA	The Department of Water Affairs
EfD	The Environment for Development Initiative
EGS Department	Environmental and Geographical Science Department
ENS	Environmental and Nanoscience research group
E&PSE	Environmental & Process Systems Engineering Research Group
EPP	The Employment Promotion Programme
EPRU	Environmental Economics Policy Research Unit South Africa
ERC	Energy Research Centre
ERC	European Research Council
ESRC	Economic and Social Research Council
EStAR	Enabling Sustainability through Action Research
ETR	Environmental Toxicity and Remediation
EWSETA	Energy and Water Services Sector Education and Training Authority
FANPRAN	the Food, Agriculture and Natural Resource Policy Analysis Network
FAO	Food and Agriculture Organisation of the United Nations
FCFA	Future Climate for Africa
FET	Further Education and Training
FFC	The Financial and Fiscal Commission
FSI	Food Security Initiative
GEF	Global Environment Fund
GEF	Global Environmental Facility
GESAMP	United Nations joint group of experts on the scientific aspects of marine environmental protection
GIGA	German Institute of Global and Area Studies
GIZ	Gesellschaft für Internationale Zusammenarbeit
GSB	Graduate School of Business
HDM	Highway Development and Management
HUMA	Institute for Humanities in Africa
HySA	Hydrogen South Africa

IAEA	The International Atomic Energy Agency
IBMB	Institute of Biomedical and Microbial Biotechnology
ICEMASA	International Centre for Education, Marine and Atmospheric Sciences over Africa
ICLEI	Local Governments for Sustainability
ICRAF	International Center for Research in Agroforestry
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
ICSU	International Council for Science
ICT	Information and Communication Technology
ICT4D	Centre in Information & Communication Technologies for Development
IDRC	Canada's International Development Research Centre
IFAMA	International Food and Agribusiness Management
IFPRI	International Food Policy Research Institute
IFREMER	French Research Institute for Exploitation of the Sea
IHACC	Indigenous Health and Climate Change
IMEL	Institute of Marine and Environmental Law
IPCC	United Nations Intergovernmental Panel on Climate Change
IUCN	International Union for Conservation of Nature
IWS	Institute of water studies
LeNSes	Learning Network on Sustainable Energy Systems
MARAM	Marine Resource Assessment and Management group
Ma-Re Institute	Marine Research Institute
MIR	Managing Infrastructure Reforms and Regulation
MIT	Massachusetts Institute of Technology
NCC	Nature Conservation Corporation
NCE	New Climate Economy
NDP	National Development Plan
NEPAD	New Partnership for Africa's Development
NERC	The Natural Environment Research Council
NERSC	Nansen Environmental and Remote Sensing Center
NMMU	Nelson Mandela Metropolitan University
NRF	National Research Foundation
NRM	Natural Resource Management
NTC	Nansen-Tutu Centre for Marine Environmental Research
OABS	Optimal Agricultural Business Systems

OCSDNet	Open and Collaborative Science in Development Network
ODI	Overseas Development Institute
OECD	Organisation for Economic Co-operation and Development
OWSDW	Organisation for Women in Science for the Developing World
PAR	Participatory Action Research
PCU	Plant Conservation Unit
PFIAO	Percy FitzPatrick Institute of African Ornithology
PLAAS	Institute for Poverty,Land and Agrarian Studies
PLMCC	Product Lifecycle Management Competency Centre
PPA	Power Purchase Agreement
PRISM	Policy Research on International Services and Manufacturing
PSP	Provincial Strategic Plan
PSS	Product Service Systems
PWP	Public Works Programme
RAU	Royal Agricultural University
REDZs	Renewable Energy Development Zones
REFURB	Researching Resource Futures for Urbanisation
RNC	Restoring Natural Capital
RSPB	Royal Society for the Protection of Birds
RTDS	Real-Time Distributed Systems
RUBEN	Research Unit in Behavioural Economics and Neuroeconomics
RUFORUM	Regional Universities Forum for Capacity Building in Agriculture
SA	South Africa
SADC	Southern African Development Community
SAEON	South African Environmental Observation Network
SAIAB	South African Institute for Aquatic Biodiversity
SAICE	The South African Institute of Civil Engineering
SALDRU	Southern Africa Labour and Development Research Unit
SAMMRI	The South African Minerals to Metals Research Institute
SANAP	NRF's South African National Antarctic Programme
SANBI	South African National Biodiversity Institute
SANCOOP	South Africa – Norway Research Co-operation on Climate Change, the Environment and Clean Energy
SANEDI	South African National Energy Development Institute

SANParks	South African National Parks
SASA	Sustainable Agriculture in South Africa
SASSCAL	Southern African Science Service Centre for Climate Change and Adaptive Land Management
SAT	Southern Africa Trust
SAWS	South African Weather Service
SCOR	Special Committee on Oceanic Research
SEA	Strategic Environmental Assessment
SEEC	Statistics in Ecology, the Environment and Conservation
SEEC	Sustainable Enterprise and Emergent Change
SEI	Stockholm Environment Institute
SEIP	Sustainable Energy Investment Policy
SI	Sustainability Institute
SIDA	Swedish International Development Agency
SLSFS	Social Learning for Sustainable Food Systems
SMRI	Sugar Milling Research Institute
SOLTRAIN	Southern African Solar Thermal Training and Demonstration Initiative
SPL	School of Public Leadership
SRC	Stockholm Resilience Centre
SSAJRP	Swiss South African Joint Research Programme
SSCA	Supporting Smallholders into Commercial Agriculture
SSHRC	Social Sciences and Human Research Council
START	Global Change System for Analysis Research and Training
SU	Stellenbosch University
SUN	Sustainable Urban Neighbourhood Development
SUWI	Stellenbosch University's Water Institute
THRIP	Technology and Human Resources for Industry Programme
TSAMA HUB	Centre for Transdisciplinarity, Sustainability Assessment, Modelling and Analysis
TSP	Transformative Scenarios Process
UCT	University of Cape Town
UKCIP	UK Climate Impacts Programme
UKZN	University of Kwazulu Natal
UN	United Nations
UNDP	United Nations Development Programme

UNEP	United Nations Environment Programme
UNFCCC	United Nations Convention on Climate Change
UN-HABITAT	United Nations Human Settlements Programme
UNISA	University of South Africa
UNITAR	he United Nations Institute for Training and Research
UPMC	University Pierre and Marie CURIE
URC	University Research Committee
UWC	University of the Western Cape
VPUU	City of Cape Town's Violence Prevention through Urban Upgrading Programme
WCG	Western Cape Government
WCoE	Water Centres of Excellence
WCPG	The Western Cape Provincial Government
WCRP	World Climate Research Programme
WEP	Waste Energy Policy
WESSA	Wildlife and Environment Society of South Africa
WRC	Water Research Commission
WRI	World Resources Institute
WUN	The Worldwide Universities Network
WWF	The World Wildlife Fund

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Executive summary

This report describes the research relating to climate change, sustainability and the green economy taking place at the four CHEC institutions in the Western Cape, the Cape Peninsula University of Technology (CPUT), Stellenbosch University (SU), the University of Cape Town (UCT), and the University of the Western Cape (UWC).

The future of the South African economy is threatened by poverty and unemployment, the impact of climate change, and declining and degraded natural resources. Solving these problems lies, in some measure, on a transition to a green economy, one characterised by low carbon emissions, the efficient use of resources and social inclusion. The Western Cape Government aims for its policy to be informed by the best available evidence.

The higher education research institutions of the Western Cape are important generators of high quality, innovative research that can inform policy and practice, and generate new knowledge in a co-production manner with government.

In order to maximise the potential for research to support sustainable development, there is a need to survey the expertise and activities in these areas currently underway at the CHEC institutions, to map these onto the sustainability, climate change and green economy dimensions of the strategic goals of the Western Cape Government, and to identify emerging trends and areas of innovation that offer potential for supporting these goals.

The scope of research within this report included an analysis of research entities, training units, technology stations and key curricula components.

Findings were arrived at through an exploration of university research reports, university websites, faculty handbooks and interviews with specific entities where possible.

It was found that research at the four universities is predominantly focussed around climate change and its supportive infrastructures (see table below). This is linked to the fact that most research at the CHEC institutions is taking place in both the Applied Sciences and Engineering and Built Environment faculties.

Other key findings include:

- Limited relevant research in the social sciences,
- Research does not always fall within the frames of a funded project or programme, and can thus be hard to capture within a mapping exercise such as this one,
- There are extensive projects in undergraduate programmes that do not receive funding as not linked to a research unit,
- Limited collaboration between research entities within universities,
- Multiple research units within a university have similar themes.

Table 1: Overview of projects identified per CHEC institution, per thematic area

	Natural environment	Built environment	Infrastructure	Climate change	Green economy
CPUT	33	34	36	23	21
UCT	78	26	74	124	75
SU	169	60	65	227	186
UWC	17	2	28	2	16

2. Introduction and background to the research mapping exercise

The Western Cape Government (WCG) has a vision of an open opportunity society for all, this vision has been translated into an actionable policy agenda which is comprised of 11 Provincial strategic objectives and is referred to as the Provincial Strategic Plan (PSP). Several practical policies, programs and projects were designed in an attempt to achieve the vision of the WCG. In 2012 the National Development Plan (NDP) was implemented and the WGC endorsed the NDP as it was compatible with the PSP and would aid in achieving an open opportunity society for all by the reduction of poverty through growth and development. This would be accomplished the objectives of the PSP which aimed at diverting resources into the creation of job opportunities while maintaining the drive to deliver improved health care, education and social development. The WCG has now embarked on a 5 year strategic plan centred on five strategic goals these include: creating opportunities for growth and jobs, Improving education outcomes and opportunities for youth development, Increase wellness, safety and tackling social ills, Enabling a resilient, sustainable, quality and inclusive living environment and finally Embedding good governance and integrating service delivery through partnership and spatial alignment.

The PSGs all work towards the creation of a highly skilled, innovation-driven, resource efficient, connected, high opportunity society for all. The 4th PSG's contribution to this open opportunity society for all involves the formation of a resilient, sustainable, quality and inclusive living environment. The WCG aims to accomplish this by following strategic objectives which include the enhancement of management and maintenance practices of both ecological and agricultural resource-bases, Improving climate change response, the establishment of sustainable and integrated urban and rural settlements and improving the living conditions of households with emphasis on low income and poor households.

In spite of improvements made to the conservation and management of resources and the state of certain settlements, there is still room for more improvement. Several settlements across the Western Cape are still characterised by the persistence of apartheid spatial divide and the associated social exclusion, informal housing and resource inefficiencies. These settlements do not only have negative consequences on the environment and agricultural resources but on government finances. The rapid growth of the population in conjunction with climate change is another obstacle in achieving the 4th PSG. Although improvements have been made to conservation and environmental management the resource base is still under pressure. These pressures on the environment are further exasperated by inefficiencies in the use of water and energy, the generation of pollution and waste disposal as a result extensive environmental degradation, poor air quality and loss of ecological and agricultural resources have been experienced which all lead to deterioration of social and economic conditions. The Western Cape has relatively good infrastructure in place, however many challenges still remain. These challenges which include poorly located and inadequate infrastructure are limiting factors, preventing the formation of an inclusive society and inhibited economic growth.

Four strategic priorities have been outlined for PSG4, these include the maintenance of ecosystem health which will be achieved by optimising the use of resources, developing sustainable waste

management practices and enhancing resilience to climate change and disaster response. The proper management of the Western Cape's water resources is another of these strategic priorities, this will be complimented by river health improvement plans, enhanced governance over water utilities and water technology and management innovation. The improvement of the provinces air quality is another important focus area for PSG4 this will be aided by activities such as reducing the burning of fossil foals and the Western Capes air quality management plan which will focus development of innovative practices related to governance and integrated management of air quality, climate change as well as town and regional planning and transport planning. The final strategic priority of the Western Cape is to protect it vulnerable agricultural sector from the impacts of climate change this will be enacted by the Western Cape Climate Change Implementation Framework.

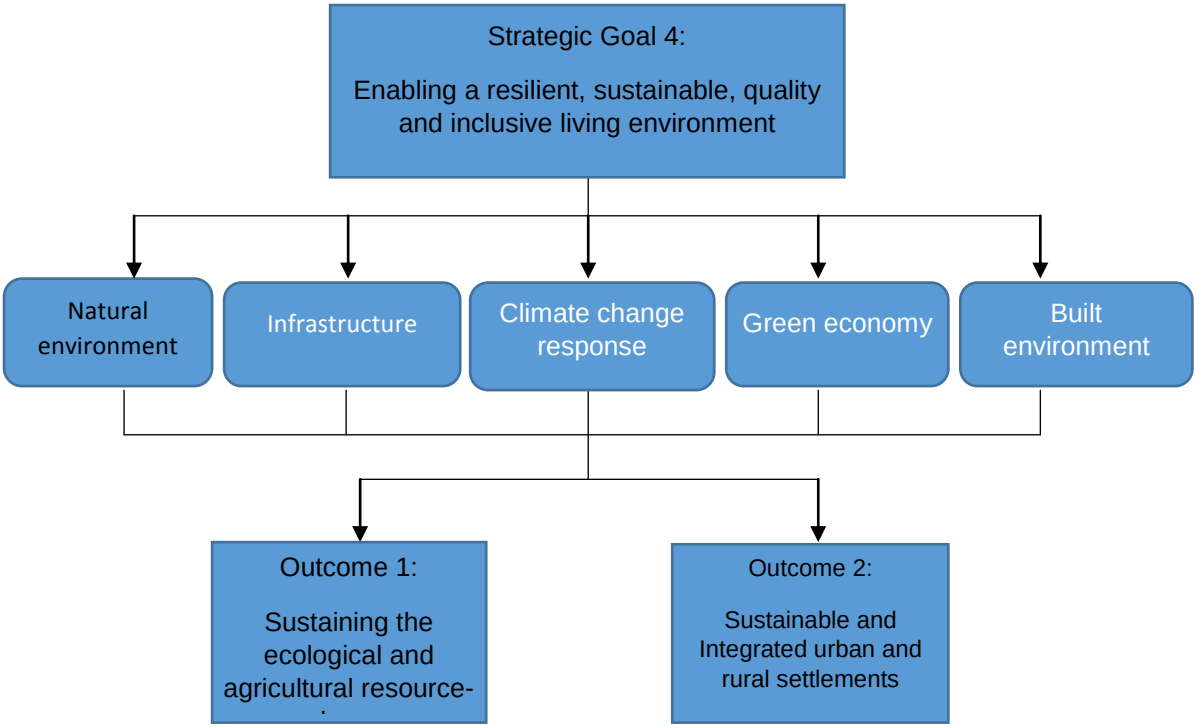

Figure 1: Provincial strategic goal 4, obstacles and outcomes. The 4th PSG is out lined at the top of the figure and explains that PSG 4 aims to enable the development of a resilient, sustainable, quality and inclusive living environment for all of the provinces inhabitants. This will only be achieved with research, development and improvement in the thematic areas indicated in the rounded rectangles. The outcomes of a successful PSG 4 are the sustainable use of the provincial ecological and agricultural resources and the development of sustainable and integrated urban and rural settlements.

The WCG emphasizes the need for policy and implementation to be underpinned by evidence. In that context, this rapid assessment of research capacity and trends at Cape Higher Education Consortium (CHEC) institutions was commissioned. This report aims to identify research groupings and programmes and projects that address the 4th PSG and, in particular, that relate to the areas of climate change, sustainable settlements and the green economy. The aim is for this work to identify

emerging research trends and gaps, in order to create a picture of the areas in which evidence for policy and implementation is being created and the areas where more funding and focus is required. The aim is for this synthesis report to create the foundation for which areas of potential innovation and priority research activities related to climate change, sustainable settlements and the green economy that could be funded by the WCG and CHEC can be identified.

This research mapping exercise has been conducted in parallel at the four CHEC institutions, the Cape Peninsula University of Technology (CPUT), the University of Cape Town (UCT), the University of Stellenbosch (US) and the University of the Western Cape (UWC). Internet resources were used to identify research units and institutes which conduct research in the thematic areas of the natural environment, infrastructure, climate change, green economy and build environments. Once these unit/institutes were identified a questionnaire (appendix C) was sent to the relevant contact persons, the information obtained from these questionnaires were then used to categories relevant projects into their thematic areas after which the projects in each area were tallied and that information was used to write a review of each universities research capacity in terms of PSG4 aligned research.

3. Methodology

The project involved the parallel work of four researchers, each based at one of the four CHEC universities: University of the Western Cape (UWC); Cape Peninsula University of Technology (CPUT); University of Stellenbosch; and University of Cape Town. Each researcher followed the approach outlined below for their respective university.

The collation of information on current areas of expertise, research projects and research capacities was approached through five main steps:

The first step was centred around grasping the scope of expertise and research activities that should be included in the mapping and developing a framework for mapping research. This required engaging with and unpacking the fourth strategic goal of the Western Cape Provincial Government (WCPG), and breaking it down into categories under which research activities could be classified. (The definitions and framing that emerged are outlined in section 2.1 below)

The second step of the research mapping exercise was to identify relevant Departments, Centres and Units. This was done by reviewing all Faculty, Department and research unit/centre websites, faculty handbooks and research reports. In the cases where it was unclear whether the work of the Department or research unit/ centre is relevant, contact was made with them to clarify.

The third step was to collate an overview of each of the relevant Departments and research units/centre, based on the information available on the website, and identifying key persons to contact for each. The snowball approach was applied in the process, with both meetings and email questionnaires including requests for details for other relevant contact persons and projects.

The fourth step of the process was to make contact with the key persons, in an attempt to verify and to add to the information from the website. A questionnaire (see appendix x), which included the

overview of the Department or unit/centre, was developed for making contact. Depending on the variety of information required, the availability of contact persons or the nature of the information available for each unit these were adapted on a case per case basis. Generally, a telephone discussion or in person meeting was suggested when initial contact was made by email, though the researcher focused on accommodating the preference of the interviewee. As it became increasingly evident that contact persons at the various Departments and research units/centres are generally very busy emphasis was made on collating information on current and past projects, with additional information on research interests and desired research projects considered a bonus.

The fifth and last step entailed analysing the information collated using the framework developed in step one. The framework allowed for the classification of projects according to thematic areas, through which a picture of current research focus and subsequent gaps could emerge.

3.1 Framework for mapping and analysis

This research was centred around the mapping of expertise and research projects and capacities related to the 4th provincial strategic goal (PSG) of the Western Cape Government (WCG), Enable a resilient, sustainable, quality and inclusive living environment, with specific focus on climate change, sustainability and green economy. The mapping entailed the provision of an overview of expertise and research relevant for implementation of PSG4, and to further provide a picture of the thematic areas within PSG 4 where the majority of current research and expertise is focused. In order to provide this picture it was important to further unpack the PSG4, and to design a framework against which the findings from each university could be mapped out.

Based on input from the WCG representatives[1], five thematic areas were identified as corner stones for the accomplishment of PSG4. Research and improved understanding of the following five thematic areas are thus considered central to enable a resilient, sustainable, quality and inclusive living environment:

Firstly, the **natural environment**, which encompasses all living and non-living components of the environment and their interactions with humanity. These components include climate, weather and natural resources such as agricultural land and rivers.

Secondly, the **built environment**, the human-made space created through urban design and town planning, encompassing the building materials used, the construction process and the buildings, houses and structures built.

Thirdly, an important aspect of developing sustainable settlements in urban as well as rural areas is the **Infrastructure**, which entails provision and improvement of the structures and facilities needed for operation of a society. These include but are not limited to clean water, electricity, sanitation, information and communication technologies (ICT) and transport.

Fourthly there is **climate change**, which here refers to "a change of climate that is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and that is in

[1] Note that at the time of the research the PSGs were still being discussed and unpacked by the WCG, and the researchers had to work with the input WCG representatives were able to give at that point

addition to natural climate variability observed over comparable time periods" (UNFCCC[2]). The focus of this thematic area includes the assessment of risk and vulnerability, mitigation of and adaptation to climate change, as well as disaster response and the development of resilience.

The aforementioned focus areas are important, however last thematic area, the development of a **green economy** is the glue that ties PSG4 together. The green economy is here defined as "an economy that results in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcity" (UNEP, 2011[3]). Research into the green economy includes aspects such as sustainability, low carbon economy, green growth, green investment trajectories and green jobs.

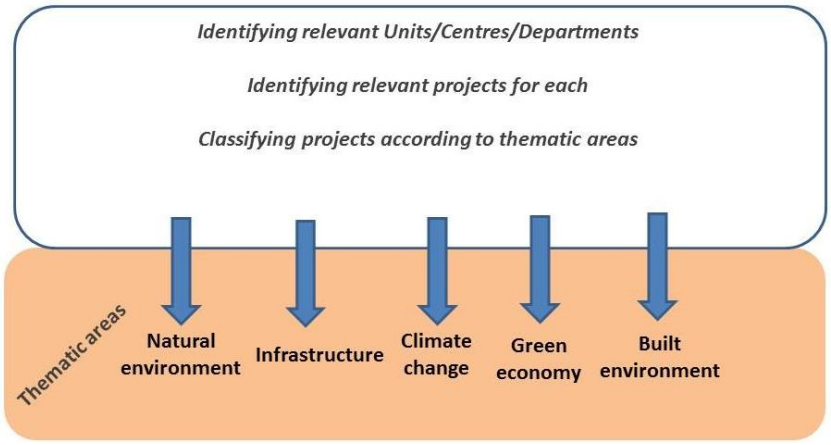

Figure 2: Framework for classification of projects. The lenses and the thematic areas provide the framework through which the research identified in the mapping exercise is classified.

4. Findings

The below section brings together the data that was collected across the four CHEC institutions. For each faculty it outlines the departments and research units and centres that were identified as being relevant to the PSG4, and further maps their projects in relation to the five thematic areas that form the corner stones of the PSG4. While the initial section looks at the university as a whole, the following sections outline each faculty separately. For further details on each of the departments and research units and centres identified, and their projects, please see Appendix C.

Before reading the section below it is important to note a few of the limitations related to the data presented. Firstly, the extent to which website information is up to date, and the extent to which representatives from the various departments, units and centres have responded to requests for

[2] http://unfccc.int/files/documentation/text/html/list_search.php?%20zwhat=keywords&val=&valan=a&anf=0&id=10

[3] http://www.unep.org/greeneconomy/Portals/88/documents/ger/1.0_Introduction.pdf

project information has impacted the information presented. Secondly, as emerged through engagements with various academics across the university, research does not necessarily sit neatly within the framework of a project or programme. Academic staff also conduct individual research without an overarching project or specific funding, and a lot of research is also covered through the dissertations of the individual students that they supervise. As argued by one academic, some of the most innovative and cutting edge research actually emerge outside the set frameworks created by some funders and projects, in the 'spaces' where researchers are able to creative and flexible.

4.1 Overview of Cape Peninsula University of Technology (CPUT)

CPUT is the only University of Technology in the Western Cape and the largest University in the province. Here, a total of ***18 departments and research entities*** were identified that carry out work related to Climate Change, Sustainability and the Green Economy, from which a total of ***43 related undertakings*** were documented. 'Related Undertakings' here is a blanket term used to refer to projects (from within research entities to programme level), research themes, modules and coursework. Research related to the themes of this report takes place in 4 of the 6 faculties. As illustrated in the figure below, the large majority of these are based in the Engineering faculty, followed by the Applied Sciences faculty. A large portion of CPUT's relevant research capacity, knowledge and skills, sits in the space of engineering, technology and applied sciences. Although there is research taking place in the Business & Management Sciences and Informatics and Design faculties, the lack of specific units can be seen as a significant gap, as innovative design and business practices are imperative in the shift toward a greener economy. Business as usual is no longer an option, with the transition to a green economy requiring innovation in creating more sustainable products[4], services and systems (PSS) and the business models to support and promote these.

[4] UNEP, 2012, The Business Case for the Green Economy. Sustainable Return on Investment.

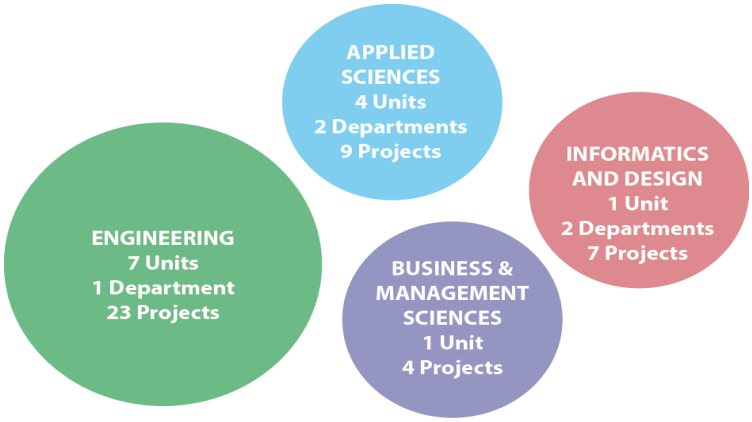

Figure 3: Overview of units and projects identified per faculty at the Cape Peninsula University of Technology.

A possible further gap is the seemingly silo approach to research and practice, necessary in the shift toward a sustainable, greener economy. As can be seen in Figure 5, most research happens within faculties and not between them. Universities in general require "new ways of thinking and working together…taking lessons from unexpected sources, inspiration from overlooked places and experimentation with unlikely partners[5]. CPUT's offerings present novel opportunities for a multidisciplinary approach to research regarding Climate Change, Sustainability and the transition to a green economy.

Projects were mapped against the five thematic areas, identified as cornerstones for the accomplishment of PSG4. In CPUT research that relates to Natural and Built Environments and Infrastructure is most prevalent (see table 2 below). This refers to research that addresses renewable energy, green building, sustainable Product Service Systems (PSS) and impact studies. Here it should be noted that most of the research linked to the climate change theme comes from the Faculty of Engineering, having both the most research units related to PSG4 as well as course components. A fair amount of research is embedded in undergraduate courses and within certain programmes. Research Units often also have very specific or niche research areas, while course components are more easily adapted.

There is somewhat less research that focusses specifically on Climate Change and the Green Economy.

Table 2: Classification of projects identified at CPUT*

Natural environment	Built environment	Infrastructure	Climate change	Green economy
33	34	36	23	21

[5] Abena Ojetayo, F. (2015). *Breaking silos for sustainability*. [online] Tallahassee Democrat. Available at: http://www.tallahassee.com/story/life/causes/2015/03/16/breaking-silos-sustainability/24837325/ [Accessed 5 May 2015].

* Note that each project can be linked to several themes, and that the each projects can thus been counted more than once in the mapping framework above

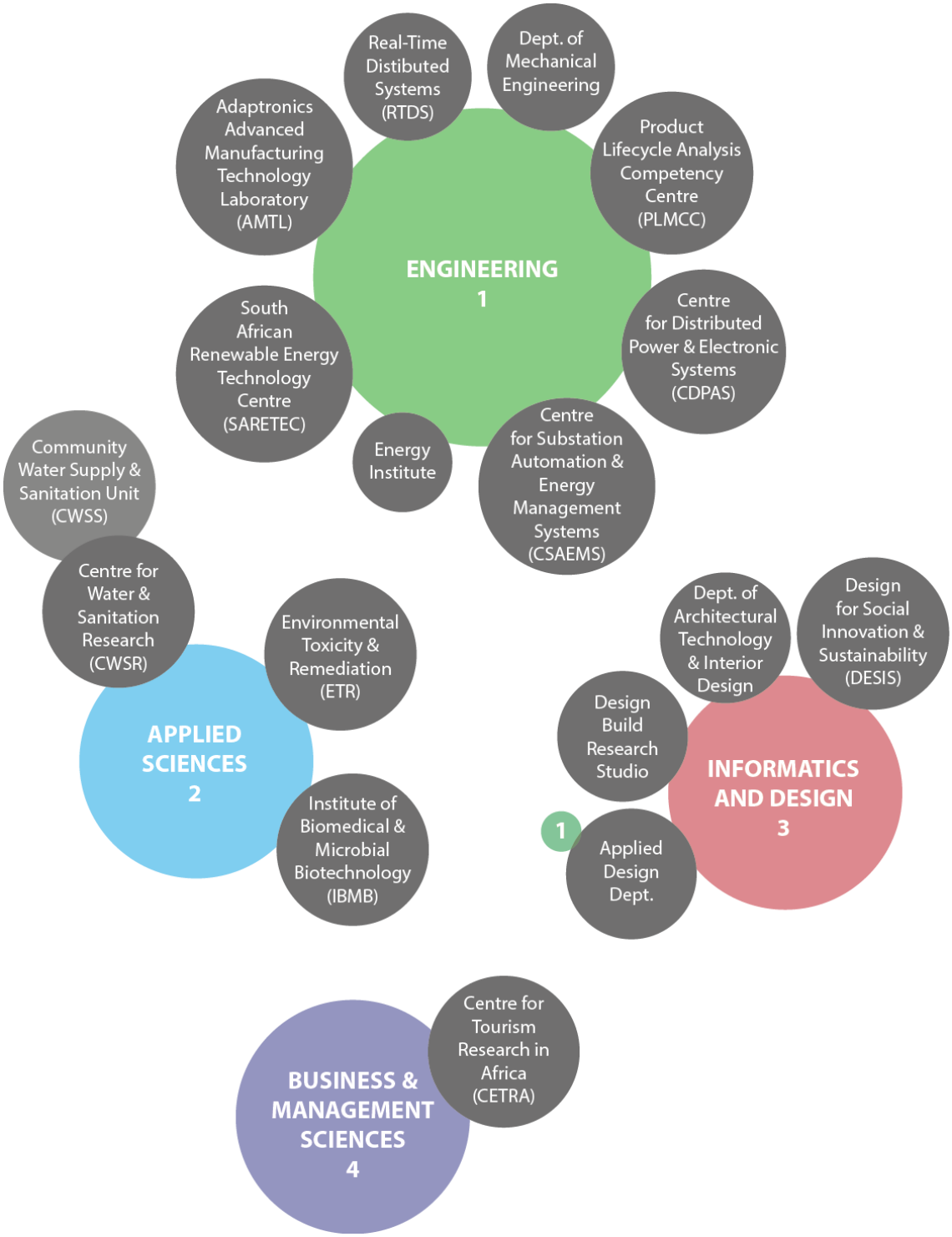

Figure 4: Overview of Departments, Centres and Units identified within each Faculty. The numbers are used to highlight interdisciplinarity, illustrating where linkages have been identified between a Department, Centre or Unit that is based within on faculty and researchers based at another faculty.

4.1.1 Per faculty overview of Cape Peninsula University of Technology

4.1.1.1 Engineering Faculty

Dean: Dr. N Mahomed

Website: http://www.cput.ac.za/academic/faculties/engineering

Relevant departments/units/centers: 8

Relevant projects/themes identified: 23

The Faculty of Engineering covers a broad range of engineering disciplines, which are currently being reformed to respond to the demands of regional, National and global industry priorities in engineering education. Through a range of multi-disciplinary research institutes and centres, the Faculty aims to integrate its education and research programmes into a cohesive system, providing students with modern technology platforms for relevant and industry-responsive education, with a high degree of work-integrated learning. These platforms include the Product Life Cycle Management Competency Centre, providing state-of-the-art education in product design through to simulation and life-cycle management, the Advanced Manufacturing Technology Laboratory, and the Centre for Substation Automation and Energy Management Systems, to mention a few. Through this approach, the Faculty aims to emerge as a major driver of socio-economic change in the region.

Regional, National and international partnerships provide an essential mechanism for research and technology transfer, while at the same time developing opportunities for student international experience. The Foundry Technology Programme with RWTH Aachen University of Technology, and the Satellite Technology Programme under the French South Africa Technology Initiative, amongst others, are high impact examples of such partnerships. Exchange programmes, such as those with Shanghai Dian Ji University and De Haagse Hogeschool, provide students with opportunities to participate in collaborative technology projects, while developing multicultural and global perspectives.

As part of a University of Technology, our mandate requires participation in community-based and SME projects, with a strong emphasis on commercialisation, providing a platform for technology transfer and spin-off technology enterprises. In this way, we provide our students and researchers with opportunities to engage at the highest level of engineering, and continue to impact on the development of high-end engineering skills as a basis for industrial competitiveness.[6]

In the Engineering Faculty the following 8 units/programmes were identified as relevant:

- *The Energy Institute*
- *The Centre for Distributed Power and Electronic Systems (CDPES)*
- *The Product Lifecycle Management Competency Centre (PLMCC)*

[6] Copied directly from the faculty's website http://www.cput.ac.za/academic/faculties/engineering

- *Adaptronics Advanced Manufacturing Technology Laboratory (AMTL)*
- *Centre for Substation Automation and Energy Management (CSAEMS)*
- *Department of Mechanical Engineering*
- *French South African Institute of Technology (F'SATI)*
- *Centre for Real-Time Distributed Systems (RTDS)*

Within these Units, Centres, Departments and Technology Stations, research predominantly covers: renewable energy and its production and management, global environmental studies, wastewater treatment and the engineering and design of appropriate products and systems.

As illustrated in the table below, projects within the Faculty of Engineering relate to all five thematic areas of PSG4, namely natural and built environments, infrastructure, climate change and the green economy, and often also relate to PSG1 in relation to growing and retaining skills and infrastructure development. Infrastructure is however the most represented theme, often relating to renewable energy and power systems protection, automation and optimisation.

Table 3: Classifying projects identified in the Faculty of Engineering*

Natural environment	Built environment	Infrastructure	Climate change	Green economy
14	15	16	13	12

* Note that each project can be linked to several themes, and that the each projects can thus been counted more than once in the mapping framework above

4.1.1.2 Applied Sciences Faculty

Dean: Prof O Fatoki

Website: http://www.cput.ac.za/academic/faculties/appliedsciences

Relevant departments/units/centers:6

Relevant projects/themes identified: 7

The vision of the Faculty of Applied Sciences is "to be the faculty of choice in science and technology, nationally and in Africa". This is clearly aligned to the vision of CPUT which is "to be the heart of technology education in Africa". We count it an opportunity for us in the faculty the relevance of all our current programmes to priority skills needs of government and industries. All our programmes are also relevant within the context of CPUT as a University of Technology. Also the applied nature of our academic programmes and research endear us to so many partners locally, nationally and internationally and to industries[7].

In the Applied Sciences Faculty the following 65 units/programmes and institutes were identified as relevant to PSG4:

- *Biodiversity and Conservation Department*
- *Agriculture Department*
- *Centre for Water Supply and Sanitation research (CWSR)*
- *Community Water Supply and Sanitation Unit (CWSS) (incorporated into the CWSR)*
- *Environmental Toxicity and Remediation (ETR)*
- *Institute of Biomedical and Microbial Biotechnology (IBMB)*

Between these research entities, themes such as ecology conservation, food security, community health, pollution monitoring, sustainable sanitation, waste-water treatment and Climate Change are focussed on.

As can be seen in the able below, projects within the Faculty of Applied Sciences encompass all themes related to PSG4, with most projects aligned with the natural environment. These projects generally deal with water quality and supply, food security and remediation technologies.

Table 4: Classification of projects identified at the faculty of Applied Science*

Natural environment	Built environment	Infrastructure	Climate change	Green economy
8	5	5	6	3

[7] Copied directly from the faculty's CPUT webpage: http://www.cput.ac.za/academic/faculties/appliedsciences

* Note that each project can be linked to several themes, and that the each projects can thus been counted more than once in the mapping framework above

4.1.1.3 Faculty of Informatics and Design

Dean: Prof J Cronje

Website: http://www.cput.ac.za/academic/faculties/informaticsdesign

Relevant departments/units/centers: 3

Relevant projects/themes identified: 7

The vision of the faculty is to lead creativity and innovation in Africa which aligns to the vision of CPUT which is "to be the heart of technology education in Africa".The faculty consists of 6 departments with most of the research associated to PSG4 coming from the Departments of Applied Design and Architectural Technology & Interior Design.

Key themes prevalent in this faculty's research are waste management, sustainable product service systems (PSS), green building and sustainable construction. Another important theme that links a number of the programmes within the faculty is Biomimicry. The table below presents the faculty's 'green' approach to the design of the built environment and supporting infrastructures.

Table 5: Classification of projects in the faculty of Informatics and Design[*]

Natural environment	Built environment	Infrastructure	Climate change	Green economy
6	7	7	4	3

[*] Note that each project can be linked to several themes, and that the each projects can thus been counted more than once in the mapping framework above

4.1.1.4 Faculty of Business and Management Sciences

Dean: Prof M Binza

Website: http://www.cput.ac.za/academic/faculties/business

Relevant departments/units/centers: 1

Relevant projects/themes identified: 4

The Faculty of Business and Management Sciences is the largest faculty at CPUT. Graduates of the various departments are skilled to participate in the economic and business sectors of South Africa. The faculty was recently restructured to form three academic schools consisting of thirteen academic departments. It houses two centres of excellence, one of which is engaged in work relating to PSG4.

The Centre for Tourism Research in Africa (CETRA), a centre of excellence within the faculty, has several projects related to PSG4 which cover themes of impact assessment, sustainability and legacy around mega events.

These themes align to two key areas of PSG4, namely infrastructure and the green economy. The research centre is also involved in developing an instrument for the measurement of event legacies.

Table 6: Classification of projects in the faculty of Business and Management Science*

Natural environment	Built environment	Infrastructure	Climate change	Green economy
3	3	4	0	4

4.2 University of Cape Town Overview

At UCT a total of ***54 relevant departments and research units and centres*** were identified, from which a total of ***256 relevant projects*** were documented[8]. As illustrated in the figure below, the large majority of these are based in two out of six faculties, namely the Faculty of Engineering & the Built Environment and the Faculty of Science. Hence a large portion of UCT's relevant research, and thus research capacity, sits in the space of engineering, technology and natural sciences, while there is significantly less relevant research taking place in the fields relating to business and commerce, law and the social sciences. The limited research taking place in law and social sciences can be recognised as a significant gap, considering the central role of policy and regulatory frameworks, as well as the human and social dimensions, in enabling *resilient, sustainable, quality and inclusive living environments.* The limited focus on relevant research in the business and commerce related faculties is a further gap, considering the massive role of industry and the private sector in general in mitigating climate change and in creating a shift towards a greener, more sustainable economy.

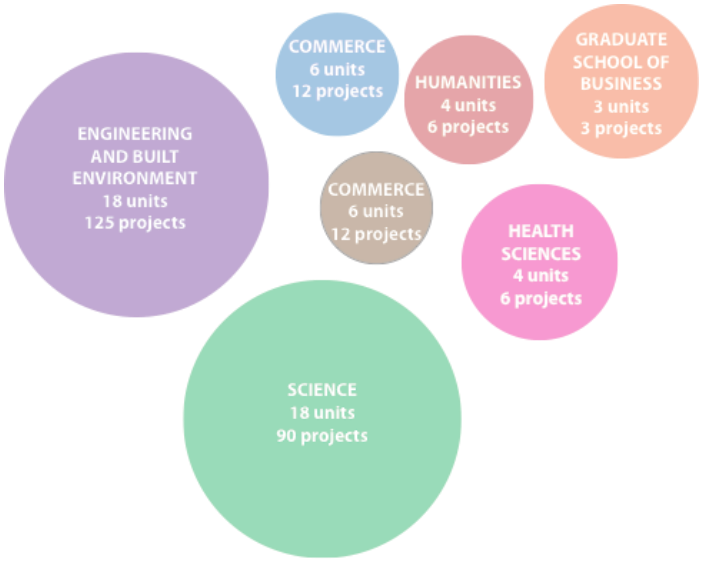

Figure 5: Overview of units and projects identified per faculty at the University of Cape Town

For the mapping of projects against the five thematic areas that were identified as corner stones for the accomplishment of PSG4, research that relates to the climate change theme dominates (see table below). This refers to research that addresses aspects of risk and vulnerability, resilience, mitigation of and adaptation to climate change, and disaster response. Here it should be noted that half of the projects that are linked to the climate change theme come from just three of the 54 departments, units and centres identified, namely the ERC, CSAG and the ACDI. These are research

[8] Note that this does not mean that there is no further relevant research. The projects identified are dependent on the extent to which websites are up to date, the extent to which representatives from the identified Departments/Centres/Units provided input and the extent to which research is taking place inside the frames of a structured project.

groupings that all have a specific focus on climate change. The large number of climate change related projects across the university, and the fact that three units are specifically focused on climate change related issues, reflects how UCT has strong research capacity related to climate change.

Three out of the four remaining themes, natural environment, infrastructure and the green economy, are all related to a similar number of projects (~70), while the built environment stands out with only just over 20 projects. Hence there seems to be limited research focus on, and possibly also research capacity for, aspects that relate to urban design, town planning, construction, housing provision and building materials. For the built environment projects that were identified, these were mainly linked to three units, namely the sub-units of the School of Architecture, Planning & Geomatics, the ACC and CoMSIRU. While the two former largely focus on aspects of urban design and town planning, CoMSIRU's built environment focus relates to construction and building materials (cement etc). Here the Department of Construction, Economics & Management should also be highlighted, as they have focus on aspects such as green building construction. Yet this focus was largely reflected in individual student research rather than larger projects, and these were thus not included in the project mapping analysis.

Table 7: Classifying projects identified across UCT[*]

Natural environment	Built environment	Infrastructure	Climate change	Green economy
78	28	78	124	75

[*] Note that each project can be linked to several themes, and that the each projects can thus been counted more than once in the mapping framework above

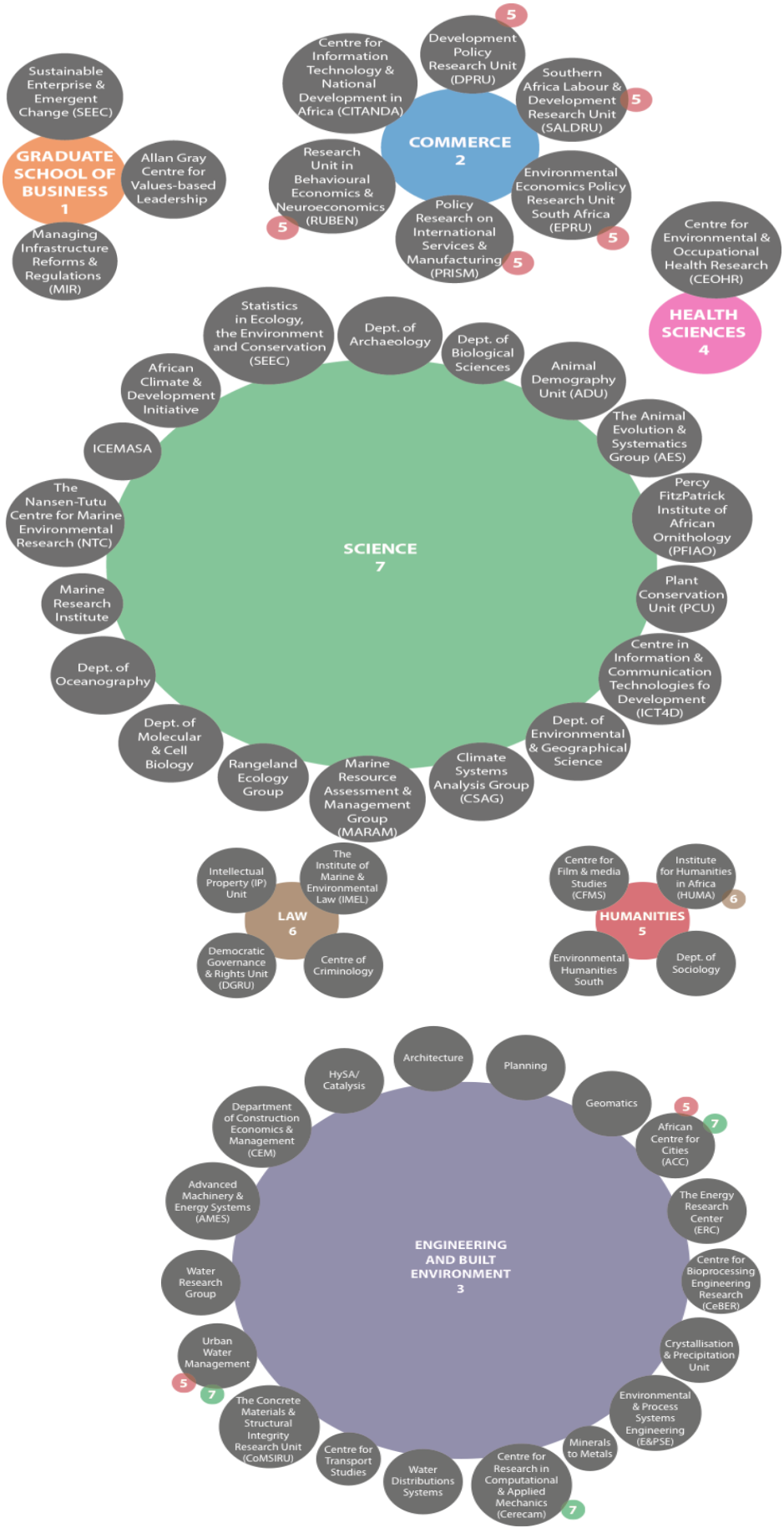

Figure 6: Overview of Departments, Centres and Units identified within each Faculty. The numbers are used to highlight interdisciplinarity, illustrating where linkages have been identified between a Department, Centre or Unit that is based within on faculty and researchers based at another faculty.

4.2.1 Faculty per faculty overview

4.2.1.1 The Graduate School of Business

Director: Professor Walter Baets

Website: http://www.gsb.uct.ac.za/

Relevant departments/units/centres: 3

Relevant projects identified: 3

The Graduate School of Business (GSB) research is broadly focused on emerging market business, with an overarching missing of "engaged inquiry in a complex world." Research can be clustered into three inter-connected thematic clusters: Values-based leadership; Emerging markets finance, investment and trade; and Social innovation and sustainability. The school offers a variety of study options, including academic programmes such as the MBA and the Executive MBA, and executive education short courses and doctoral studies.

At GSB the following three groupings were identified as relevant:

- *Sustainable Enterprise and Emergent Change (SEEC) (3 projects)*
- *Allan Gray Centre for Values-based Leadership (0 projects)*
- *Managing Infrastructure Reforms and Regulations (MIR) (0 projects)*

In these groupings research is centered around:- organisational innovation and intermediation in complex social-ecological systems; exploring new ways of doing business based on purpose, sustainability and responsible practices that create dignity and belonging; enhancing understanding and building capacity in infrastructure investment, reform and regulation in support of sustainable development, respectively. The three projects that were identified[9] all relate to the green economy thematic area, and all are conducted by the SEEC.

Table 8: Classifying projects identified at the GSB*

Natural environment	Built environment	Infrastructure	Climate change	Green economy
				3

[9] Note that this does not mean that there is no further relevant research happening in these groups. The limited projects identified could be attributed to limited input from persons in the groups and/or due to research taking place outside the frames of a structured project.

4.2.1.2 Faculty of Commerce

Dean: Professor Ross

Website: http://www.commerce.uct.ac.za/

Relevant departments/units/centres: 6

Relevant projects identified: 12

The Faculty of Commerce offers programmes through which students can meet the needs of financial service industries and be ready to participate in the global economy. While receiving support from international agencies, the faculty is committed to engagements with the African continent.

The Faculty of Commerce houses a number of research groupings, of which six have been identified as relevant:

- *Development Policy Research Unit (DPRU) (1 project)*
- *Southern Africa Labour and Development Research Unit (SALDRU) (1 project)*
- *Environmental Economics Policy Research Unit South Africa (EPRU) (6 projects)*
- *Policy Research on International Services and Manufacturing (PRISM) (1 project)*
- *Research Unit in Behavioural Economics and Neuroeconomics (RUBEN) (2 projects)*
- *Centre for Information Technology and National Development in Africa (CITANDA) (1 project)*

Broadly speaking these research groupings take a policy and economics perspective through which they focus on issues related to aspects such as labour markets, poverty and inequality, trade and industrialisation, natural resources and sustainable development. Interdisciplinarity is strong in these groupings, with five out of the six also having strong linkages to the Faculty of Humanities.

A total of 11 relevant projects were identified, most of which are conducted by the EPRU[10]. As illustrated in the table below, these projects are spread evenly across three of the thematic areas, namely natural environment, climate change and the green economy.

The DPRU and SALDRU projects are both green economy projects that look at public works programmes in the context of employment and poverty reduction. The EPRU projects are largely focused on the natural environment theme, with some links to climate change, looking at aspects including the value of wildlife resources, marine conservation policy, sustainable and financially viable management of parks, sustainable wildlife conservation, sustainable livelihoods and valuing ecosystem services. PRISM's project relates to the political economy of renewable energy, while the RUBEN projects look at climate change related policy and investments. CITANDA's new project in Green Information Systems is enabling integration of carbon footprinting into the curriculum, and

[10] Note that this does not mean that there is no further relevant research happening in at the Faculty. The limited projects identified could be attributed to limited input from persons in the groups and/or due to research taking place outside the frames of a structured project.

provides opportunities for students to elect to research related to green information systems and green information technology.

Table 9: Classifying projects identified at the Faculty of Commerce[*]

Natural environment	Built environment	Infrastructure	Climate change	Green economy
5		1	5	5

[*] Note that this does not mean that there is no further relevant research happening in these groups. The limited projects identified could be attributed to limited input from persons in the groups and/or due to research taking place outside the frames of a structured project.

4.2.1.3 Faculty of Engineering & the Built Environment

Dean: Professor Barry Downing

Website: http://www.ebe.uct.ac.za/

Relevant departments/units/centres: 18

Relevant projects identified: 125

The Faculty of Engineering & the Built Environment offers programmes that produce architects, planners, quantity surveyors and property valuers and a variety of engineers, all of which fall within the built environment sector. The faculty has a continued focus on research and innovation, and hosts a large number of research groupings with a variety of focuses.

The below have been identified as relevant, 18 in total of which 17 are research groupings and one is a department:

- *Architecture (5 projects)*
- *Planning (2 projects)*
- *Geomatics (2 projects)*
- *African Center for Cities (ACC) (14 projects)*
- *The Energy Research Centre (ERC) (44 projects)*
- *The Centre for Bioprocessing Engineering Research (CeBER) (14 projects)*
- *Crystallisation & Precipitation Unit (3 projects)*
- *Environmental & Process Systems Engineering (E&PSE) Research Group (5 projects)*
- *Minerals to metals (4 projects)*
- *Centre for Research in Computational and Applied Mechanics (Cerecam) (1 project)*
- *Water Distribution Systems (6 projects)*
- *Centre for Transport Studies (8 projects)*
- *The Concrete Materials & Structural Integrity Research Unit (CoMSIRU) (6 projects)*
- *Urban Water Management (9 projects)*
- *Water Research Group (0 projects)*
- *Advanced Machinery and Energy Systems (AMES) (0 projects)*
- *Department of Construction Economics & Management (CEM) (0 projects)*
- *HySA/Catalysis (2 projects)*

The majority of the groupings above are focused on aspects of engineering, and thus on research concerned with things such as improved technologies, and more efficient and less polluting mining and industrial processes. This type of research can be seen as addressing the natural environment theme, by working to minimise environmental impacts, the infrastructure theme, by improving

infrastructure systems and system components (water, energy, transport etc), and the green economy, through focus on creating more efficient industries.

In terms of infrastructure there is a lot of focus on water, with three of the groupings focusing on aspects of water, including water management, conservation of water quality and quantity and leakage in water distribution systems. One grouping, the Centre for Transport Studies, is specifically focused on transport, more specifically urban passenger transport systems.

The ERC stands out, both through its large number of relevant projects (44), and through its focus on both the technological and policy and developmental aspects of energy generation and distribution. Hence while largely falling under the infrastructure theme, the ERC projects have a lot of linkages to the climate change and green economy themes.

Architecture, Planning and Geomatics, the three groupings that address different focus areas under the School of Architecture, Planning and Geomatics, largely deal with issues of design, town planning and construction, and thus the built environment.

Like the ERC, the ACC stands out somewhat from the rest. It has a relatively large number of relevant projects (14), but further more it straddles the urban design and town planning space and the more socio-economic urban issues, including urban poverty and risks and urban resilience and sustainability. Hence the ACC is good example of interdisciplinarity, and while it is administratively located within the Faculty of Engineering & the Built Environment it has strong linkages to the Faculty of Humanities and the Faculty of Science.

Overall, the projects identified for the Faculty of Engineering & the Built Environment[11] are largely focused on the infrastructure, climate change and green economy themes, yet with a relatively large number of projects also falling within the natural environment and built environment themes.

Table 10: Classifying projects identified at the Faculty of Engineering & the Built Environment*

Natural environment	Built environment	Infrastructure	Climate change	Green economy
16	25	68	32	53

[11] Note that this does not mean that there is no further relevant research happening in at the Faculty. The limited projects identified could be attributed to limited input from persons in the groups and/or due to research taking place outside the frames of a structured project.

* Note that each project can be linked to several themes, and that the each projects can thus been counted more than once in the mapping framework above

4.2.1.4 Faculty of Health Sciences

Dean: Professor Gregory Hussey

Website: http://www.health.uct.ac.za/

Relevant departments/units/centres: 1

Relevant projects identified: 6

The Faculty of Health Sciences offers programmes that are embedded in four main themes: undergraduate and postgraduate teaching, clinical services and research. Research is high on the Faculty's agenda, and it houses over 20 multi-disciplinary research groupings.

Out of the large number of research groupings, only one was identified as relevant:

- *Centre for Environmental and Occupational Health Research (CEOHR) (6 projects)*

The work of the CEOHR is centred around health in the context of environmental and work related factors, and as illustrated in the table below it has a number of projects related to climate change and the natural environment. More specifically, the research identified as relevant to this research mapping looks at health in relation to issues such as pests, chemicals, heat, air quality and air and water pollution.

Table 11: Classifying projects identified at the Faculty of Health Sciences*

Natural environment	Built environment	Infrastructure	Climate change	Green economy
3		1	5	

4.2.1.5 Faculty of Humanities

Dean: Professor Sakhela Buhlungu

Website: http://www.humanities.uct.ac.za/

Relevant departments/units/centres: 4

Relevant projects identified: 6

The Faculty of Humanities produces graduates that are the lead producers of knowledge on the human condition. The faculty's departments can broadly be divided into three main clusters, namely the Arts, the Social Sciences and the Performing and Creative Arts.

The below have been identified as relevant, four in total of which three are research groupings and one is a department:

- *The Centre for Film & Media Studies (CFMS) (1 project)*
- *Institute for Humanities in Africa (HUMA) (3 projects)*
- *Environmental Humanities South (1 project)*
- *Department of Sociology (1 project)*

The humanities disciplines study aspects related to human culture. Broadly speaking the groupings above are in various ways interrogating the relationship between people and nature, researching aspects such as expression (media and writing), human agency, governance and regulatory environments, and societal issues such as education and urbanization.

Only a small number of relevant projects were identified[12] (6), and of these the majority fall under the natural environment theme, with some links also to the green economy, climate change and infrastructure. More specifically, research projects identified covered aspects such as: societal adaptation to the threats presented by climate-risk; how regulatory environments condition transitions to more decentralized, flexible and sustainable electricity systems; women reflecting on how they can enhance their impact on ecological sustainability; the relationship between sciences, states and publics; perspective on local agency and resistance around natural resources; and fracking and the media.

Table 12: Classifying projects identified at the Faculty of Humanities*

Natural environment	Built environment	Infrastructure	Climate change	Green economy
4		1	1	2

[12] Note that this does not mean that there is no further relevant research happening in at the Faculty. The limited projects identified could be attributed to limited input from persons in the groups and/or due to research taking place outside the frames of a structured project.

* Note that each project can be linked to several themes, and that the each projects can thus been counted more than once in the mapping framework above

4.2.1.6 Faculty of Law

Dean: Professor PJ Schwikkard

Website: http://www.law.uct.ac.za/

Relevant departments/units/centres: 4

Relevant projects identified: 14

The Law Faculty does not only produce advocates and attorneys, it trains students to write clearly, logically, coherently and succinctly, while developing the ability to analyse problems and assess available options. Law graduates have a variety of career opportunities, ranging from academia to government, business and the NGO sector.

Research plays a central role at the Law Faculty, with each of the three law departments hosting specialised research units. The four groupings below have been identified as relevant:

- *The Intellectual Property (IP) Unit (1 project)*
- *The Institute of Marine and Environmental Law (IMEL) (5 projects)*
- *Democratic Governance & Rights Unit (DGRU) (2 projects)*
- *Centre of Criminology (4 projects)*

Each of the law groupings hold quite distinct, yet quite different, research focuses. While IMEL, as indicated by the name, is concerned with marine and environmental law, DGRU focuses on the intersection between public administration and accountability and the issues of human rights. The IP Unit does research centred around innovation, development and public policy, while the Centre of Criminology is focused on aspects related to community safety, policy and criminal justice reform.

The projects identified[13] are spread between three of the thematic areas, natural environment, climate change and green economy, yet with a lot of emphasis on the natural environment theme. Projects deal with governance and regulatory and legal regimes in relation to aspects such as fracking, carbon capture and storage, protected areas, biodiversity conservation, ecosystem based adaptation, climate finance, environmental crime and issues related to the intellectual property rights of climate change response strategies.

Table 13: Classifying projects identified at the Faculty of Law*

Natural environment	Built environment	Infrastructure	Climate change	Green economy
8			5	4

[13] Note that this does not mean that there is no further relevant research happening in at the Faculty. The limited projects identified could be attributed to limited input from persons in the groups and/or due to research taking place outside the frames of a structured project.

* Note that each project can be linked to several themes, and that the each projects can thus been counted more than once in the mapping framework above

4.2.1.7 Faculty of Science

Dean: Professor Anton le Roex

Website: http://www.science.uct.ac.za/

Relevant departments/units/centres: 18

Relevant projects identified: 90

The Faculty of Science aims to produce research that is globally competitive and locally relevant, and strives to be a major contributor to educating scientists of the future. The majors that are offered at the faculty can loosely be grouped into three clusters, namely biology, earth and environmental sciences, chemical and molecular sciences and numerical and physical sciences.

The below have been identified as relevant, 18 in total of which 13 are research groupings and five are departments:

- *Department of Archaeology (1 project)*
- *Department of Biological Sciences (3 projects)*
- *Animal Demography Unit (ADU) (1 project)*
- *The Animal Evolution & Systematics Group (AES) (1 project)*
- *Percy FitzPatrick Institute of African Ornithology (PFIAO) (5 projects)*
- *Plant Conservation Unit (PCU) (2 projects)*
- *Centre in information & Communication Technologies for Development(ICT4D)(1 project)*
- *The Department of Environmental & Geographical Science (6 projects)*
- *African Climate & Development Initiative (17 projects)*
- *Climate Systems Analysis Group (CSAG) (35 projects)*
- *Marine Resource Assessment and Management group (MARAM) (2 projects)*
- *The Rangeland Ecology Group (1 project)*
- *The Department of Molecular and Cell Biology (1 project)*
- *Department of Oceanography (5 projects)*
- *Marine Research Institute (0 projects)*
- *The Nansen-Tutu Centre for Marine Environmental Research (NTC) (6 projects)*
- *The International Centre for Education, Marine and Atmospheric Science over Africa (ICEMASA) (0 projects)*
- *Statistics in Ecology, the Environment and Conservation (SEEC) (1 project)*

The Departments and groupings at the Faculty of Science largely focus on the natural sciences, including both biological science and physical science. For the former, biological sciences, focus includes animal and plant focused research, with a lot of emphasis on conservation and management of resources. There is also some ecology related research, which through emphasis on the relations between organisms and their physical surroundings work to bridge the biological with the physical sciences. While there are fewer groupings in the physical science space, a large body of research is being produced in the climatology and oceanography spheres, with a large emphasis on modelling, mainly through CSAG, the Oceanography Department, [14] the NTC Centre and ICEMASA. Modelling work also go beyond the spheres of climatology and oceanography, with smaller research groupings such as the MARAM, the Rangeland Ecology Group and SEEC applying statistical analysis and modelling to ecological, conservation and management aspects.

Some of the research at CSAG and the EGS Department, as well as the large majority of research at ACDI, span beyond the realm of natural sciences. Such research focuses on aspects such as human geography, vulnerability, adaptation and sustainability, which brings the research towards the political, social and economic spheres.

As illustrated in the table below, projects at the Faculty of Science are largely focused on climate change and the natural environment, with very little overlap into the other thematic areas.

Table 14: Classifying projects identified at the Faculty of Science*

Natural environment	Built environment	Infrastructure	Climate change	Green economy
42	3	7	76	8

[14] Note that it has not been possible to get an overview of specific research projects at the Department of Oceanography

* Note that each project can be linked to several themes, and that the each projects can thus been counted more than once in the mapping framework above

4.3 Overview the University of Stellenbosch

The sustainability; green economy and community development initiatives and projects of Stellenbosch University are administered through the Hope Project[15], as a university's way to create the sustainable solutions to some of South Africa and the African continent's pressing challenges. The Hope Project is rooted in teaching and learning, research and community interaction, as way to showcase the initiatives and research that serves the community and human needs. The five focus areas of the Hope Project is *eradicating poverty and related conditions; promoting human dignity and health; promoting democracy and human rights; promoting peace and security; and promoting sustainable environment and a competitive industry*. Therefore, projects on sustainability in Stellenbosch University are rooted in Science and follows the multidisciplinary approach, which explains the diversity and interlinks between departments and research units mapped below (see figure 9).The Hope Project further functions as the main fundraiser of the University's Sustainability related initiatives and projects.

This section consist of different research units that where collected and analysed across Stellenbosch University's sustainability, green economy and community development according to the Hope Project and the PSG4. The identified relevant faculties consists of Agriscience; Arts and Social Science; Economic and Management Sciences; Engineering; Law; Medicine and Health Sciences; and Natural Sciences as out lined in the figure 7 below. Each of this department consists of different research units that are currently undertaking different projects that are relevant to the Sustainability in terms of the Western Cape Government in Sustainability Strategic Goal 4 (PSG4). The details of these projects according to faculties and research units is clearly outlined in Appendix C Of this document.

Table 15: Overview of projects identified at the University of Stellenbosch*

Natural environment	Built environment	Infrastructure	Climate change	Green economy
169	60	65	227	186

[15] http://thehopeproject.co.za/hope/Pages/default.aspx

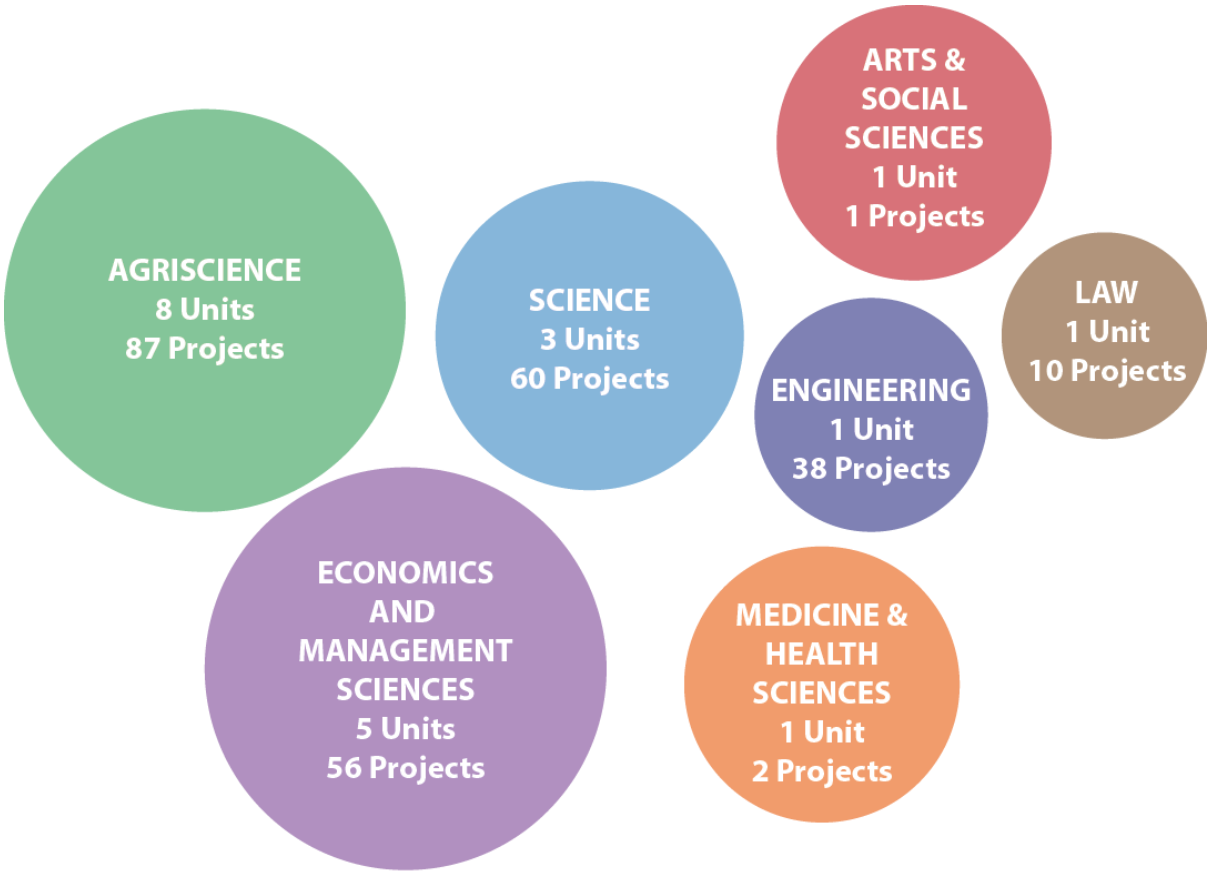

Figure 7: Overview of projects identified at the University of Stellenbosch

The Reader of the following section should note that the mapping exercise of these projects involved a couple of limitation in terms of data validation, in some research units. For example, the websites that the information was extracted from might not necessarily be up to date, thereby missing the information on the other projects taking place. Further, the faculties that where not mapped does not necessarily mean they do not have relevant research units and projects, but are highly engaged with other faculties, as a way of emphasising the interfaculty research approach. It is also important for the reader to note that most of the researchers do conduct some research without funding from the specific funding institution, as some of their researches are done as voluntary initiatives in the surrounding communities, and through the supervisions of the masters degree's theses and dissertations. The other limitation of this mapping is that most of the research units and faculties do not have the validation of either the annual budget or the desired budget information which is the main gap of the missing information across the research units. In addition, some units have extensive amount of projects taking place, and therefore it is important to note that most of those units their projects actually operates across the faculties and departments which therefore diversify their projects focus areas. For example, the Food Security Initiative projects does not all belong at

the faculty of Agriscience but also forms part of the Arts and Social Science; Health Sciences; Economic and Management Sciences; Engineering; and Natural Sciences.

As displayed in the figure below, Stellenbosch consists of the seven faculties, which holds 20 relevant research units and departments, of which 261 relevant projects where mapped and documented. The figure below further illustrate how the faculty of Agriscience holds majority of the Research units and 92 projects, followed by the faculty of Natural Science with 63 projects; the Economic and Management Sciences with 59 projects; and the Faculty of Arts and Social Sciences with the least projects as only one relevant research unit was identified. Therefore there is an extensive gap on the relevant research initiatives based on the Arts and Social Sciences. Considering the role that the social science research has on communities and humans' livelihoods, the encouragement of the social science based research has the potential to enable the creation of sustainable equally just societies.

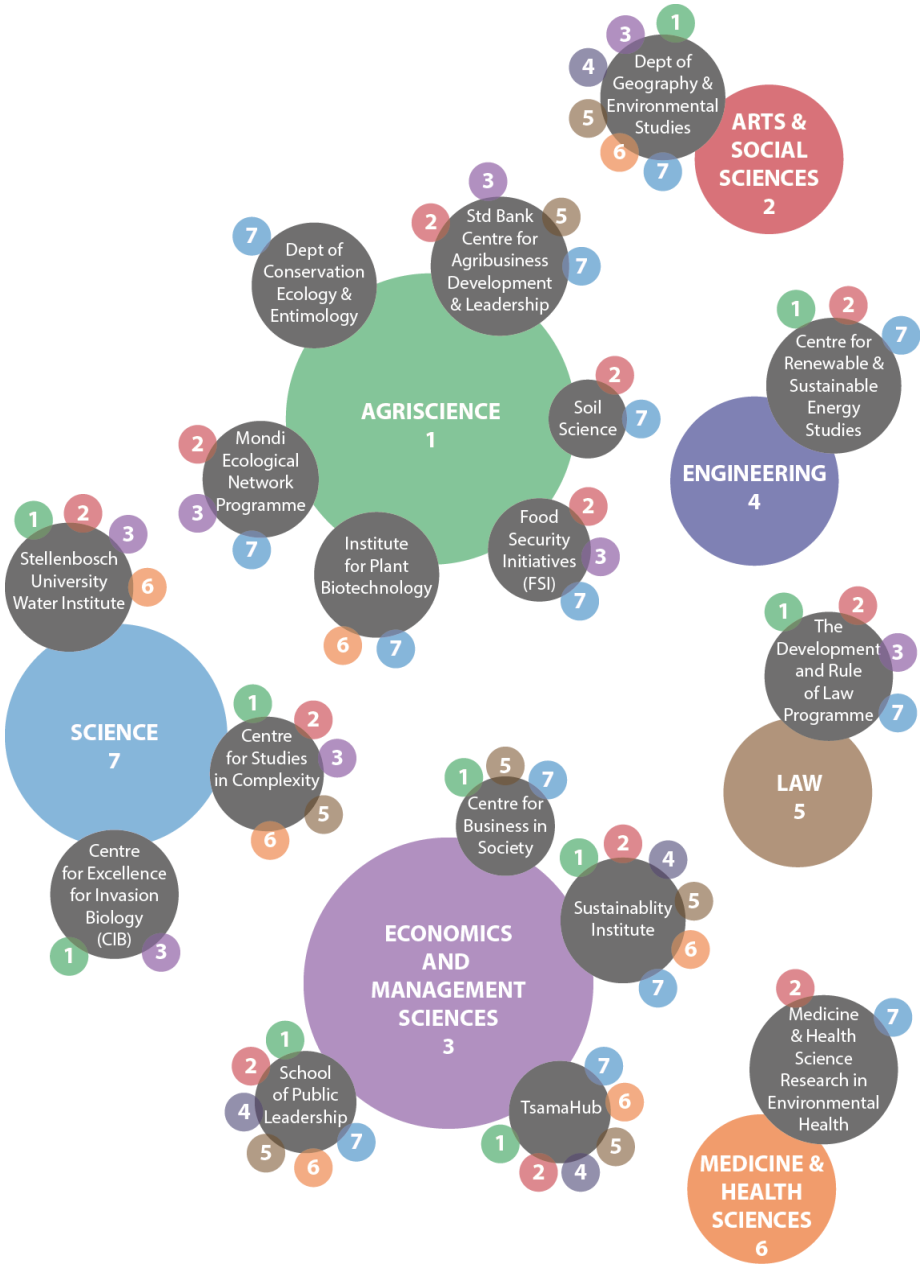

Figure 8: Overview of Departments, Centres and Units identified within each Faculty. The numbers are used to highlight interdisciplinarity, illustrating where linkages have been identified between a Department, Centre or Unit that is based within on faculty and researchers based at another faculty.

Stellenbosch University research initiatives also have the limited focus on the infrastructure and build environment, which are the most important focuses as they can determine the future of the cities and surrounding communities. However, there if extensive focus on climate change, green economy and natural environment.

The mapping exercise of Stellenbosch University used different categories of the PSG4 which are the natural environment, infrastructure, climate change, green economy, built environment as presented in the table below. The projects distribution yield table shows how most of the research initiative focus is on climate change with 227 projects having the main focus on climate mitigation factors, and the design of the climate resilient communities' strategies (see the table 15 above). All the mapped faculties has the initiatives on climate change resulting in the substantial focus on climate change. The Second most focused on PSG4 pillar is that of green economy with 186 initiatives taking place in the university. Most of the initiatives in the green economy are based on the faculty of economic and management sciences and Agriscience, with the engineering faculty as a supportive faculty for the promotion of green economy through the investments in renewable and sustainable energy. The focus on the natural environment is also high with 169 projects taking place in the university. Majority of the projects on natural environment are based at the faculty of Agriscience and Natural Science, with the economic and management sciences as the supporting faculty with 20 projects on the importance of natural environment in the natural environmental system, and the role of business in natural environment. There is limited focus on the infrastructure and built environment at Stellenbosch University. For example, on infrastructure there are 65 projects and on built environment there are 60 project. Most of the projects on infrastructure and green economy are based on the faculty of economic and management sciences through units such as logistics and sustainability institute; the engineering faculty through the centre for renewable and sustainable energy; and the Natural Science faculty through the Stellenbosch university water institute.

4.3.1 Per faculty overview for the University of Stellenbosch

4.3.1.1 Faculty of Agriscience

Dean: Prof Mohammad Karaan

Website: http://www.sun.ac.za/english/faculty/agri

Relevant departments/units/centres: 8

Relevant projects identified: 87

The Faculty of Agriscience at Stellenbosch University (SU) is held in high esteem at national and international levels for the quality of its training and research and also as consultant in the agricultural and forestry industry. Students enrolled in the Faculty's under- and postgraduate programmes are expertly trained to become leaders and managers in the various sectors of the industry. Throughout the RSA – and abroad – alumni of the Faculty can be found in top positions.

The relevant research units and departments of the Agriscience faculty are as follows:

- Department of Conservation Ecology and Entomology
- Department of Forest and Wood Science
- Department Soil Science
- Food Security Initiatives (FSI)
- Hydrology, Remote Sensing, GIS
- Mondi Ecological Network Programme
- Standard Bank Centre for Agribusiness Development and Leadership
- Sustainable Agriculture in South Africa (SASA)

The main focus in the units of Agriscience faculty is the natural environment and climate change as a way to find strategies on the protection and conservation of the natural environment, while finding ways on how the natural environment can be resilient while promoting green economy through the agricultural based initiatives. The main projects on natural environment are promoted by the department of conservation ecology and entomology; department of forest and wood science and the Mondi ecological Network Programme. The climate change projects are across all the units with Sustainable Agriculture in South Africa having the most projects. Standard Bank Centre for Agribusiness Development and Leadership administers most of the green economy projects. In overall the faculty of Agriscience has little focus on the built environment and infrastructure.

Table 16: Classification of projects in the faculty of Agriscience*

Natural environment	Infrastructure	Climate change	Green economy	Built environment
79	4	73	57	9

* Note that each project can be linked to several themes, and that the each projects can thus been counted more than once in the mapping framework above

4.3.1.2 Faculty of Arts and Social Sciences

Dean: Prof Johan Hattingh

Website: http://www.sun.ac.za/english/faculty/arts

Relevant departments/units/centres: 1

Relevant projects identified: 1

There is one relevant research unit at the faculty of Arts and Social Science. However this faculty prides itself by providing a dynamic and interactive learning environment to its students focusing in particular on preparing our graduates for an ever-growing knowledge-based society and economy. Its research, teaching and learning, and community interaction focuses on the challenges of being human in a rapidly globalising world. It is our goal to not only become the base for training in the humanities in particular the Arts, Languages and Social Sciences, but to provide teaching and research that is relevant to the region, country and continent, and is internationally competitive. Therefore the faculty of Arts and Social Sciences is fully aware of the extent of this challenge and strives continuously through its creative strategies to make a significant contribution to a knowledge-based society and economy in Africa. The relevant department is:

- Department of Geography and Environmental Studies

However, it is important for the reader to note that even though the only identified research unit is the Department of Geography and Environmental Studies, most of the projects in other faculties are administered in conjunction with the Arts and Social Science faculty. For example most of the projects at the Food Security Initiatives at Agriscience faculty are administered form the Social Sciences departments. The sustainability institute from the economic and management sciences faculty is highly reliant on the social sciences departments in terms of research methodologies and focus areas. Pars of the projects in the Engineering Faculty further develops through the social science. The rule of law projects are all community based projects. On the Natural Sciences faculty the Water Institute projects highly emphasise the importance of communities and the social sciences in researches on water. Thus, the Water and Society researches are dedicated on linking the Natural Sciences with the Social Science.

Table 17: Classification of project in the Faculty of Art and Social Science[*]

Natural environment	Infrastructure	Climate change	Green economy	Built environment
1	1	1	1	1

[*] Note that each project can be linked to several themes, and that the each projects can thus been counted more than once in the mapping framework above

4.3.1.3 Faculty of Economics and Management Sciences

Dean: Prof Stan du Plessis

Website: http://www.sun.ac.za/english/faculty/economy

Relevant departments/units/centres: 5

Relevant projects identified: 56

For the past years, the Faculty has been strengthening and diversifying its postgraduate platform. The latest development is the establishment in 2014 of a postgraduate school in Economic and Management Sciences. The school offers researchers from Africa and the rest of the world a full-time bursary programme to enable them to complete their doctoral studies in three years. Most postgraduate students study at the School of Public Leadership and the USB, while the Africa Centre for HIV/Aids Management boasts an annual intake of almost 300 students. USB was the first school from an African university to acquire all three international accreditations for business schools, namely AACSB, EQUIS and AMBA. The Faculty vigorously pursues research excellence and capacity development. We are therefore very proud of our 26 NRF-rated researchers and the Research Chair in the Economics of Social Policy hosted by the Faculty. The relevant research units for this faculty are:

- Centre for Business in Society
- Department of Logistics
- School of Public Leadership
- Sustainability Institute
- Sustainability Institute projects

The main focus in this faculty is the promotion of green economy and sustainable investments as a way to support the climate change initiatives, infrastructure development and the natural environment. For example the Centre for Business in Society has the mandate to make the sustainable development agenda of the 21st century relevant for leadership, organisational and societal learning. In doing so, CBiS is a laboratory for co-creating `transformative solutions for a sustainably developed world. The Sustainability Institute is the main link of the Economic and Management faculty and other faculties through it transdisciplinarity research initiatives which focuses on ecological, community and mental development. The Sustainability Institute projects prides itself as being the main network between institutions offering the expertise sustainability research focuses with the organisation that need assistance with the understanding of sustainability. However, the economic and management sciences faculty has least focus on the built environment with only 17 projects taking place, against the 56 projects on green economy. Infrastructure development is the speciality of the department of logistics through the promotion of sustainable infrastructure development.

Table 18: Classification of projects in the Faculty of Economics and Management Science[*]

Natural environment	Infrastructure	Climate change	Green economy	Built environment
20	24	38	56	17

[*] Note that each project can be linked to several themes, and that the each projects can thus been counted more than once in the mapping framework above

4.3.1.4 Faculty of Engineering

Deans: Prof Hansie Knoetze

Website: http://www.sun.ac.za/english/faculty/eng/

Relevant departments/units/centres: 1

Relevant projects identified: 38

The Faculty of Engineering at Stellenbosch University is one of South Africa's major producers of top quality engineers. Established in 1944, the Faculty is housed in a large complex of buildings with modern facilities. It has excellent teaching facilities and research laboratories. The Faculty has approximately 900 postgraduate. The Faculty of Engineering is at the forefront of basic and applied research by focusing on cutting-edge and inter-disciplinary research. The identified relevant research unit within the faculty of engineering which encourages the inter-disciplinary research across the faculty's department is the flowing:

- Centre for Renewable and Sustainable Energy Studies (CRES)
- Department of Information Technology

CRSES acts as a central point of entry into Stellenbosch University for the general field of renewable energy, and strives to develop renewable and sustainable energy in order to facilitate economic growth in the area of renewable energy. For example the table below displays how CRES facilitates green economy with 37 projects, through renewable energy infrastructure development, in order to mitigate the climate change effects in the societies. Thus the Faculty is research-intensive and is one of the largest contributors to the research income of Stellenbosch University. Built environment is one of the strong focus for CRES, as the unit is more concerned about the future of energy provisions that supports green economy and the development of sustainable infrastructure. There is little focus on the natural environment with only 14 projects taking place. However, the IT faculty through their initiatives on energy efficiency, Indoor environmental quality and transport, is moving its focus closely to the natural environment. For example theThe new IT Building is under construction for occupancy 1 Sept 2015. As clients the IT Division has insisted on various sustainability features in the design and these have been incorporated.

Table 19: Classification of projects in the faculty of Engineering*

Natural environment	Infrastructure	Climate change	Green economy	Built environment
14	24	35	37	19

* Note that each project can be linked to several themes, and that the each projects can thus been counted more than once in the mapping framework above

4.3.1.5 The Faculty of Law

Dean: Prof Sonia Human

Website: http://blogs.sun.ac.za/law/

Relevant departments/units/centres: 1

Relevant projects identified: 10

The relevant research unit according to the PSG4 is The Development and Rule of Law Programme [DROP]. The aim of DROP is at researching "sustainable development law and policy" focusing on reconciling the tensions between environmental sustainability, economic development, and human welfare with a holistic view of current legal, political, economic, social and cultural developments. It integrates public international law (i.e. international economic, social, and environmental law), regional and national law and policy with the goal of enhancing the rule of law around the world and reducing poverty in developing nations. This unit therefore has its main focus on climate change and the natural environments, as its aim is to reconcile the tensions between the ecological justice and social justice, which promotes green economic development. As show in the table below the faulty of law has little focus on the infrastructure and built environment as its main focus is on the societies and climate change, in the African societies.

Table 20: Classification of projects at the faculty of Law*

Natural environment	Infrastructure	Climate change	Green economy	Built environment
7	2	10	6	4

4.3.1.6 The Faculty of Natural Science

Director: Prof Louise Warnich

Website: http://www.sun.ac.za/english/faculty/science/

Relevant departments/units/centres: 3

Relevant projects identified: 60

The Faculty of Science is respected within South Africa, Africa and the world arena as a knowledge-partner of note that builds on the scientific, technological and intellectual capacity of Africa and plays an active role in the development of South African society. The faculty is placed in the top 300 within the category Natural Sciences of the QS World University Ranking list. The Faculty of Science has eight departments, as well as several world-renowned centres with excellent facilities and established research groups. The relevant identified research units and departments consists of the following:

- Centre for Studies in Complexity
- DTS-NRF Centre for Excellence for Invasion Biology (CIB)
- Stellenbosch University Water Institute

The main focus of the projects from the Science faculty is on climate change and natural environment, with the strong interdisciplinary research approach. For example the Centre for Studies in Complexity (CSC) is an interdisciplinary research and training centre of Stellenbosch University that studies complex phenomena and draws together researchers and practitioners interested in complexity. The CSC provides the institutional framework and infrastructure for engaging with complexity systematically and in depth. According to the table below 48 projects focuses on the protection of the natural environment, and this is administered through the DTS-NRF Centre for Excellence for Invasion Biology (CIB) which aims to reduce the rates and impacts of biological invasions by furthering scientific understanding and predictive capability, and by developing research capacity. Green economy is not the main focus of the science faculty with only 29 projects. there is limited focus on the infrastructure and built environment.

Table 21: Classification of projects in the Faculty of Natural Science[*]

Natural environment	Infrastructure	Climate change	Green economy	Built environment
48	10	60	29	10

[*] Note that each project can be linked to several themes, and that the each projects can thus been counted more than once in the mapping framework above

4.4 Overview of the University of the Western Cape

At the University of the Western Cape a relatively small number of relevant research units and projects were identified, of the seven faculties at UWC only two are involved in PSG4 related research these being the faculty of Economic and Management Science and the faculty of Natural Science as shown in figure 9 below. These result indicate that the larger portion of PSG4 research at UWC involve a scientific approach to climate change, sustainability and green economy.

Figure 9: Overview of units and projects identified per faculty at the University of the Western Cape

Research is being conducted in the field of sustainability thought the development of sustainable harvesting practices of natural and agricultural resources as well as the development and implementation of legislation concerning the agriculture and the harvesting of natural resources as seen in the research conducted in the Faculty of Economics and management science. The Lack of PSG4 related research in faculties such as law and community and health science represent a gap in the research capacity of UWC. The limited PSG4 related research conducted at UWC in comparison to the three other CHEC institutions could be attributed to the limited linking of PSG4 to the faculties which are housed at UWC. Faculties such as Dentistry, Art and Education do not provide platforms on which to conduct PSG4 related research. The division of projects into the five pillars of PSG4 show that the focus of UWC as a whole in relation to PSG4 is the development of infrastructure. This is evident in the fact that the majority of the research conducted by the Environmental Nanoscience research group (ENS) and the Institute of Water studies (IWS) involve the purification and management of water. Similarly the contributions of Hydrogen South Africa systems (HySA) to UWC's research pool places the emphasis of research at UWC on the development of infrastructure. Research alighted with the natural environment pillar of PSG4 is also being conducted at UWC in the form of the work done by the Institute of Poverty, Land and Agrarian Studies (PLAAS), whose main focus is the development of sustainable farming and fishing practices. The table below provides an overview of how the research conducted at UWC is distributed across the five pillars of PSG4.

Table 22: Classification of projects at UWC*

Natural environment	Built environment	Infrastructure	Climate change	Green economy
17	2	28	2	16

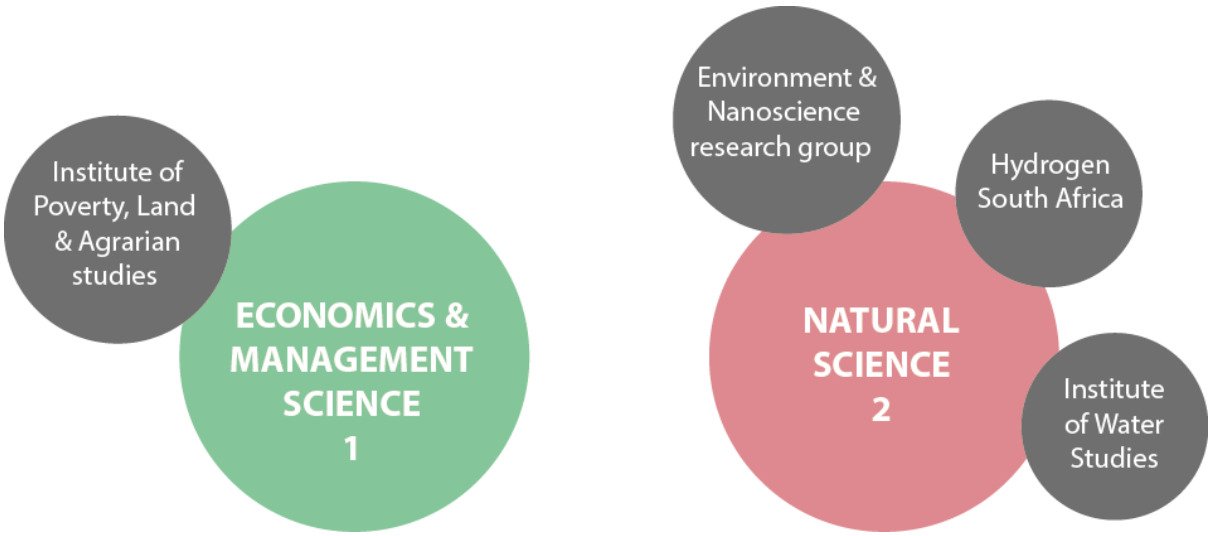

Figure 10: Overview of Departments, Centres and Units identified within each Faculty

* Note that each project can be linked to several themes, and that the each projects can thus been counted more than once in the mapping framework above

4.4.1 Per faculty overview for the University of the Western Cape

4.4.1.1 The Faculty of Natural Science

Dean: Professor Mike Davies-Coleman

Website: http://www.uwc.ac.za/Faculties/NS/

Relevant departments/units/centers: 3

Relevant projects identified:

The University of the Western Cape boasts a fast growing and diverse faculty of Natural Science, with an undergraduate programme bolstered by a rigorous teaching and learning programme focused on improved throughput and increased pass rates. Postgraduate studies form a large part of the Natural Science Faculty which hosts in excess of 900 postgraduate students completing honours, Maters and Doctoral degrees. The faculty of Natural Sciences houses ten departments, covering fields ranging from biological sciences to physical sciences and mathematics. The faculty is also home to three research institutions and two scientific service units.

Groups within the Faculty of Natural Science participating in relevant research:

- Hydrogen South Africa systems (HySA) (11 projects)
- The Institute of Water Studies (IWS) (7 projects)
- The Environmental and Nanoscience research group (ENS) (16 projects)

The theme of the research carried out by IWS surround the sustainable use and management of water sources and the purification of water. ENS is focused mainly on the decontamination/remediation of mining waste and water purification, while HySA's research themes revolve around the production of energy via the use of hydrogen fuel cells. Among these research groups there is a total of sixteen projects being conducted that is relevant to PSG4 these projects are categorised as general research, however they are in the areas of natural environment, infrastructure and green economy.

Table 23: Classification of projects identified in the faculty of Natural Science*

Natural environment	Built environment	Infrastructure	Climate change	Green economy
13	1	21	0	10

* Note that each project can be linked to several themes, and that the each projects can thus been counted more than once in the mapping framework above

4.4.1.2 The Faculty of Economics and Management Sciences

Dean: Professor Kobus Visser

Website: http://www.uwc.ac.za/Faculties/EMS/

Relevant departments/units/centers: 1

Relevant projects identified:

The faculty of Economics and Management Science (EMS) at the University of the Western Cape is well- connected with commerce, industry and government, aiding in the maintenance of a strong teaching and applied research focus. This has allowed the faculty of Economics and Management to build and sustain a curtail presence in both the private and public sectors. The focus of this faculty is the development of individuals who will flourish in the field of economics, business management, finance, human resources and information systems. The education of those with an interest in government, developmental studies and public administration is another facet of this faculties programme. The output of individual academic as well as a number of research units have allowed the EMS faculty maintains a strong research focus.

Groups within the Faculty of Economics and Management Science participating in relevant research:

- Institute for Poverty, Land and Agrarian Studies (PLAAS) (6 projects)

Five relevant projects driven by PLAAS has been identified one of which is categorised as general research in the area of climate change, another is categorised in the areas of infrastructure and built environment. Three of the five projects are categorised in the area of natural environment. The main research focus of this faculty is the sustaining naturally occurring food sources ie. fish reserves, however the development of research tools and the social aspects of inadequate water and sanitation in rural settlements is being studied as well.

Table 24: Classification of projects in the faculty of Economic and Management Science*

Natural environment	Built environment	Infrastructure	Climate change	Green economy
3	1	1	1	0

* Note that each project can be linked to several themes, and that the each projects can thus been counted more than once in the mapping framework above

5. Conclusion

In conclusion, each of the four CHEC institutions provided substantial amounts of research initiatives which address aspects that fall under the WCG's five identified thematic areas crucial for achieving the PSG4's goals. In essence, this project was a research mapping exercise that provided an overview of the raw number of projects as well as the faculties and departments they belonged to. It emerged that some CHEC institutions focussed more on certain thematic areas than others, whilst some produced a greater amount of projects than others. These particular differences and complexities can be accounted for historically in terms of the role Apartheid played in funding preferences to white institutions. As a result of this legacy, the previously white-only institutions of the University of Cape Town and Stellenbosch University developed and maintained well equipped and well-resourced faculties/departments that were capable of larger research outputs. However, the gap between the two historically advantaged institutions and the two disadvantaged institutions, University of the Western Cape and the Cape Pennisula University of Technology, is closing, with cutting edge research being produced across all institutions. Today, the four institutions are equally important for the WCG's plan in meeting the goals for the PSG4 project, yet there is still some way to go in enabling each institution to conduct a broad range of research.

As mentioned, there were not only noticeable differences in total volume of projects between the four institutions, but also within the faculties or research divisions inside the institutions. The humanities faculties and affiliated branches produced noticeably fewer projects outlined under the five thematic criterions. This can be accounted for by the differences in research aims and goals between faculties, with the humanities possessing fewer departments that are interested in built environment, infrastructure and climate change,and not the result of the shortcomings of humanities faculties in general terms. In fact, the primary bulk of humanities related projects are the result of the willingness for interdisciplinary studies. Furthermore, the humanities faculty often provides the ideas that later become the projects for the engineering faculty, whilst providing crucial research methodologies to the economic and management departments. Naturally, the engineering, science and commerce faculties produced the highest output of projects, which can be accounted for due to the teaching and research interests of those faculties being related to the themes of the PSG4.

In terms of the overall thematic spread of projects, the climate change theme has the largest number of associated projects, followed by the green economy and the natural environment. The infrastructure theme has somewhat less associated projects, with the built environment category having the least. This distribution of projects varies somewhat between the different institutions, with for example the majority of CPUT's projects, contrary to the overall trend across the four institutions, falling in the infrastructure and built environment themes. The individual trends that were discovered for the four institutions are outlined in more details below.

While the focus of this research mapping exercise was on identifying research trends through the identification of projects, the process revealed how a significant amount of research also takes place outside the frames of a research project or programme. This includes individual research conducted by academic staff, as well as student dissertations, both of which are at times either individually funded or unfunded and thus does not fall within one structured project or programme. Hence future research mapping exercises should focus on also uncovering this less obvious research activities.

5.1 University of Cape Town (UCT)

At UCT 256 projects were identified as relevant to PSG4, distributed across 54 departments and research units and centres – primarily from the engineering and science faculties. The bulk of the projects, 124, were associated with the climate change theme, which can to a large extent be attributed to there being three units in which climate change is a central focus: the Energy Research Centre (ERC), the Climate Systems Analysis Group (CSAG) and the African Climate & Development Initiative (ACDI). The green economy, infrastructure and the natural environment themes were roughly equal in terms of related projects – each averaging just over 70 associated projects. With only 28 projects the built environment theme had by far the least number of associated projects at UCT.

The distribution of projects across the different UCT faculties, with the majority falling under the Faculty of Science and the Faculty of Engineering and the Built Environment, reflects how a large portion of UCT's relevant research capacity is in the space of engineering, technology and natural science. While there is relevant research taking place in departments and research units and centres associate with business and commerce, law and the social sciences, the number of projects are significantly less.

Overall, it was found that UCT holds a broad capacity for research across the five thematic areas relevant to the PSG4, with noteworthy specialisation in the area of climate change.

5.2 The Cape Peninsula University of Technology (CPUT)

The CPUT has undertaken 43 research projects under its 18 departments and research interest groups with strong emphasis on the economy, climate change and sustainability. These research areas were primarily spearheaded by the engineering and applied science faculties. The engineering faculty piloted projects almost evenly across the five themes with infrastructure having the most related projects. The applied sciences faculty's research area includes but is not limited to ecology conservation, food security, community health, pollution monitoring and sustainable sanitation. The faculty of informatics and design focuses on waste management, sustainable product service systems (PSS), green building and sustainable construction. The Departments of Applied Design and Architectural Technology & Interior Design spearheaded most of the projects – focusing on the built environment and infrastructure. Lastly, the Faculty of Business and Management Sciences is the largest faculty at CPUT with the Centre for Tourism Research in Africa (CETRA) producing most of the projects related to PSG4 such as sustainability and economic growth. This resulted in infrastructure and the green economy being the two leading projects interest areas within this faculty.

5.3 Stellenbosch

Simply put, the scope of this report has been; to identify research groupings and programs which speak to PSG4. More specifically, it has highlighted those programs which are related to the arena of climate change, sustainable settlements and, finally, the green economy. Stellenbosch University positions itself strategically in relation to the PSG4. Part of the strategic intent is driven by the HOPE project, which aims to address socio-economic issues, as well as environmental issues at the level of teaching and learning. Among the faculties relevant to the PSG4 are, Agriscience; Arts and Social Science; Economic and Management Sciences; Engineering; Law; Medicine and Health Sciences; and Natural Sciences.

An obvious limitation in the collation of data at Stellenbosch University has to do with the very source of information. While the website has not being properly updated to reflect ongoing curricula changes, it is important to understand that Stellenbosch University adopts an inter-disciplinary approach to teaching and learning. Therefore, research units that are relevant may not have been included in the mapping, since they may have fallen outside of the categories of the PSG4.

As mentioned above, although researchers conduct studies that are at times commissioned, much of the output is located in dissertations and theses. In addition, the interdisciplinary nature of the university means that initiatives, such as the food security initiative, do not fall under the auspice of any one department, but can in fact be promoted in seemingly incompatible faculties such as the Health Science Faculty and the Arts and Social Science Faculty. Nevertheless, the focus at this institution remains critically low when it comes to two important components; infrastructure and the built environment. At any rate, most of the projects focus on climate change and green economy, evidence most strongly by the promotion of renewable and sustainable energy. For instance, the Faculty of Agriscience, considered among the best in the world, consists of a number of departments. These include, among others, Department of Soil Science as well as the Department of Conservation and Ecology and Entomology. The department's focuses on the natural environment and climate change, in order to create innovative ways of production that do not contribute to excessive carbon footprints. The focus thus remains largely on the green economy and not on the built environment or infrastructure. In keeping with the interdisciplinary approach, a faculty such as the Arts and Social Science will at one and the same time have links with other faculties such as Natural Science or Business Science, since the aim of the social science is to develop critical ways of thinking about humanity in an increasingly globalising world. So, food security initiatives run alongside the Department of Geography and Environmental studies, for instance. This highlights yet again the focus on green economy over infrastructure and built environment.

The Faculty of Management Science at Stellenbosch University also emphasises the green economy by making all the departmental research goals and aims dovetail with sustainable investments which aim to support climate change initiatives. One component of this faculty is the Sustainability Institute, which helps link different entities to networks of sustainable development programmes. This faculty is least focused on infrastructure and the built environment. As far as engineering is concerned, the main centre for PSG aligned research is the Centre for Renewable and Sustainable Energy Studies. Unlike others, this centre is committed to mitigating climate change by attending to the built environment. At the same time, however, it is less concerned with the natural environment as a result. Furthermore, the Law Faculty creates a narrow space through which to attend to the juridical aspects of environmental law, both nationally and internationally. Lastly, the Faculty of Science is, unlike the others, less concerned with Green economies than it is with protection of the natural environment. It is clear from the above that Stellenbosch University does not currently privilege the built environment as well as infrastructure as much as it does climate change and green economy.

5.4 UWC

At the University of the Western Cape, only two faculties conducting research in the PSG4 thematic areas have been identified; Economic and Management Science and the Faculty of Natural Science, making it by far the least nuanced of the institutions. Although only two faculties at UWC are doing PSG4 aligned research several thematic areas are being covered. The main focus of PSG4 aligned research conducted at UWC is centered on the improvement of infrastructure and by extension

green economy. Researchers at HySA and ENS are focused on the production of clean energy sources and improving water sanitation and management strategies respectively. The preservation of ecological and agricultural resources is another thematic area which is focused on at UWC, as seen in the work carried out by the PLAAS. The limited amount of research into PSG4 related areas highlights a gap in the research capacity of UWC. The limited PSG4 aligned research at UWC can be attributed to the fact that UWC does not house all the faculties that the other CHEC institutions do, faculties such as engineering for example contribute many projects to the research capacity of the other institutions but are absent from the research capacity at UWC. Therefore in spite of the short coming of UWC as a PSG4 aligned institution, the gaps in UWC's research capacity mean that there is room for expansion and aligned with PSG4.

6. Appendices

6.1 Appendix A: Questionnaire circulated to relevant units and institutions

CHEC and Western Cape Government research Mapping Exercise

The Cape Higher Education Consortium (CHEC) and the Western Cape government are exploring climate change, sustainability and green economy research being conducted at the four universities in the Western Cape. Completion of this questionnaire will aid in the accomplishment of this task, thank you in advance for you cooperation.

What research/ projects are relevant for this mapping exercise?

The focus of this mapping exercise is on research related to the Provincial Strategic Goal #4 of the Western Cape Government (PSG 4)**:** *Enable a resilient, sustainable, quality and inclusive living environment.* This includes research that speaks to the following thematic areas:

#1	*#2*	*#3*	*#4*	*#5*
Natural environment	*Infrastructure*	*Climate change*	*Green Economy*	*Built environment*
Agricultural land, rivers, air, land/rock/sand etc	Water, sanitation, electricity, ICT, transport, etc	Mitigation, adaptation, resilience, disaster response, risk, vulnerability etc	Low carbon economy, green growth, green investment trajectories, green jobs etc	Urban design, town planning, construction, housing provision, building materials etc

Name:

Research units that you are affiliated to:

1. Research interests

a. What are the main research themes/research questions of interest to your research entity?

b. What are your current research interests related to PSG 4 (as outlined above)? Kindly specify which of the above thematic areas your interests relate to, and outline central research questions.

c. If you did not have to consider availability of funding, what research directions/ideas related to PSG 4 would you like to explore? Kindly specify which of the above thematic areas your interests relate to, and outline central research questions.

2. *Research projects*

a. Are you involved in any relevant research projects outside you department or research unit (i.e projects you are involved in through other research units/groups)? If yes, please fill in project info below, or provide the name of the project and the details for a contact person for the project. (*Please also include projects that are in the pipeline, but which have not yet started, or projects that have been completed in the past three years)*

Name of project:

Department/research group/research unit through which you are involved:

Project focus area (geographical):

Funder:

Project contact person:

Short project description: [Max 1 paragraph]

Project partners:

Status of project:

Project website:

Expected project outputs: [i.e. one PhD and one Masters thesis, policy briefs, research reports]

(if you have more than one project then please copy and paste the outline above and fill out below)

3. *Relevant research units/groups*

a. Are there any departments/units/groups at the university conducting research relevant to the PSG 4 that you think we should contact?

[kindly provide key contact person if possible]

b. Are there any relevant projects (current or planned) that you are not part of, but that you think will be relevant for this mapping exercise?

[kindly provide key contact person if possible]

Thank you for aiding in this research, please indicate if you would like to be kept informed about the findings of the research and publication of the compiled results.

YES	*No*

6.2 Appendices B: Distribution of projects at CHEC institution into thematic research areas

University	Faculty	Group	Projects/ Themes/ Activities	PSG4: Enable a resilient, sustainable, quality and inclusive living environment				
				Natural environment	Infrastructure	Climate change	Green economy	Built environment
Cape Peninsula University of Technology	**Faculty of Engineering**	**Energy Institute**	Renewable Energy (T)	✔	✔	✔	✔	✔
			Bioenergy (T)	✔	✔	✔	✔	✔
			Gel Fuel Stove (P) - *with PLMCC*	✔		✔		
			Biomass (T)	✔	✔	✔		
		Centre for Distributed Power & Electronic Systems (CDPES)	Renewable Energy (A)	✔	✔	✔	✔	✔
			Small hydro power plants in distributed electricity generation (A)	✔	✔	✔	✔	✔
			Distributed co-generation automation systems (A)		✔			✔

		Product Lifecycle Management Competency Centre (PLMCC)	Shell Eco Marathon (P)			✔	✔	
			Renewable Energy (T)	✔	✔	✔	✔	✔
		Adaptronics Advanced Manufacturing Technology Laboratory (AMTL)	Ocean Engineering (R+A)	✔	✔	✔	✔	✔
			UAV 60 - *with PLMCC*				✔	
			Universal Design (R+A)		✔			✔

		Centre for Substation Automation and Energy Management Systems (CSAEMS)	Development of IEC61850 standard-based substation automation (T+A)	✔	✔			✔
			Development of IEC61970 standard-based Energy Management Systems (T+A)	✔	✔			✔
			CSAEMS development and growth (P)	✔	✔			✔
			CSAEMS development and implementation (P)	✔	✔			✔
			Energy Management Systems for building smart grid of power system (energy security)		✔			✔
		Department of Mechanical Engineering	Environmental Engineering	✔	✔	✔	✔	✔
			Hydraulic Machines	✔	✔	✔	✔	✔
			Global Environmental Studies	✔	✔	✔	✔	✔

		French South African Institute of Technology (FSATI)	FSATI Field Mill - *with PLMCC*	✔	✔			✔
		Real-Time Distributed Systems (RTDS)	Development of nonlinear controllers and their PLC implementation for control of wastewater treatment (P)	✔	✔			✔
			Waste water treatment (T)	✔	✔	✔		✔
	Faculty of Applied Sciences	**Biodiversity and Conservation Department**	Ecology conservation and understanding	✔		✔		

		Agriculture Department	Food Security and Agricultural Livlihoods	✔		✔		
		Centre for Water and Sanitation Research (CWSR)	Evaluation of user acceptance and functioning of mobile communal sanitation (P)	✔	✔			✔
			Interactive Risk Reduction Approach: reducing risks from informal settlement waste stream (P)	✔	✔			✔
		Community Water Supply and Sanitation Unit (CWSS)	Sustainable sanitation and water supply (T)	✔	✔	✔		✔

		Environmental Toxicity and Remediation (ETR)	Assess and monitor the state of pollution in aquatic and terrestrial environments (T)	✔	✔		✔	✔
			Develop and evaluate appropriate remediation technologies to clean environment (T)	✔	✔	✔	✔	✔
		Institute of Biomedical and Microbial Biotechnology (IBMB)	Community Health (T)			✔		
			New Perspectives on Global Warming (Climate Change) and Food Security (P)	✔		✔	✔	

	Faculty of Informatics and Design	**Design for Social Innovation and Sustainability (DESIS)**	Solid Waste Management in Informal Settlements (P)	✔	✔			✔
		Industrial Design Department	Biomimicry	✔	✔	✔	✔	✔
			LeNSES PSS	✔	✔	✔	✔	✔
		Architecture Department	Construction & Detailing (CDR4) - Green Building	✔	✔	✔	✔	✔
			Design Build Research Studio	✔	✔			✔
			Sandbag House construction	✔	✔	✔		✔
			Mixed-use Social Housing		✔			✔

	Faculty of Business & Management Sciences	**Centre for Tourism Research in Africa (CETRA)**	Sustainability and legacy of mega and hallmark events	✔	✔		✔	✔
			Event Impact Study	✔	✔		✔	✔
			Developing a standardised methodology to conduct event impact assessment for the five events (Cape Town Cycle Tour, Old Mutual Two Oceans Marathon, Cape Town International Jazz Festival, ABSA Cape Epic & ABSA Klein Karoo Nasionale Kunstefees)	✔	✔		✔	✔
			CARNiVAL		✔		✔	

University	Faculty	Group	Projects/ Themes/ Activities	PSG4: Enable a resilient, sustainable, quality and inclusive living environment				
				Natural environment	Infrastructure	Climate change	Green economy	Built environment
The University of Cape Town	**Graduate School of Business**	**Sustainable Enterprise and Emergent Change (SEEC)**	Knowledge on organisational innovation in response to social-ecological problems					✔
			Develop, implement and learn from different models of trans-disciplinary, engaged scholarship					✔
			The Business of Social and Environmental Innovation: New Frontiers in Africa					✔

	Faculty of Commerce	**Development Policy Research Unit (DPRU)**	EPP: Community Work Programme					✔
		Southern Africa Labour and Development Research Unit (SALDRU)	Evaluation of the Public Works Programme					✔
		Environmental Economics	Climate Change and Wildlife Utilization on Private Land in South Africa				✔	

		Policy Research Unit (EPRU)	Marine Protected Areas and Small-Scale Fishing Behaviour: a Comparative Analysis between South Africa, Tanzania and Costa Rica	✔				
			Optimal Pricing of Parks and Wildlife Resources in Eastern and Southern Africa	✔				
			The role of institutions in wildlife conservation in South Africa and Zimbabwe: A social-ecological systems approach	✔				
			Poverty, resource scarcity and climate variability: constraints to adaptation	✔			✔	
			Evaluation of Dry-lands Ecosystems Services in the area surrounding the Kgalagadi Transfrontier Park in South Africa	✔				

		Policy Research on International Services and Manufacturing (PRISM)	The Political Economy of Renewable Energy in South Africa				✔	✔
		Research Unit in Behavioural Economics and Neuroeconomics (RUBEN)	Climate change in an experimental setting: The effect of stochastic future disasters and country vulnerability on cooperation				✔	✔

			Impact of Climate Policy and Policy Instruments on Investment on Environment				✔	✔
		Centre for Information Technology and National Development in Africa (CITANDA)	Green Information Systems			✔		
	Faculty of Engineering & the Built Environment	**Geomatics section of the School of Architecture,**	Cape Urban Observatory		✔			

		Planning and Geomatics	Water as a constraint on development		✔	✔		
		Architecture section of the School of Architecture, Planning and Geomatics	Space and transformation - Third space typology in Education		✔	✔		
			Emthonjeni Water points project		✔	✔		
			Emthonjeni Project: Design and Making Epistemology – in Search of an Afrocentric Perspective via the African Informal Settlement.		✔			
			Sustainable buildings in South Africa		✔			
			Framework for Sustainable building in South Africa		✔			

		Planningsection of the School of Architecture, Planning and Geomatics	Studio A: Generating spatial development frameworks for two informal settlements located in Gugulethu through a PAR methodology		✔			
			Fracking in the Karoo - Planning considerations: Need and desirability – values and attitudes	✔				✔
		African Centre for Cities	New Climate Economy - Africa Progress Panel				✔	✔
			Urban ARK		✔		✔	
			Hungry Cities Partnership	✔	✔			
			Consuming Urban Poverty: governing urban food systems to alleviate poverty in secondary cities in Africa	✔	✔			
			Centre of Excellence in Food Security	✔	✔			
			Mistra Urban Futures		✔			✔
			Flooding in Cape Town under Climate Risk (FliCCR)		✔		✔	

			Move Project		✔			
			Socio-institutional prerequisites for climate adaptation at the local scale: a comparison of three South African municipalities				✔	
			Working with informality to build climate resilience in African cities		✔		✔	✔
			Climate Change CityLab / Cape Town Climate Change Think Tank				✔	
			Urban Flooding CityLab		✔			
			Sustainable Human Settlements CityLab		✔			
			Urban Ecology CityLab	✔	✔			
		The Energy Research Centre	The Rising Powers, Clean Development and the Low Carbon Transition in Sub-Saharan Africa					✔
			Collaboration Agreement for Understanding the Barriers to the Introduction and Uptake of Clean/Improved Cookstoves in Southern Africa Project					✔
			The impact of rising electricity prices on the poor – developing a communication strategy and tool			✔		

			Building the evidence base for improving energy interventions' effectiveness by taking a gender approach			✔		✔
			Energy, Poverty and Climate Change			✔	✔	✔
			Assessing energy needs, challenges, resources, energy usage practices and consumption patterns and opportunities			✔		
			Monitoring and assessing energy supply programmes			✔		
			Tracking the progress of electrification programmes (both grid and non-grid electrification) and advocating a broader "integrated development" approach			✔		
			Sectoral considerations for energy access e.g. subsidies, gender, the benefits/constraints of using renewable energy, and energy sector re-structuring			✔		✔
			Action research to improve perceptions of energy supply and use (in co-operation with energy suppliers and government).			✔		
			Evaluating the electrification programme in urban settlements in South Africa			✔		

			Eskom Demand Side Management (DSM) programme monitoring and evaluation, particularly the potential for DSM with industrial electrical loads			✔		
			Energy footprint and energy savings potential study for heavy industry in South Africa					✔
			SE4All energy efficiency initiatives in Africa.					✔
			Energy End-use study			✔		
			Research extending from M&V work for Eskom in the areas of persistence of energy efficient technologies such as compact fluorescents (CFLs) and solar water heaters					✔
			Second phase of an assessment of the energy demand of the Transport Sector - scope and impacts of future technology change			✔		
			Development of a public energy data resource			✔		
			Regional growth and development in Southern Africa			✔		
			Supporting Sub-Saharan Africa's municipalities with sustainable energy transactions (SAMSET)			✔		✔

			Climate, Land, Energy and Water Strategies: City of Cape Town			✔	✔	✔
			Transition to sustainable energy systems in emerging economies: A South African focused comparative project-SANCOOP			✔		✔
			Climate Change/Water Nexus in the Zambezi			✔	✔	
			Review and Enhance Energy Data Collection and Management Tools, Process and Systems for a 12-Month Period			✔		
			Planning for an emerging natural gas economy for South Africa					✔
			South African Low Carbon Modeling for U.N. Deep Decarbonization Pathways Project (DDPP)					✔
			Consideration of single segments of the energy system, such as least cost expansion planning, or renewable energy strategies for the electricity sector			✔		✔
			A detailed assessment of the potential future energy demand of the transport sector and the potential for mitigation within the sector			✔	✔	

			Developing new tools for various applications to simulate aspects such as energy use behaviour in low income areas or multi-criteria decision analysis tools and environmental (externality) costing tools			✔		
			Continued development of a national Computational General Equilibrium model for assessing economic impacts of energy system decision on indicators such as GDP and employment					✔
			Energy-Water Nexus Initiative: Case study for South Africa			✔		
			South African 2050 Calculator					✔
			Water-Energy nexus in the context of climate change: investigating trade-offs between water use efficiency and renewable energy options for South Africa			✔	✔	✔
			Development of the Western Cape Agricultural Sector Climate Change Framework and Implementation Plan	✔			✔	
			Development of an advanced high-efficient low-cost power-generation with minimum carbon emission from hybrid-fuel supplies			✔		✔

			Technology needs assessment			✔		
			Climate Change Mitigation and Poverty Reduction (CliMip) – Trade-Offs or Win-Win Situations				✔	
			Co-Operation agreement on Climate Change Research/INDC				✔	
			Preparation for the Third National Communication under the United Nations Framework Convention on Climate Change				✔	
			Mitigation Action Plans and Scenarios (MAPS) Project				✔	✔
			MAPS Africa				✔	✔
			South African Low Carbon Modeling for U.N. Deep Decarbonization Pathways Project (DDPP)					✔
			Development of Desired Emission Reduction Outcomes (DEROS) and Mix of Measures (MOMs)				✔	
			Water-Energy Nexus in the Context of Climate Change: Investigating Trade-Offs Between Water Use Efficiency and Renewable Energy Options for South Africa			✔	✔	✔
		The Centre for	Biofunctionalisation of linear alkanes to produce value-added chemicals					✔

		Bioprocesses Engineering Research(CeBER)	Production of natural pigments from various microbial sources	✔				✔
			Selection and characterization of CO2 sequestering algal strains for carbon mitigation of coal-derived flue gas and waste water remediation at a power production plant	✔		✔	✔	✔
			Large-scale production of Spirulina					✔
			Phycocyanin Extraction from Spirulina					✔
			Beneficiation and recycling of wastewater from the olive industry	✔		✔		✔
			Low energy bioreactors for energy efficient bioconversions			✔		✔
			Value addition in the South African sugar industry through bioconversions					✔
			Anaerobic digestion			✔		✔
			Thiocyanate and Cyanide biodegradation					✔
			Acid Mine Drainage remediation with value recovery	✔				✔
			Acid Mine Drainage Prevention	✔				✔
			Metal recovery from low-grade ores and complex concentrates through biomining	✔				✔

			Biological routes to metal recovery from electronic waste			✔		✔
		Crystallisation & precipitation unit	Systematic comparison of the effectiveness of water treatment processes			✔		
			Improving colloidal particle settling in metal sulphide precipitation	✔				
			Assessment of organic influence on crystals characteristics from petrochemical brine treatment by EFC			✔		
		Environmental & Process Systems Engineering (E&PSE)	Cleaner Production in Informal Food Processing Projects				✔	✔
			Life Cycle Assessment for SA food & agriculture reduced impacts (LCA-safari)				✔	✔
			Nutrient and Energy Recovery from Sewage: towards an integrated approach			✔		
			Towards a technology specific innovation system for harnessing water-based bio-energy			✔	✔	
			Evaluation of the Biomethane potential of different types of organic wastes in Cape Town			✔	✔	
		Minerals to metals	Development of a Minerals Beneficiation Strategy for KwaZulu-Natal Province					✔

			Assessing the performance of mineral processing and beneficiation systems					✔
			Mine waste-Acid mine drainage mitigation and value recovery	✔				
			CO2 sequestration through mineral carbonation of mine waste	✔			✔	
		Centre for Research in Computational and Applied Mechanics (Cerecam)	Modelling and simulation of efficient solar collectors			✔		✔
		Water Distribution Systems	The effect of system pressure on leakage from water distribution systems			✔		
			Advanced water metering and its potential for South Africa			✔		
			Leak detection through pressure testing			✔		

			Aqualibrium water competition			✔		
			Introduction to operation and maintenance of water distribution systems			✔		
			Introduction to Integrated Water metering Management]			✔		
		Centre for Transport Studies	City Restructuring			✔		
			Intelligent transport systems			✔		
			Non-motorised travel and infrastructure in Cape Town			✔		
			Paratransit operations and regulation in Cape Town			✔		
			Transport and environment, science technology network			✔		✔
			Travel behaviour change			✔		
			Non-Motorised Transport Facility Guidelines			✔		✔
			Non-Motorised Transport climate value tool			✔		✔
		The Concrete Materials and Structural Integrity Research Unit (CoMSIRU)	Investigation of the durability performance of South African's Portland limestone cement blends		✔		✔	
			The South African Cement Industry: A critical analysis of its energy and environmental impacts since 1980	✔	✔		✔	✔

			Thermo-mechanical modelling of arch dams for performance assessment		✔	✔	✔	
			The effect of a diverging reservoir on the dynamic characteristics of the Roode Elsberg Dam		✔	✔	✔	
			Production of low clinker cements		✔		✔	✔
			Sustainability of concrete structures		✔		✔	✔
		Urban Water Management	The control and removal of litter from urban drainage systems			✔		
			The management of grey water in the non-sewered areas of South Africa			✔		
			The development of sustainability and risk indicators for urban water management			✔		
			Alternative sewage systems in low-income settlements			✔		
			Sanitation for the Urban poor			✔		
			Sustainable Drainage Systems (SuDS)			✔		
			Water-sensitive urban design (WSUD)/Water Sensitive Design (WSD)			✔		

			The Integrated Infrastructure Network			✔	✔	
			Feasibility Study in Urban Water Research			✔		
		HySA/Catalysis	Fuel processing			✔		✔
			Fuel cells			✔		✔
	Health	**Centre for Environmental and Occupational Health Research (CEOHR)**	Climate change, variability, pest infestation and vector borne disease				✔	
			Climate change and implications for endocrine disrupting chemicals				✔	
			Climate change, heat and workers				✔	
			Climate change and air quality	✔			✔	
			Health effects due to air pollution	✔			✔	
			Health effects due to water pollution	✔		✔		

	Humanities	**The Centre for Film & Media Studies (CFMS)**	Fracking and the Media	✔				✔
		Institute for humanities in Africa (HUMA)	Fulcrum Institutions and Sustainability Programme (FISER)				✔	
			Transition to Sustainable Energy Systems in Emerging Economies: A South African Focused Comparative Project			✔		✔
			Empowering Women to reach Leadership Potential	✔				
		Environmental Humanities South	The Contested Ecologies Programme	✔				

		Department of Sociology	Hidden Politics in Conservation: Forests and the Power of the Weak in Southern Africa	✔				
	Faculty of Law	**Intellectual Property Unit (IP Unit)**	Empowering Indigenous Peoples and Knowledge Systems Related to Climate Change and Intellectual Property Rights' Project				✔	
		Institute of Marine and Environmental Law (IMEL)	Shale gas extraction or fracking in the Karoo: Critical sustainability and governance perspectives	✔				✔
			Carbon Capture and Storage				✔	✔
			Protected Areas Law & Governance Project	✔				
			Spatial Planning Project	✔				
			Promoting Ecosystem-Based Adaptation in the Dassenberg Coastal Catchment Partnership: A Critical Reflection of the Relevant Conservation Regime (Mistra Urban Futures Knowledge Transfer Project)	✔			✔	

		Democratic Governance & Rights Unit (DGRU)	African Climate Finance				✔	✔
			The Governance of Climate change and Climate finance				✔	✔
		Centre of Criminology	Illicit economies & criminal networks	✔				
			Environmental Security Observatory	✔				
			Investigating the role of environmental crime in funding insurgencies	✔				
			Toward a Global Legal Framework on Transnational Organized Environmental Crime	✔				
	Science	**Department of Archaeology**	The North of Kuruman Project				✔	
		Department of Biological Sciences	Alien invasions and nutrient deposition	✔				
			Ecosystem δ15N determinants	✔				

			Plant nutrient acquisition under elevated CO2 environments	✔			✔	
		Animal Demography Unit (ADU)	Birds and Environmental Change: building and early warning system in South Africa	✔			✔	
		Animal Evolution & Systematics Group (AES)	Geographic variation in morphology and acoustic signals among several species of horseshoe bats in southern Africa	✔		✔		
		Percy Fitz Patrick Institute of African Ornithology (PFIAO)	Predicting the impacts of climate change on desert birds: the “Hot Birds Programme”	✔			✔	
			Climate change and fynbos endemic birds	✔			✔	
			Conserving Southern Ocean seabirds	✔			✔	
			Plastics in the ocean	✔				

			Spatial resilience of protected areas	✔				
		Plant Conservation Unit (PCU)	Landscape History & Palaeoecology	✔			✔	
			Multi-year rainfall manipulation and warming experiment for the three main biomes of the CFR	✔			✔	
		Centre for information & communication technologies for development (ICT4D)	Telecommunications for Development			✔		

		Department of Environmental and Geographical Science	African Urban Food Security Urban Network (AFSUN)	✔	✔			
			HYRAX	✔			✔	
			Regional Archives for Integrated Investigations (RAIN)	✔			✔	
			Community-level socio-ecological vulnerability assessment in the Benguela Current Large Marine Ecosystem (BCLME)	✔			✔	
			CLIMWAYS – Climate change and urban water governance: pathways to social transformation				✔	
			DO4 Models: Dust Observation				✔	
			Franschhoek Water Innovation Centre			✔	✔	✔
			Liesbeek Life Plan	✔	✔	✔	✔	✔
		African Climate & Development Initiative	Developing a SARUA Master's Curriculum and Courseware in Climate Change and Sustainable Development				✔	
			Berg River Climate Knowledge Network				✔	
			ASSAR: Adaptation at Scale in Semi-Arid Regions				✔	
			FLOW – Fostering Local Wellbeing				✔	

			SmartAgri	✔			✔	
			Sustainable Economic Development in Water Constrained Catchments	✔				✔
			Green Skills: Building capacity for a sustainable future					✔
			Monitoring and Tracking Climate Resilience				✔	✔
			Scientific Capacity Development (SCD) study: Analysis of barriers, opportunities and good practice in Africa				✔	
			Regionally-extensive droughts and climate change in Southern Africa				✔	
			NIE Scenarios Project				✔	
			CCAFS Near-term Climate Project	✔			✔	
			Indigenous Health and Climate Change	✔			✔	
			Food, Energy, Water, Land-Use & Biodiversity (FEWLB) Nexus				✔	✔
			China and South –South Scoping Assessment for Learning and Development (CASSALD)				✔	
			Saldanha Bay Municipality Scenario Building: a road to sustainable growth and development?					✔

			Global Islands' Vulnerability Research, Adaptation, Policy and Development Project (GIVRAPD)				✔	
		Climate Systems Analysis Group	Seasonal Forecasts - Global Forecasting Centre for South Africa				✔	
			Co-ordinated Regional Downscaling Experiment (CORDEX)				✔	
			The CORDEX Africa Analysis Campaign				✔	
			Southern Africa Agricultural Model Intercomparison and Improvement Project (SAAMIIP-2)	✔			✔	
			Crop-livestock intensification in the face of climate change (CLIP-2)	✔			✔	
			Integrated use of seasonal forecast for community preparedness to climate variability	✔		✔	✔	
			Climate Change Adaptation Assessments, Thought Leadership, and Learning (ATLAS)				✔	
			Exploration of attribution for e✔treme agricultural events in Limpopo	✔			✔	
			IDRC Communities of Practice				✔	

			Wind Atlas for South Africa (WASA) – Phase 1&2				✔	✔
			Land use change: assessing the net climate forcing, and options for climate change mitigation and adaptation (LUC4C)	✔	✔	✔	✔	
			Water Harvesting Toolkit			✔	✔	
			UAV Sonde				✔	
			Future Climate for Africa (FCFA) Pilot Case studies				✔	
			Fynbos Fire	✔			✔	
			Downscaled Climate Modelling for local authorities (and water basins) in Southern Africa				✔	
			Climate Science input into Municipal Climate Adaptation Plans: Phase 1&2				✔	
			Southern Africa Agricultural Model Intercomparison and Improvement Project (SAAMIIP-1)	✔			✔	
			Crop-livestock intensification in the face of climate change (CLIP-1)	✔			✔	
			Household Vulnerability to Disasters: An Application of the Household Vulnerability Index (HVI)				✔	
			Healthy Futures				✔	

			Malawi Department for Climate Change and Meteorological Services (DCCMS) Capacity Building Project				✔	
			Linking stakeholders with integrated climate change data				✔	
			Berg River Municipal Workshops as part of the Western Cape Government Municipal adaptation support programme				✔	
			Climate Change Vulnerability Modelling, Indices Development and Downscaling Refinement in Malawi				✔	
			Strengthening Evidence-Based Climate Change Adaptation Policies (SECCAP) Project				✔	
			Improving Seasonal Forecast Information for Managing On-farm Decisions				✔	
			Agriculture transforming to adapt to climate change: Peanut industry expansion in the Northern Territoryas a blueprint	✔			✔	
			Adaptive interventions in agriculture to reduce vulnerability of different farming systems to climate change in South Africa	✔			✔	
			Visualising climate information				✔	

			Projected changes in extreme rainfall over South Africa				✔	
			Historical extreme rainfall changes over South Africa				✔	
			ClimAfrica - Climate change predictions in Sub-Saharan Africa: impacts and adaptations	✔			✔	
			Limits to predictability				✔	
			Climate Information Portal (CIP) Development and Capacity Development				✔	
		Marine Resource Assessment and Management group (MARAM)	Sustainable fisheries – estimating fish stocks and providing advice for catch levels	✔				
			Fisheries management under climate and environmental uncertainty	✔			✔	

		The Rangeland Ecology Group	Intermittent high-intensity grazing	✔				
		Department of Molecular and Cell Biology	Improving tolerance to water deficit stress	✔			✔	
		Department of Oceanography	SCOR Working Group 147: Towardsd comparability of global oceanic nutrient data (COMPONUT)	✔				
			Southern Ocean Carbon and Climate Observatory	✔			✔	
			South Atlantic Meridional Overturning Circulation	✔				
			UMFULA	✔			✔	
			TRAIN-SOPP	✔			✔	
		Nansen-Tutu	Ocean modelling and data assimilation				✔	

		Centre for Marine Environmental Research	The role of the Southern Ocean carbon cycle under climate change				✔	
			Seasonal to decadal Changes Affecting Marine Productivity: an Interdisciplinary investigation				✔	
			The Role of the Ocean on Climate				✔	
			Enhancing prediction of Tropical Atlantic climate and its impacts				✔	
			South Atlantic Meriodional Overturning Circulation				✔	
		Centre for Statistics in Ecology, Environment and Conservation (SEEC)	Climate change effects on biodiversity and ecosystems	✔			✔	

University	**Faculty**	**Group**	**Projects/ Themes/ Activities**	**PSG4: Enable a resilient, sustainable, quality and inclusive living environment**				
				Natural environment	**Infrastructure**	**Climate change**	**Green economy**	**Built environment**
Stellenbosch University	**Faculty of Agrisciences**	**Department of**	Invasion Ecology	✔		✔		

		Conservation Ecology & Entomology (Plant Ecology)	Restoring Natural Capital	✔		✔	✔	
			Restoring Riparian Function	✔		✔		
			Transdisciplinary Research	✔		✔	✔	
		Department of Forest and Wood Science	Green Landscapes	✔		✔	✔	✔
			CatchMan			✔		✔
			AgroSolar Systems	✔	✔	✔	✔	✔
			Effect of climate change on wood quality	✔		✔		
			Pine prescribed burning	✔		✔		
			Climate fit forests	✔		✔		
			A spatial simulation framework to assess the impact of climate change on forest tree growth	✔	✔	✔		
			FORSIM	✔		✔	✔	
			Drought stress in indigenous forests	✔		✔		

			The role of bark as a fire protection of selected indigenous and exotic trees	✔		✔		
			Dryland tree regeneration and development	✔		✔		
			Emerging Farmer Agroforestry in dry regions	✔		✔	✔	
			Drought tolerant eucalypts to alleviate poverty in South Africa	✔		✔	✔	
			Properties of burnt wood	✔		✔		
			Green building: A life-cycle assessment of timber building systems compared to conventional building systems in South Africa	✔		✔	✔	
			Development of enterprise guidelines for Natural Resource Management Value Added Industries	✔		✔	✔	
			Evaluation of selected quaternary catchments to guide management of the use, rehabilitation and conservation of natural woodlands and forests	✔		✔	✔	
			Development of a standard time study and productivity protocol for NRM operations	✔		✔	✔	

			Eucalyptus pulpwood cut-to-length clear-felling productivity and cost optimisation using discrete Event Simulation techniques	✔		✔		✔
			Impact of mechanised debarking of Eucalyptus pulpwood on chip quality and quantity and timber harvesting costs	✔		✔	✔	
			Impact of slope, tree size for both coppiced and planted regimes of Eucalyptus pulpwood cut-to-length clear-felling stands on productivity and cost for excavator based and custom built mechanised harvesters	✔		✔		
			Fibre balances (losses) during pine saw timber clear-felling operations in South Africa.	✔		✔		
			Loaded and unladen travel speeds of articulated skidder timber extraction systems in pine saw timber regimes in South Africa taking into account slope, species, tree size, travel distances and geographic location.	✔	✔	✔		✔
			Establishing travel speeds (loaded and unladen) of pine saw timber secondary timber transport in South Africa taking road class, road condition into account	✔		✔		✔

			Development of an internationally benchmarked Time Study Protocol for South Africa forest industry in order to make South African forest operations internationally competitive.	✔		✔	✔	✔
			Supply chain optimisation of South African pine saw-timber harvesting and transport operation	✔	✔	✔	✔	✔
			Development of an internationally benchmarked Forest Operations Machine and Systems Costing protocol for South Africa forest industry in order to make South African forest operations internationally competitive	✔		✔	✔	
			Application of Discrete event Simulation Operations Research techniques in the optimisation of productivity and production costs of multi-stem tree-length Eucalyptus pulpwood clear felling operations in the Zululand coastal region	✔		✔	✔	
			State of the art of the use of forest residue for bioenergy in Southern Africa	✔		✔	✔	✔
			The effect of irregular stand structures on growth, wood quality and its mitigation in operational harvest planning of Pinus patula stands	✔		✔	✔	

		Department of Soil Science (Soil Chemistry)	Effects of long-term tillage and crop-rotation practises on soil carbon stocks and soil quality in Swartland, Western Cape, South Africa	✔		✔		
			Effect of composted biochar on soil quality and Carbon sequestration	✔		✔		
			Sustainable soil fertility management of rooibos tea (Aspalathus linearis)	✔		✔	✔	
			Effect of physicochemical properties of biochars on C and N mineralisation, and mineral N availability in sandy soil	✔		✔	✔	
			Effect of inorganic fertilizers on the decomposition dynamics of composts and crop litters in sandy soil	✔		✔		
			Effects of long-term no-till crop-rotation practises on soil carbon functional pools and quality in the Overberg, Western Cape, South Africa	✔		✔		
			Investigation of soil quality (health) in commercial production of rooibos tea (Aspalathus linearis) in the Western Cape, South Africa	✔		✔		
			Biochar amendment of Cape Flats sandy soil: Effect on soil quality (chemical, physical and microbiological properties) and plant growth	✔		✔		

			Distribution and stability of soil carbon in spekboom thicket, Eastern Cape, South Africa	✔		✔	✔	
		Food Security Initiative (FSI)	Agricultural policy and food security	✔		✔		
			Soil science (Biochar)	✔		✔	✔	
			Community Nutrition Security Project (CNSP)			✔		
			Reducing Post-Harvest Losses of Fruit and Vegetables	✔		✔	✔	
			Minimize the wastage that occurs during the whole meat value chain. Food (meat) safety. And Increase the nutritional intake of those who are currently undernourished (specifically protein intake).	✔		✔		
			Reduce food 'lost' in the farm to fork chain in South Africa	✔		✔	✔	
			Food security in West Coast fishing communities	✔		✔	✔	
			Food Security, Agro-Ecological Science and Land Reform: A Stellenbosch Case Study	✔		✔	✔	
			EAU4FOOD	✔		✔	✔	
			Community based Nutrition Security Project (CNSP)	✔		✔	✔	

			Sharing Best Agroecological Practice for Resilient Production Systems in Dryland and Drought Conditions - EcoDry.	✔		✔	✔	
			STING - Systematic Review of the effects of iodised salt and iodine supplements on growth. Researcher led.	✔		✔	✔	
			Effect of basal and top dressing soil amendments on yield of wild okra (Corchorus olitorius) in northern KwaZulu-Natal	✔		✔	✔	
			Social Learning for Sustainable Food Systems – Researcher led	✔		✔	✔	
			Smart Agriculture for Climate Resilience (SmartAg) Project Launch	✔		✔	✔	
			Western Cape Food Security Strategy	✔		✔	✔	
			Sustainable Agriculture South Africa, Researcher led	✔		✔	✔	
			BIOSOL | Biochar to reduce and eliminate persistent organic pollution from agricultural water and soil	✔		✔	✔	
			SOLIQA – Integrated approach of managing soil fertility to enhance crop nutrient contents in a sustainable way	✔		✔	✔	
			Mass rearing of insects as feed and food, researcher led	✔		✔	✔	

			Unlocking the value of smallholder ruminant livestock for food security	✔		✔	✔	
			Food System Governance, Food Security and Land Use in Southern Africa	✔		✔	✔	
			Strengthening Linkages between Social Protection and Agriculture	✔		✔	✔	
			South Africa's Food Future: A Transformative Scenarios (TSP) Process and Supporting Smallholders into Commercial Agriculture (SSA), these are multi-stakeholder processes	✔		✔	✔	
			Supporting Smallholders into Commercial Agriculture and Strengthening Linkages with the Media	✔		✔	✔	
			Building Local Economies and Standards, researcher-driven	✔		✔	✔	
			Organic Agriculture in South Africa	✔		✔	✔	
		Hydrology, Remote	ACCESS: continued long term monitoring of the hydrology of the Berg River catchment	✔		✔		

		Sensing, GIS	Southern African Science Service Centre for Climate Change and Adaptive Land Management (SASSCAL): SU manages the focus on water for SA	✔		✔	✔	
			PPP Giyani Limpopo	✔		✔	✔	
			SUWAM-Hessequa. Sustainable water management for resilience to climate change impact on society in South Africa	✔		✔		
			Optimising soil fertility and plant nutrient status for increased Rooibos tea (Aspalathus linearis) quality and sustainable production in the Northern Cape, South Africa	✔		✔	✔	
		Mondi Ecological Network Programme	Future-proofing Food	✔		✔	✔	
			Green Matter Biosphere Reserve Project	✔		✔		
		Standard Bank Centre for Agribusiness	Academic and Research Programme			✔		
			Agribusiness and Mentorship Development			✔	✔	

		Development and Leadership	Agri-Leadership Laboratory			✔	✔	
			The African Agriculture Leadership Programme (AALP)			✔	✔	
			International networking				✔	
		Sustainable Agriculture in South Africa (SASA)	One boer met die natuur: towards sustainable production of rooibos and honeybush in the Cape Fynbos of South Africa	✔		✔	✔	
			SASA Project	✔		✔	✔	
			Honeybush Knowledge Partnership	✔		✔	✔	
			Local Ecological Knowledge and Climate Change	✔		✔	✔	

	Faculty of Arts and Social Sciences	**Department Of Geography and Environmental Studies**	Renewable energy infrastructure development in rural South Africa: An Evolutionary Analysis	✔	✔	✔	✔	✔
	Faculty of Economic and Management Sciences	**Centre for Business in Society (CBiS)**	Systemic Organisational Transformation	✔			✔	
			Systemic Societal Transformation				✔	
			Spiral Dynamics Integral				✔	
			Sustainability for Managers			✔	✔	
			Enabling Sustainability through Action Research (EStAR)			✔	✔	
			Accelerating Next Generation Leadership in South Africa			✔	✔	
		Department of Logistics	Provincial Land Transport Framework for the Provincial Government of the Western Cape	✔		✔	✔	✔

			Implementation, updating and maintenance of the Highway Development and Management (HDM) software, South Africa	✔		✔	✔	✔
			C885 - HDM-IV Implementation and Management, South Africa			✔	✔	
			Learner Public Transport System, South Africa			✔	✔	
			HDM-4 and RED support, South Africa				✔	
			Integrated Transport Plan for Central Karoo, Western Province, South Africa		✔		✔	✔
			Various projects for City of Cape Town and Western Cape Provincial Administration, Western Province, South Africa		✔		✔	✔
			Proposed system for guiding travel intensive land use, Department of Transport, South Africa		✔		✔	✔
			Identifying land suitable for low income housing, Western Province, South Africa		✔	✔	✔	✔
		School of Public Leadership	Improving the governance and economics of protected areas, ecosystem services and poverty eradication through HEI-capacity-building and transdisciplinary research		✔		✔	

			An assessment of the functional fit between environmental regulation and agricultural management of riverscapes in a biodiversity hotspot: the Breede Water Management Area	✔		✔	✔	
			A natural risk governance model for the agricultural sector in the Western Cape	✔		✔	✔	
			Tax-based integrated environmental policy instruments to promote sustainable agricultural practice in South Africa	✔		✔	✔	
		Sustainability Institute	Untamed Urbanism		✔	✔	✔	✔
			Greening the South African Economy				✔	✔
			Sustainable community-based infrastructure solutions		✔		✔	
			Material flow analysis of the South African economy		✔	✔	✔	✔
			Greening intra-African trade relations				✔	
			Ethiopia's developmental state and the sustainability of agricultural irrigation systems		✔		✔	✔
			Integrated urban water management in Accra, Ghana		✔		✔	✔

			Just Transitions: Explorations of Sustainability in an Unfair World	✔	✔	✔	✔	✔
			iShack: community-based energy provision		✔	✔	✔	✔
			Understanding change agents for sustainable food systems in South Africa (PhD)	✔		✔	✔	
			The Food-Water-Energy Nexus in Developing Countries	✔		✔	✔	
			The status of organic agriculture in South Africa and opportunities for smallholder farmers	✔		✔	✔	
			African Urban Metabolism Research Network (AUMRN)	✔		✔	✔	
			Africa cities typologies: in-depth analysis for South Africa cities resource consumption		✔	✔	✔	
			Towards building an inclusive green informal economy in South Africa: A systems approach				✔	
			Project: Participatory Integrated Assessment of Energy Systems to Promote Energy Access and Efficiency (PARTICIPIA)			✔	✔	
			Dynamic model of the Western Cape economy: Focus on the agricultural value chain	✔		✔	✔	

			Incorporating agro-processing, automotive, iron and steel manufacturing into South Africa Green Economy Model	✔		✔	✔	
			South Africa Green Economy Modelling				✔	
		Sustainability Institute Projects	Researching Resource Futures for Urbanisation (REFURB)		✔	✔	✔	
			Green Economy Toolkit for the Sub-National Level in Africa			✔	✔	
			Toolkit for Resource Efficient Cities		✔		✔	✔
			Mitigating Risks and Vulnerabilities in the Energy-Food Nexus in Developing Countries	✔	✔	✔	✔	
			Spatial Development Framework for Stellenbosch town		✔	✔	✔	
			The State of African Cities 2014: Re-imagining Sustainable Urban Transitions		✔		✔	✔
			City-Level Decoupling: Urban resource flows and the governance of infrastructure transitions		✔	✔	✔	
			Oil Shock Mitigation Strategies for Developing Countries		✔		✔	✔

			Green economy modelling report for South Africa: focus on the sectors of Natural Resource Management, Agriculture, Transport and Energy		✔	✔	✔	
			Green Living Guide	✔	✔	✔	✔	✔
			Urban Patterns for a Green Economy Quick Guides		✔	✔	✔	
			Testing Loan Finance to Peri-urban Land Reform			✔	✔	
			GIZ/FoodLab Status of Smallholder Organics in South Africa	✔	✔	✔	✔	
			DFID Global Food/Water/Energy Nexus Research Report	✔		✔	✔	
			Coproducing knowledge on food systems for development in Africa	✔		✔	✔	
			Understanding change agents for sustainable food systems in South Africa			✔	✔	
			Discord and transition: Leveraging crisis as a catalyst for change in peri-urban food systems in Southern Africa	✔		✔	✔	
			Ernst & Young Food Systems Research Series – exploring private sector engagement in African food systems	✔		✔	✔	

	Faculty of Engineering	**Centre for Renewable and Sustainable Energy Studies (CRES)**	Letsatsi Solar PV - Resource and Yield prediction		✔	✔	✔	
			Continuation Lephalale Measurements				✔	
			On Site Solar Insolation Measurement – Danielskuil and Kimberley		✔	✔	✔	
			Solar and Wind Potential Study of South Africa (Grid Study)		✔	✔	✔	✔
			On Site Solar Measurement – Noupoort CPV site: Installation of equipment and site visits		✔	✔	✔	✔
			Pre-feasibility Study of a Concentrating Solar Power (CSP) Plant at Distell		✔	✔	✔	✔
			Maintenance of Solar Measurement Stations in the Northern Cape		✔	✔	✔	✔
			Lesotho Solar Measurement Installation and Personnel Training – UNDP	✔	✔	✔	✔	✔
			Supply and Delivery of Solar Resource Maps at the Department of Economic Development and Tourism	✔	✔	✔	✔	✔
			SOLTRAIN I: Southern African Solar Thermal Training and Demonstration Initiative	✔	✔	✔	✔	✔
			PV Rooftop Study – Hessequa	✔	✔	✔	✔	✔

			Grid Planning Phase 3 – WASA data (CRSES2012/07)	✔	✔	✔	✔	✔
			Broadbased RE Potential of South Africa (CRSES2012/12)	✔	✔	✔	✔	✔
			Solar Study: Effect of Clouds on Solar Plants (CRSES2012/14)	✔	✔	✔	✔	✔
			Installation and Measurements at Solar Station in Upington	✔	✔	✔	✔	✔
			DNI measuring equipment procurement, installation, commissioning and reporting		✔	✔	✔	✔
			Rwanda Renewable Energy Strategy		✔	✔		✔
			Solar and wind energy for rural water supply projects in Ethiopia	✔	✔	✔	✔	✔
			OWS Scaling / Testing Device				✔	
			REVIEW OF OCEAN ENERGY RESOURCE DATA		✔	✔	✔	
			Eskom RE Analyst				✔	
			SOLTRAIN II: Southern African Solar Thermal Training and Demonstration Initiative	✔	✔	✔	✔	
			South African-German Energy Programme - Installation and Monitoring of DNI Solar Stations and Updating of the South African DNI Solar Map	✔	✔	✔	✔	✔

			ETHEKWINI – GREEN POWER TARIFF PROPOSAL			✔	✔	
			Mapping of Current Renewable Energy EIA Applications	✔	✔	✔	✔	✔
			National Strategic Environmental Assessment (SEA) identification for the rollout of Wind and Solar PV Energy in South Africa		✔	✔	✔	
			V & A Waterfront Renewable Energy Advisory		✔	✔	✔	
			STAGE-STE EU-FP7 (Scientific and Technological Alliance for Guaranteeing the European Excellence in Concentrating Solar Thermal Energy)			✔	✔	
			Technical Advice on Large (1MW) PV Installation			✔	✔	
			GUIDELINES FOR ENERGY MANAGEMENT IN WINERIES			✔	✔	
			Conducting RESEARCH on the GREEN ECONOMY IN KWAZULU-NATAL (Contract 1)			✔	✔	
			Conducting RESEARCH on the GREEN ECONOMY IN KWAZULU-NATAL (Contract 2)			✔	✔	
			Desktop study on technologies to convert biomass to energy and electricity			✔	✔	✔
			Renewable Energy Advisor			✔	✔	

			Singita Lebombo Tender Review			✔	✔	
			Biofules: From Viability to Pilot Projects	✔		✔	✔	
			Mangaung Municipality Water Project – Renewable Energy Advisory	✔		✔	✔	
			Aurecon Solar Assisted Central Receiver Concept Design and Optimisation		✔	✔	✔	✔
	Faculty of Law	**The Development and Rule of Law Programme [DROP]**	Wasser und Land - Brennpunkte innerhalb der Entwicklungsgemeinschaft des südlichen Afrika (SADC)			✔	✔	
			Knowledge lives in the lake. Case studies in environmental and customary law from southern Africa. Namibia Scientific Society	✔		✔	✔	
			Research on Climate Change: International Law and Global Governance: Legal Responses and Global Responsibility	✔		✔	✔	
			Research on Policy, Diplomacy and Governance in a Changing Environment		✔	✔	✔	
			Research on Environmental Law and Policy in Namibia: Towards Making Africa the Tree of Life			✔	✔	
			Research on the FUTURE OKAVANGO	✔		✔		✔

			AR5 - Research on the scientific state of Climate Change Vulnerability in Africa	✔		✔		
			Research on Development and Rule of Law (DROP)	✔	✔	✔	✔	✔
			Research on “Regulatory Aspects and Legal Environment Related to Sugar Cane Ethanol production in South Africa and Mozambique, compared to Brazil. A Comparative Analysis and Indication of a Possible Legal Ideal Model for the Development of Economic Activities Related to the Production of Ethanol from Sugarcane, in Mozambique and South Africa.”	✔		✔		✔
			Research Regulation and Policy for Energy Security and Sustainable Development in Subsahara Africa	✔		✔		✔
	Faculty of Science	**Centre for Studies in Complexity at Stellenbosch University**	Generating and disseminating scientific-, policy-, and regionally-relevant knowledge of social-ecological dynamics and transformations to enable stewardship toward sustainable development.	✔		✔	✔	✔
			Bright Spots: Seeds of the Good Anthropocene	✔		✔		
			Assessing resilience to regime shifts: The case of bush encroachment	✔		✔		

			Ecosystem Services in the Anthropocene	✔		✔		
			Regime Shifts in the Anthropocene	✔		✔		
			Ecosystem service based strategies to alleviate poverty in southern Africa	✔		✔		
		DST-NRF Centre of Excellence for Invasion Biology (CIB)	Long-term change in Insect Assemblages	✔		✔		
			Long-term Changes to the Prince Edward Islands Ecosystem	✔		✔		
			Biodiversity Foundations	✔		✔		
			Biodiversity Dynamics through Space and Time	✔		✔		
			Molecular Ecology and genetics of Invasions	✔		✔		
			Global Environmental Change, Biological Invasions, Ecosystem Services and Sustainability	✔		✔		
			Detection, Deterioration, Restoration and Re-introduction	✔		✔		
			Risk assessment, Indicators and Policy	✔		✔	✔	
			Invasion, Science, and Society	✔		✔		

			Research for the Integrated Management of Invasive Alien Species in collaboration with the Working for Water Programme (Natural Resources Management Programmes)	✔		✔		
			Invasion Biology in Support of Environmental Sustainability during Times of Change	✔		✔		
		Stellenbosch University Water Institute	EAU4Food	✔		✔		
			NRF - NFI bilateral program	✔		✔	✔	
			INNO-Giyani	✔		✔	✔	
			ACCESS	✔		✔	✔	
			WRC K5/2063	✔		✔	✔	
			SASSCAL					
			WRC - Point of use disinfections systems designed for domestic rainwater harvesting (DRWH) tanks for improved water quality in rural communities.	✔	✔	✔	✔	
			Eskom collaboration			✔	✔	✔
			Exxaro collaboration			✔	✔	✔
			CSIR 1			✔	✔	✔
			CSIR 2			✔	✔	✔

			Construction methods for concrete water retaining structures		✔	✔	✔	✔
			Links between lateral riparian vegetation zones and flow		✔	✔	✔	
			Improving Water Quality: Developing a Natural Toxic Free Nanomebrane	✔		✔	✔	
			Decoupling economic growth from water consumption and degradation: A transition towards sustainable water resource management and planning	✔	✔	✔	✔	
			Mitigation of Soil Degradation, and Ground Water Pollution caused by on-land disposal of Vegetable Oil mill Effluents	✔		✔		✔
			Economics of incremental infrastructure upgrading in informal settlements: A case study of sanitation upgrading in Enkanini, South Africa.		✔	✔	✔	✔
			Institutional economics approaches and Developmental State: A case in Northern Ethiopia (Tigray), Raya Valley Ground water Irrigation Project		✔	✔	✔	
			ERWAT Research Chair			✔	✔	
			EWSETA Project					
			AU/NEPAD Networks of Water Centres of Excellence		✔	✔	✔	

			Endocrine Disruptors in South African Waters	✔		✔		
			Reducing the risk of endocrine disruption through early detection	✔		✔	✔	
			Faecal contamination in rivers and health sanitation risks for community health	✔		✔		
			The DST-NRF Centre of Excellence for Invasion Biology	✔		✔		
			Water engineering to ensure sustainable use of our river	✔		✔	✔	
			Understanding ecology of riparian habitats to enable effective catchment management	✔		✔		
			Database development to support critical resource management	✔		✔		
			Understanding the hydrogical cycle	✔		✔		
			Financial-economic planning of water use Agriculture	✔		✔	✔	
			Conservation through Research and Development	✔		✔	✔	
			Bridging the gap between science and strategy	✔		✔	✔	
			Small-Scale water and wastewater treatment technologies	✔		✔		

			Geochemical Evolution of Water and Waste Waters	✔		✔		
			Nanotechnology Applications in Providing Potable Water	✔		✔		
			Membrane and Membrane process development	✔		✔		
			Teabag Water Filter: The Way Forward	✔		✔	✔	
			Ethics of Freshwater Management	✔	✔	✔	✔	
			Climate Change, Water-Related Matters and Human Rights	✔		✔	✔	
			Exposition of the legal framework within which the new water dispensation operates	✔	✔	✔		✔
			Water Governance and Management	✔		✔		
			Impact of Water Quality on Safety of Agricultural Produce	✔		✔	✔	
			Food Industry Waste-Water treatment and re-use	✔	✔	✔	✔	✔
University	**Faculty**	**Group**	**Projects/ Themes/ Activities**	**PSG4: Enable a resilient, sustainable, quality and inclusive living environment**				

				Natural environment	Infrastructure	Climate change	Green economy	Built environment
University of the Western Cape	**Economics and Management Science**	**Plaas**	Intergrating the human dimensions into an ecosystem approach to fisheries	✔				
			Fish for whom-required nutrition for the poor and luxury consumption for the wealthy, can small-scale fisheries supply both consumers	✔				
			How important is fish as food for human nutrition?	✔				
			A decision support tool for response to global change in marine systems: the IMBER-ADApT Framework			✔		
			Center of excellance in food security	✔		✔		
			Social protests in water and sanitation in peri-urban slum settlements in South Africa		✔			✔
	Natural Science	**Hydrogen South Africa (HySA)**	Fuel cell catalysts and membrane electrode assemblies for micro CHPs		✔		✔	
			High Temperature MEAs for hybrid FCVs		✔		✔	

			CHP systems integration and technology validation up to 5kW HT-PEMFC stacks for micro CHPs		✔		✔	
			Portable power systems integration and technology validation of PEMFC stacks up to 15 Kw		✔		✔	
			MH H2-storage for LT-PEMFC power systems for 0.5 t0 5 kW portable and standby systems		✔		✔	
			On-board use of metal hybrids for utility vehicles, MH H2 storage systems for FC powered forklifts trucks		✔		✔	
			On-board Hydrogen storage for advanced lightweight Mg-based Nanocomposites for H2 storage		✔		✔	
			Metal hydride integrated energy systems-Refuelling systems for H2-fulled forklifts based on MH compressors		✔		✔	
			CHP system integration and technology validation for micro CHP 2.5 kWe		✔		✔	
			Portable power systems integration and technology validation up to 5Kw backup power		✔		✔	

			HVF systems integration and technology validation for integration of MH storage and FC into 3-ton forklift, establishing FCV test protocols using 15 kW FCV emulator, development of an integrated FC/battery power module and integration of an FC into a three-wheeler community vehicle.		✔		✔	
		Institute of water studies	Heuningnes catchment research project	✔				
			Capacity building for intergrated water resource management in South Africa	✔				
			Understanding the effect of global change on water resources through long-term catchment monitoring	✔				
			The application of stable isotopes to the study of groundwater recharge and flow: Primary and Fractured aquifiers of South Africa and Argentina	✔	✔			
			Using IWRM best practices to develop appropriate capacity and training for the benefit of Sub-Saharan African water		✔		✔	
			WDS design principles to strengthen planning for water sensitive cities of the future		✔			✔

			Exploring lowest appropriate levels of water in South Africa	✔				
		Environmental Nanoscience research group	PGM Nanoarchitecture		✔		✔	
			Nano in Water		✔			
			Eskom SASOL Research Initiative- Sustainable Salt Sinks	✔	✔			
			Treatment of mine water using a combination of coal fly ash and the flocculants in a jet loop reactor system	✔	✔			
			Industrial brine minimization: Determining the physical chemical parameters that affect evaporation rates on multi-component hyper-saline effluents	✔	✔			
			Advanced oxidative water treatment process for water disinfection using an electrohydraulic discharge reactor and TiO2 immobilised on nanofibers	✔	✔			
			Application of mineral carbonation processes for brine remediation	✔	✔			

			Degradation of emerging micropollutants by combined advanced oxidation with immobilized plasmon titanium dioxide nanocomposites in an electrohydraulic discharge reactor		✔			
			Synthesis, characterization & applications of zeolites from South African fly ash.	✔	✔		✔	
			Novel consolidated core/shell nanomaterials based on noble metals and semiconductors for hybrid photovoltaic membrane processes in water purification	✔	✔			
			The Synthesis of Highly Selective Immobilized Ligands for Extraction of Toxic Metal Ions from Waste Water	✔	✔			
			Construction of a DeNOx and DeSOx rig to test the ability of zeolites synthesised from Eskom fly ash to remove certain gases from flue gases produced at power stations		✔		✔	
			Recovery and application of useful products from coal combustion products		✔		✔	

6.3 Appendices C: Description of identified projects

6.3.1 Cape Peninsula University of Technology

TIA Adaptronics Advanced Manufacturing Technology Laboratory (Adaptronics AMTL)

Faculty: Engineering
Department: Mechanical Engineering
Type*: Technology Station*
Website: http://www.cput.ac.za/academic/faculties/engineering/research/amtl
Head of the Unit: *Prof O Philander (philandero@cput.ac.za)*
Main contact points: *Chantal Rensburg (021 953 8435 / rensburgc@cput.ac.za)*
Annual budget:
Nationally/internationally funded:

Outline: The TIA Adaptronics Advanced Manufacturing Technology Laboratory (Adaptronics AMTL) was established in 2007. The primary objective of the unit is to specialise as a national manufacturing, research and educational resource centre for Adaptronic Technologies in South Africa. Adaptronics is the technology that integrates sensor and actuator functions into materials, components and structures so that they may react to environment stimuli thus making them intelligent.

Based on the technology activities, innovation, and successes of the CPUT Adaptronics AMTL, it was officially incorporated into the Technology Innovation Agency's Technology Station programme in March 2013, and became the 18th Technology Station in South Africa.

Research Areas

Adaptronic Technology: Research and Technology projects into the development of intelligent structures, MEMS and Nano-sensing Devices

Ocean Engineering: Research and Technology projects related to maritime applications

Centre for Distributed Power and Electronic Systems (CDPES)

Faculty: *Engineering*
Department: Electrical, Electronic and Computer Engineering
Type: *Research Centre*
Website: *http://bit.ly/16gqSTb*
Head of the Unit: *Prof MTE Kahn (kahnt@cput.ac.za)*
Main contact points: *P (w) 0219596208*

Outline: CDPES strives to find ways to improve this relationship, using networked sensor technology, ubiquitous computing, ambient intelligence, and associated electronic communication systems developments. Power electronics and drives are used in diverse sectors, ranging from industrial to residential applications.

The center's research aims to:

- Develop power conversions for renewable energy sources and investigate interconnectivity of distributed resources with microgrids and electric power systems.
- Apply such technology over multidisciplinary applications, especially those pertaining to commercial and industrial applications.
- Investigate and apply optical fiber and wireless communication techniques over large-scale power systems, for telemetry and control.
- Improve control schemes for power converters and drives.
- Nuclear Energy, Environmental Protection and Sustainable Development.

The CDPES team members are Prof Tariq Kahn (Leader), Dr Marco Adonis, Dr Atanda Raji, Dr Wilfred Fritz, Mr Deon Kallis, Dr Ali Almaktoof, Mr Achmat Fish, Mr. Christopher Wills and Dr Onwunta Onwunta.

Research Areas

- **Power Electronics Systems**
- **Renewable Energy**
- **Small hydro power plants in distributed electricity generation**
- **Distributed co-generation automation systems**
- **Grid-connected technology**
- **Electrical energy management techniques.**
- **Autonomous system power systems**
- **Three-dimensional depth visualization**
- **MEMS sensors for energy technology**
- **Optical sensors for energy technology**

Technology Innovation Agency projects

- AI9 Smartmeter

Short project description: The AI9 development is an advanced energy-saving/metering solution in the space of Commercial and Industrial Building/ business parks which consume approximately 40 percent of the world's energy. The AI9 Smart Metering system captures all energy-relevant power consumption information from a client's building / complex, by using several miniaturised kwh MOTES that can be seamlessly installed in existing building reticulation without major circuit interruption.

Funders: TIA

Project contact person: Prof MTE Kahn (khant@cput.ac.za, Ph.(w) 0219596208)

- Waste plastic gasifier

Short project description: Plastic waste provides a valuable energy resource. The high energy content of the plastic can be extracted using our infrared radiation-based reactor. Through a gasification process, syngas fuel is produced. This can be fed to generators to produce electricity. This process provides a means of energy storage and can be converted later when energy is required.

Funders: TIA

Project contact person: Dr. Marco Adonis (adonism@cput.ac.za, Ph (w): +27 21 959 6488)

- Automated Solar-Powered Stove

Short project description: Dr Wilfred Fritz, Deon Kallis and a group of 5 Electrical Engineering students designed and commissioned an innovative standalone automated solar oven, combined with a solar-powered generator. The artifact is able to operate off-grid and can be used to boil water, cook food and also generate electricity.

Funders: International

Project contact person: Dr. Wilfred Fritz (FritzW@cput.ac.za, Ph (w): +27 219596784) and Mr. Deon Kallis (kallisd@cput.ac.za, Ph (w): +27 219596465)

Centre for Substation Automation and Energy Management Systems (CSAEMS)

Faculty: Engineering
Department: Electrical, Electronic and Computer Engineering
Type*: DST/NRF research Centre*
Website: www.cput.ac.za
Head of the Unit: *Prof R Tzoneva (tzonevar@cput.ac.za)*
Main contact points: *Ph.(w) 0219596459, Cell: 0822020804*
Annual budget: R4 mln
Nationally/internationally funded: Nationally

Outline: The focus of the Centre is to act as an enabler for education, training, testing, research and development in the fields of Substation Automation, and Energy Management Systems. Particular attention is paid to current and emerging standards as a framework within which to develop course work and explore experimentation and research questions for the purposes of undergraduate and postgraduate student education and technician and engineer training and retraining. The challenges of this research work are in alignment with the Department of Science and Technology's (DST's) 10 year innovation plan in Science and Technology, especially to two of the DST key Research and Development (R&D) areas, namely: Energy Security and Frontiers of R&D.

The Centre for Substation Automation and Energy Management Systems (CSAEMS) seeks to contribute to addressing the need in South Africa for research infrastructure development that supports human capital development and research and innovation in the field of metering, monitoring, protection, automation and control of power systems, paying particular attention to current and emerging standards in the field.

Core activities concentrate on contributions to the theory and practice of the Substation Automation and Energy Management Systems, as follows:

- Interpretation, modeling and implementation of the IEC61850 standard functions in special hardware and software environments
- Development of innovative protection schemes for different applications with investigation on interoperability of IEC61850 standard-based protection functions in multi-vendor intelligent electronic devices,
- Real-Time Simulation and innovative solutions of Energy Management Systems to improve the functions of the power system control centres
- Development of test-bench facilities for testing of ideas, project solutions, and new developments in the field of power systems
- Training and knowledge transfer by equipment orientated courses and yearly industrial seminars on IEC61850

The Centre for Substation Automation and Energy Management Systems is the only one of its kind in South Africa and offers specialised training, research and development in the new IEC61850 technologies, which will contribute to the building of a smarter power grid in South Africa.

The centre, equipped with a state of the art substation automation laboratory, provides students with hands-on experience, ensuring they hit the ground running when entering the industry, and also provides much needed training for engineers and technicians employed in industry by organisation of industrial seminars, courses, and the International PAC World Africa conference.

Please see the Table below of the postgraduate projects for 2015 (parts 1-3 of the Table).

Research Programmes and Projects

Title: CSAEMS development and growth

Project focus areas: Development of the CSAEMS as a unique leading centre in the field of monitoring, protection, control and optimisation of power systems, providing innovative solutions for the standar-based Substation Automation and Energy Management Problems.

Funders: THRIP/NRF, TESP Eskom Contact person: Prof. R. Tzoneva

Short project description: The project aim is to develop the research Lab infrastructure and to grow the research activities by the development of various postgraduate research projects grouped in 3 directions of research. Please see the Table below of the projects for 2015 (parts 1,2,3).

Project partners: Alectrix Pty Ltd and MBSA Consulting, vendors of equipment ABB, Areva, Schneider, GE, Siemens, etc.

Status: current

Title: Sustation Automation and Energy Management (SAEM) systems development and implementation in the CSAEMS Lab

Project focus areas: Design and development of the structure of the of the SAEM systems in the CSAEMS Lab as a prototype of the future smart grid power system, on the basis of the new standards for smart grid and the equipment purchased using the NRF fund for Strategic equipment and donations by the industry.

Funders: DST /NRF Strategic cost equipment Contact person: Prof. R. Tzoneva

Short project description: Design and implementation of the test benches for emulation of various protection schemes, design and programing of power system models in the Real-Time Digital Simulator, design and implementation of the communication network integrating the separate testbenches in one monitoring, protection, control and optimisation system. The project designed the structure of the equipment in the research lab, and implemented it by purchasing the latest IEC61850 standard-based equipment and by the building of the research benches.

Project partners: UCT, Stellenbosh university, Pretoria University

Status: current

Title: Development of a cost-effective, standard-based Process Interface Device (PID) for the acquisition and distribution of data in support of intelligent devision-making within a smart grid environment

Project focus areas: The project aims to give innovative solutions and outcomes to the needs of the power industry for novel IEC 61850 standard-based digital devices on the process level, and local and wide area methodologies on the energy management level. These would need to be capable to operate under a new paradigm of data acquisition and data distribution between the elements of the data acquisition, monitoring, protection and control networks of power systems in order to support intelligent decision-making within a smart grid environment.

Funders: CPUT Research and Innovation fund

Contact person: Prof. R. Tzoneva

Short project description: Research investigations relating to the proposed Prestigious Project encompass two complimentary activities needed to be concurrently carried out during the duration of the project, namely:

i. Design and Implementation of a Standards-based Process Interface Device, and

Design, development, implementation, and application of a standards-based (IEC 61850, IEC 61850-9-2 and IEC 61850-90-5) Process Interface Device (PID) for the acquisition of current and voltage measurements from the current and voltage transformers (sensors) at the process level, and to produce two main streams of digital data (Sampled values and Synchrophasors) published to an Ethernet network referred to as the process bus.

ii. Development of methods, algorithms and software for intelligent decision-making

Design, development, and implementation of methods for local and wide area monitoring, status assessment, protection, optimization and control, for use with the data streamed from the Process Interface Device, and to produce real-time solutions of novel formulations of the energy management problems in support of intelligent decision-making within a smart grid environment. Four types of problems are considered: Voltage stability assessment, condition monitoring, dispatch of the generated power and System Integrity Protection Schemes.

Project partners: Alectrix Pty Ltd and MBSA Consulting

Status: New, 2015

NRF RNA Real time Distributed Systems (RTDS)

Faculty: Engineering
Department: Electrical, Electronic and Computer Engineering
Type*: NRF research niche area*
Website: www.cput.ac.za
Head of the Unit: *Prof R Tzoneva (tzonevar@cput.ac.za)*
Main contact points: *Ph.(w) 0219596459, Cell: 0822020804*
Nationally/internationally funded: Nationally

Outline: Theoretical and application-based contribution to advances in real-time distributed systems. Development of novel models, design methods, software, hardware and their integrated application for real-time monitoring and control. Insightful and focused determination of proper areas of application and research through appraisal and reappraisal of emerging control technologies. The core activities concentrate on:

- Design and implementation of nonlinear controllers
- Distributed control based on IEC61499 standard for functional block programming
- Networked control systems design and implementation
- Optimisation of complex distributed systems and development of algorithms for parallel computation

The emphasis on the implementation is on the IEC61499 standard for function block programming of the PLCs, which contributes to the interoperability of the PLCs from different vendors in one industrial control system.

The RNA has modern equipment to support the research project and the postgraduates in their development as knowledgeable engineers to build the future industrial control systems

Research Programmes and Projects

Title: Nonlinear control of industrial processes (wastewater treatment)

Project focus areas: Development nonlinear controllers and their PLC implementation for control of wastewater treatment

Funders: NRF, TESP

Contact person: Prof. R. Tzoneva

Short project description: The project emphasizes on development of a new optimisation-based control technology and nonlinear controllers based on the modern control theory using the nonlinear models of the process to be controlled. Networked control systems are the latest direction of research which concentrates on control of interconnected and geographically distributed industrial systems. Please see the Table below of the postgraduate projects for 2015 (part 4 of the Table).

Project partners: Institute for Automation and Communication (IFAC), Magdeburg, Germany, CCT, Gebze Institute, Instabul, Turkey

Status: current

Project cluster	**Level**	**Student name** **status**	Project Title
Interpretation of the IEC61850 standard	DTech CPUT, PT	Quinton Bart Ongoing, Staff	Synchrophasor estimation algorithms for optimal implementation on a digital platform
	MTech CPUT, PT	Alexander Ncube Ongoing	IEC 61850-9-2 standard-based sampled and status value mapping on an FPGA platform.
	MTech SANSA, PT	J.Makoloane New	Algorithm for estimation of the phasor, the power system frequency, and the rate of change of the frequency for synchrophasor implementation
Protection using GOOSE messaging	MTech CCT, PT	Deon Jones Completing	Development of new protection schemes for sympathetic back-up tripping on a distribution network using IEC61850 standard - based technologies
	MTech CCT, PT	Mkuseli Lwana Completing	Investigation of three-terminal differential protection using standard-based numerical relays
	MTech CPUT, PT	Ncedo Mguzulwa Completing	Investigation on interoperability of IEC61850 standard-based protection functions in multi-vendor intelligent electronic devices
	MTech Eskom, PT	T. Mabuza New	Investigation and implementation of IEC61850 standard-based protection and reconfiguration schemes for a power system substation
	MTech CPUT, FT	Everett Mthunzi Ongoing	Design and implementation of a synchrophasors-based differential protection scheme
	MTech CPUT, FT	C. Elenga New	Differential inrush current discrimination-based digital protection scheme for a three phase power transformer using IEC61850 standard
Real-Time Simulation	DTech CPUT,FT	A. Adewole Completing	Voltage stability assessment and wide area protection/control based on synchrophasor measurements

and Energy Management Systems	DTech CPUT, PT	Carl Kriger Completing, Staff	Development of IEC61850 standard-based object models for conditioning monitoring
	DTech CPUT, PT	J. Retonda Ongoing	Investigation and design of methods for electrical fault detection, localization and self-healing for application in a smart grid
	DTech CPUT, PT	M. Mnguni, Ongoing,, Staff	IEC61850 standard-based adaptive load shedding scheme for distribution power networks
	DTech CPUT, FT	L. Mbangeni New	Decomposition-coordinating method for the solution of a multi-area power system optimization problems incorporating distributed generation sources
	MTech CPUT, FT	G. Frank New	Real-time implementation of an inverter control method for load balancing and power factor correction in power distribution systems
	MTEch Eskom, PT	Mquqwana Manduleli, Ongoing	Development of a method for real-time solution of the problem for optimal placement of capacitor banks in distribution networks
	MTech CPUT, FT	H. Mataifa Completing	Investigation, simulation studies and IEC61850 standard-based protection for the interconnection to the power grid of a small-scale generation unit
	MTech Consulting PT	M. Ratchitanga Completing	Investigation and design of an integrated monitoring, protection, and control system of a power reticulation network
	MTech PT	E. Alofoje New	Algorithms and software for estimation and control of the power swing in the smart grid
Integration of IEC61499 and IEC61850 standards	DTech CPUT, FT	J. Muga Completing	Design and implementation of IEC61499 standard-based nonlinear controllers using function block programming in a distributed control platform
	DTech CPUT, FT	Y. Mfoumboulou New	Design and implementation of an adaptive networked controller
	DTech CPUT, FT	N. Dube Completing	Methods for parameters and state estimation of nonlinear processes
	MTech LHC, PT	J. Kongo New	Development of a system for control of the power systems in hospitals

Mechanical Engineering Programme

Faculty: Engineering
Department: Mechanical Engineering
Type*: Programme Modules*
Website: www.cput.ac.za
Main contact points: *Ilyas Omar*

Curriculum Components

Environmental Engineering elective subject at BTech level

Environmental Engineering is an important field that students need to have an appreciation of and have specific competencies and skills in. Students who pass through a programme that is largely technical (such as mechanical engineering) by default become technocrats, and are thus unable to make decisions in industry which take broader issues into account. In particular, issues of the environment such as the social, economic, institutional and legal contexts need to be considered. The course aims to present the subject with a broad coverage, examining practice and development in a holistic way, so as to assist graduates to deal with environmental problems and offer solutions more meaningfully. Course topics include coastal areas, management tools, energy, water, air quality and wastes. Information literacy is infused into the curriculum and assessed implicitly throughout the course. To this end, an introductory session on information literacy and electronic databases is done. Specific introductory skills in project management, environmental impact assessment (EIA), water and energy audits are covered. Written and oral presentation and group work skills are evaluated by means of individual assignments, a group project with presentation, and a final written test.
Project partners: External/Internal lecturing staff
Howard Fawkes (Mechanical Engineering, CPUT)
Nomambulu Dolo (Engineering Librarian, CPUT)
Melanie Smith (Capricorn Fisheries Monitoring)
Victor Ngcongo (Capricorn Fisheries Monitoring)
Henri Fortuin (Department of Environmental Affairs and Development Planning (DEADP))
Barry Coetzee (City of Cape Town (CoCT))
C Mubadiro (CoCT)
L Siyengo (CoCT)
Dr. Elizabeth Day (Freshwater Consulting Group)
Michael Toll (CoCT)
Prof. Eugene Cairncross (Chemical Engineering, CPUT)
Saliem Haider (Stellenbosch Municipality)
Dr. Kevin Winter (UCT - External Examiner)
Status of project: Current
Project website/link: Faculty of Engineering Handbook
Expected project outputs: Throughput of 30 BTech students annually for the past 3 years. Three BTech students have presented conference papers in the past 3 years. One MTech student has presented 3 conference papers in the past 3 years.

Global Environmental Studies elective subject at Diploma level

In a world with increasing development our natural resources and ecosystems have been placed under severe pressure. These systems form an integral part of sustaining our mother earth and our livelihoods. Our environment is globally changing due to incremental effects of loss and degradation of biodiversity, land, fresh water resources, marine and coastal resources, human impacts on energy resources, climate change and air pollution, fossil fuels and mineral resource depletion. There is a growing need for individuals, industry and governments to develop a holistic understanding of these integral components.

The Global Environmental Studies (GES) course aims to increase knowledge and capacity of interested participants of current global environmental concerns. Overall, the course will provide students an understanding of environmental issues at both local and global levels. This course will be developed particularly as an elective for full-time and part-time students at the Cape Peninsula University of Technology (CPUT) in Cape Town, South Africa, to acquire a basic understanding of the key environmental issues of the 21st century, and to be able to integrate this knowledge into their programme of study.

Project partners: External/Internal lecturing staff
Dr Francois Odendaal (EcoAfrica Environmental Consultants)
Prof Eugene Cairncross (CPUT)
Dr Bernice McLean (EcoAfrica)
Ms Umaymah Jattiem (EcoAfrica)
Status of project: Current - to commence in semester 2, 2015
Project website/link: Faculty of Engineering Handbook – to be updated
Expected project outputs: Throughput of 20 diploma students, commencing 2015

Hydraulic Machines core subject at Diploma level

Students are required to do a group project related to Hydraulic Machines but covering an aspect of energy/renewable energy. They do a full technical report with oral presentation
Project partners: Internal lecturing staff
E. Erfort
S. Saal
Status of project: Current
Project website/link: Faculty of Engineering Handbook
Expected project outputs: Throughput of 250 diploma students annually who have done a group project related to small hydropower or pumped-storage systems.

Energy Institute

Faculty: Engineering
Department:
Type*: Research Unit*
Website: *http://bit.ly/1zIt6ab*
Head of the Unit: *Prof Nico Beute (beuten@cput.ac.za)*
Main contact points: *Domestic use of Electricty (DUE): due@cput.ac.za, Industrial & Commercial use of Energy (ICUE): icue@cput.ac.za, Petroleum Indsutry related: lloydp@cput.ac.za*
Annual budget:
Nationally/internationally funded:

Outline:
This programme aims to provide a research vehicle for student centred research that would be stimulating in a "high tech" arena, thereby providing ample scope for advancing the frontiers of technology. One focus area is renewable energy.

Product Lifecycle Management Competency Centre (PLMCC)

Faculty: Engineering
Department:
Type*:*
Website:
Head of the Unit: *Prof Stephané Bouyé (stephane.bouye@me.com)*
Main contact points:
Annual budget:
Nationally/internationally funded: French/SA
Outline:

The PLMCC is a Franco-South African training centre that opened in 2012. It aims to train engineers to be immediately operational upon entry into industries and laboratories after graduation.

Based on the three-dimensional modeling software suite developed by Dassault Systèmes, the training offers students in-depth knowledge of the global standards for the development of new products in many industrial fields.

The centres act as prominent anchoring points for the development of clusters in the areas of research, innovation and more generally, heightened public interest. Moreover, it aims to equip historically disadvantaged students with intensive practical, as well as sound theoretical knowledge of subject matter through access to innovative technologies and internationally competitive training programmes.

Research Programmes and Projects

UAV 60

Department/research group/research unit through which you are involved: Adaptronics AMTL
Project focus area (geographical): South Africa
Funder: n/a
Project contact person: Prof O. Philander
Short project description: The purpose of this project is to complete the preliminary design phase of the UAV 60kg project. The challenge facing the South African Aerospace Industry (SAAI) is that of achieving and maintaining a competitive edge. The SAAI strives to become the leading aerospace force for the African Continent as well as becoming a recognized player in the Global Aerospace Network. The aim of the UAV 60 project is to design a close range / short range class UAV aircraft with maximum take-off mass (MTOM) of no more than 60kg. The aircraft is to be used for surveillance, with the payload (stabilized gimbal) still to be determined. The major tasks include the structural design of the airframe (fuselage, torsion box, main spar, wing, engine mount, etc.), the propulsion system design / selection (engine/motor, propeller, etc.), undercarriage design / selection and verification of the tail design.
Project partners: n/a
Status of project: Testing Phase, continuous research and development
Project website: n/a
Expected project outputs: Design automation for low cost UAV

Gel Fuel Stove

Department/research group/research unit through which you are involved: Energy Institute
Project focus area (geographical): Western Cape
Funder: TIA
Project contact person: Eugene Erfort

Short project description: CPUT is undertaking a study for the Special Economic Projects Unit, Department of Economic Development and Tourism, Western Cape Provincial Government, concerning the use of gel fuels in low-economic households. The rationale for this is that the use of paraffin for cooking and heating remains widespread; the available appliances for paraffin-fuelled cooking and heating have proved very unsafe and have led to many disastrous fires involving the loss of life and property and widespread injury. It seems that an ethanol-gel fuelled appliance should be far safer, if only because any fire can readily be extinguished with water; and the manufacture and distribution of the fuel could create a considerable number of jobs as well as providing a renewable alternative to the fossil-fuel paraffin.
Project partners: Western Cape Government
Status of project: Current
Project website: n/a
Expected project outputs:

1. Meets the general safety standards of SANS 666
2. Consumes a gel meeting SANS 448 at a consistent rate
3. Produces heat at 1.6kW at the highest setting and 0.5kW at the lowest
4. Burns cleanly with a blue flame that does not soil the cooking utensils
5. Is readily filled (and not fillable when in use)
6. Is readily lit
7. Is readily cleaned
8. Cannot be incorrectly assembled
9. Seals the fuel when not in use.
10. Has a manufacturing cost in volume production of less than R50.00

FSATI Field Mill

Department/research group/research unit through which you are involved: FSATI
Project focus area (geographical): South Africa
Funder: FSATI
Project contact person: AProf. R. Van Zyl
Short project description: The design and development requirements for the re-design of the existing HVDC (High Voltage Direct Current) electric field-mill mechanical structure. An existing prototype shall be used by the developer to refer to during development.
Project partners: Eskom
Status of project: Current
Project website: n/a
Expected project outputs: CAD Files for the Design and Improved Field Mill

South African Renewable Energy Technology Centre (SARETEC)

Faculty: *Engineering*
Department: *Mechanical Engineering*
Type: *Technology Centre*
Website: www.saretec.co.za
Head of the Unit: *Sven Pietrangeli (pietrangelis@cput.ac.za;* +27 (0) 21 953 8665*)*
Main contact points: Senior Advisor: *Dieter Sommer /* Operations Manager: *Sven Pietrangeli*
Annual budget:
Nationally/internationally funded:
Department of Higher Education and Training (DHET): National Skills Fund (NSF)
South African-German Energy Program (SAGEN)
South African National Energy Development Institute (SANEDI)
GreenCape

Outline: The South African Renewable Energy Technology Centre (SARETEC) is the first national renewable energy technology centre in South Africa and is currently being established at the Cape Peninsula University of Technology (CPUT) - Bellville campus, Cape Town, South Africa. SARETEC will deliver specialized training for the entire Renewable Energy (RE) industry along with tailored short courses. As a national centre, it will also endeavour to make local RE research capacity more accessible to industry and will be for the benefit of education and research institutions in all provinces.

Formal Qualifications

Wind Turbine Service Technician

Project focus areas: South Africa
Funder: n/a
SARETEC contact person: Sven Petrangeli
Wind Turbine Technicians are responsible for the service, maintenance, as well as repair of wind turbines. They inspect, diagnose, maintain, and adjust wind turbines, resolving electrical and mechanical malfunctions. They are able to work at heights in all-weather condition including extreme hot and cold, for extended periods of time. Wind Turbine Technicians must be capable of working closely with other individuals. What to expect in this course:

- Health and safety
- Wind Turbine Electrics
- Wind Turbine Mechanics
- Hydraulics
- Rotor blade repair
- Wind Energy Technology
- Control system

Project partners: ??
For more information: http://bit.ly/1zxFQR1

Solar PV Service Technician

Project focus areas: South Africa
Funder: n/a
SARETEC contact person: Sven Petrangeli
Solar energy is a critical source of energy for all life forms on earth and solar energy technology can be used to harness this energy.
This course will give you a basic knowledge of solar photovoltaic (PV) cells, modules and systems components; electrical circuits; PV system design and installation; estimation and code requirements; solar electric products and applications; an understanding of energy conversion from sunlight to electricity and working with solar conversion equipment.

What one can expect in this course:

- Health and Safety
- PV Systems design
- PV installations and wiring
- Inverters
- Roof types and mounting
- Shading analysis

Project partners:
For more information: http://bit.ly/1zNoBwL

Formal Qualifications in Development

Advanced Diploma: Mechanical Engineering (Renewable Energy)
Dept of Mechanical Engineering
Contact: Cletus Magoda, Mech Eng, CPUT

Masters in Renewable Energy
Dept of Electrical Engineering
Contact: Marco Adonis, Elec Eng, CPUT

Short Course

The Principle of Hydraulic Line Equipment
Project focus areas: South Africa
Funder: n/a
SARETEC contact person: Sven Petrangeli
The course on Hydraulic Line Equipment entails issues around correct handling of safety-critical components and extended service life, increased profitability through preventative safety.
Course participants will be able to select hose line and sealing equipment more effectively and route them in compliance with specifications and gain more detailed knowledge of cutting ring technology and improvements thereto, fault analysis of installation and user errors.
Project partners: ??
For more information: http://bit.ly/1DpsVPS

Workshops

General

Project focus areas: South Africa
Funder: n/a
SARETEC contact person: Sven Petrangeli
SARETEC offers specialised workshops throughout the year with international and local presenters sharing their knowledge in their field of work.
These presenters are highly-skilled professionals experienced in their line of work as well as have the experience in identifying and responding to student's needs at all levels. We welcome applications from professionals as well as individuals with a career in Renewable Energy.
Project partners: Industry
For more information: http://www.saretec.co.za/training/workshops/workshops.html

Community Water Supply and Sanitation Unit (CWSS)

Faculty:
Department:
Type*:* Research Unit
Website:
Head of the Unit:
Main contact points: *Joao Alberts (cwsr@cput.ac.za)*
Annual budget:
Nationally/internationally funded:

Outline: The Community Water Supply and Sanitation Unit (CWSS) is an accredited training provider, nationally recognized, well networked, multidisciplinary unitoffering a range of development and collaboration opportunities to motivated staff and students within a framework of commissioned projects based on sector, community and client needs.

The CWSS Unit promotes sustainable water supply and sanitation services in accordance with VISION 21 and Millennium Development Goals (MDG) principles, provides needs assessment, curriculum and material and programme development, implementation, quality assurance and project management services at all National Qualification Framework (NQF) levels.

Centre for Water and Sanitation Research (CWSR)

Faculty:
Department:
Type*:*
Website:
Head of the Unit:
Main contact points: *Joao Alberts (cwsr@cput.ac.za)*
Annual budget:
Nationally/internationally funded:

Outline:CWSR is a multi-disciplinary research unit based at Cape Peninsula University of Technology in Cape Town, South Africa. CWSR has undertaken several research projects in the field of water and sanitation in rural, peri-urban and informal areas. Key research outputs include: operation and maintenance of basic water and sanitation; User acceptance of mobile sanitation facilities in South Africa; Srategic framework for basic water and sanitation services; Farm dwellers sanitation services; Adaptation and piloting of CLTS in South Africa; An approach to reducing risks and hazards from human waste and recently the unit is looking at School sanitation and Reuse of reclaimed wastewater for domestic application in South Africa. The unit has a multi-disciplinary range of researchers drawn from engineering, education, social and environmental science backgrounds (http://www.susana.org/en/partner/details/473).

Based on website and CPUT Research Report

Environmental Toxicity and Remediation (ETR)

Faculty:
Department:
Type*: ??*
Website:
Head of the Unit: *Prof J Odendaal (odendaalj@cput.ac.za)*
Main contact points:
Annual budget: ??
Nationally/internationally funded:

Outline: The Environmental Toxicity and Remediation research group assesses and monitors the state of pollution in aquatic and terrestrial environments of the greater Cape Town area. It also develops and evaluates appropriate remediation technologies in order to clean up the environment.

Institute of Biomedical and Microbial Biotechnology (IBMB)

Faculty:
Department:
Type: *Institute*
Website: *http://www.cput.ac.za/research/centres/ibmb*
Head of the Unit: *Prof Wentzel Gelderblom (gelderblomw@cput.ac.za)*
Main contact points:
Annual budget:
Nationally/internationally funded:
Outline:

The Biotechnology industry and Biotechnology research at tertiary institutes will play a key role in South Africa's bio-economy approach, with a move towards the sustainable management of natural resources and the production of bio-based products, which can ultimately lead to improved public health and the mitigation of **climate change**, while contributing to the balanced development of the South African society as a whole. The Cape Peninsula University of Technology (CPUT) has identified Biotechnology and the Bio-economy as a research focus area for its Research, Technology and Innovation (RTI) Blueprint (launched in 2012), which is aimed not only towards the development of the institution, but also towards playing a key role in answering the grand challenges identified for the Western Cape Province, South Africa, the African continent and the world as a whole.

Projects

New Perspectives on Global Warming (Climate Change) and Food Security

Project focus areas: ?
Funder: ?
IBMB contact person: John P Rheeder (Rheederjp@cput.ac.za)
Research into Agriculture and food security options regarding the mitigation of Climate Change
Project partners: ??
For more information: http://bit.ly/1CT5TTp

Architectural Technology Programme

Faculty: Informatics and Design
Department: *Architectural Technology and Interior Design*
Type: *Programme*
Website:
Head of the Unit: *Prof Wentzel Gelderblom (gelderblomw@cput.ac.za)*
Main contact points:
Annual budget:
Nationally/internationally funded:

Curriculum Components

Social Housing project: part time BTech Architectural Technology (Applied Design): year 1
Project focus areas: Cape Town and Johannesburg
Funder: ?
Architecture contact person: Jolanda Morkel

Outline: The aim of the social housing project is to familiarise students with urban housing and to explore the relationship of housing to its urban context. This involves producing designs for an existing mixed use/ residential neighbourhood. The project involves gaining an understanding of residential density; making proposals within an existing urban design framework; developing urban design guidelines and designing the housing typologies.

The project aims to generate ideas and debate on alternative housing design and delivery options, in order to focus on housing models that address dense residential environments within (existing) urban conditions. This will enable linkages with the existing urban fabric and, through innovative concepts, achieve sustainable housing delivery.

It is the intention of this project to explore innovative alternatives in urban design and housing, which take into account the social, economic and environmental issues we face in our cities, in order to generate housing forms that will help restore the vibrancy which previously characterised inner city communities, and prove more likely to offer investment value for occupants than conventional mass-housing models.

The project furthermore aims to support dignified, humane, healthy and sustainable urban environments and living spaces to ensure quality of life. These spaces will support opportunities for social interaction as well as privacy. It will reflect universal design principles of access for all, including the differently abled, children and the elderly.

Thus, the aim is to explore innovative subsidised rental housing models which promote:
- Densification of urban areas focussed on pedestrians
- Inclusionary communities
- Restructuring, regeneration and/or desegregation of communities
- Greater consumer choice
- Integrated environments
- Collective ownership and/or management of housing
- Sustainable management structures
- Empowerment of communities through delivery processes and operations
- Culturally adequate environments (including special needs requirements)
- Universal access
- Promote health and quality of life
- Delivery at appropriate economy of means
- Energy efficient housing and environments

- Provoke economic opportunities at micro-macro scales

Project partners: OpenArchitecture
For more information: www.openarchitecture.co.za

Research & design projects undertaken by students in the subject CDR4 (Construction & Detailing)in the Btech course in Architectural Technology

Project focus area (geographical): Cape Town, based on international best practice
Funder (if any): none
Project contact person: Wilfried Bohm
Short project description:A number of tutorials set to students during the course of the year address concerns of sustainability in their brief. Such concerns include, amongst others:

1. ENERGY:
a) energy efficiency in materials and construction
b) energy efficiency in use
c) optimising environmental performance: prioritising orientation, solar gain and solar shading respectively, plus, to a lesser degree, rain water harvesting
2. WATER: reducing use of municipal water, maximizing harvested rain water tec.
3. MATERIALS:
choice of building materials by their environmental and social sustainability

Project partners: n/a
Status of project: Regular project set every year to the Btech students
Project website/link: n/a

Built Environment

Project focus area (geographical): Khayelitsha
Funder (if any): Housing subsidy
Project contact person: Tembikosi Gondela / Desmond Jackson
Short project description: Construction Sandbag house
Project partners: Envirochoice
Status of project: Plans approved obtaining quotes for materials
Project website/link: cput
Expected project outputs:[i.e. one PhD and one Masters thesis, policy briefs, research reports] Research reports & PHD Use of Sustainable Housing (E Simpeh Const Mngmt Lecturer)

Industrial Design Programme

Faculty: Informatics and Design
Department: *Applied Design*
Type: *Programme*
Website:
Head of the Unit: *Bart Verveckken*
Main contact points:

Projects

The Learning Network for Sustainable Energy Solutions for All (LeNSes)
Project focus area (geographical): Africa
Funder (if any): EDULINK II - ACP programme, European Commission.
Project contact person: Mugendi M'Rithaa / Andrea Broom
Short project description: LeNSes is a multi-polar Network for curricula and lifelong learning capacity development focused on System Design for Sustainable Energy for All. It is a 3 year project (Oct 2013 - Oct 2016) funded by the European Commission (ACP-EU Edulink II), involving 3 design schools in Europe and 4 in Africa. LeNSes is an action of human resources and curriculum development, aiming at the promotion of a new generation of designers (and design educators) capable to e ectively contribute to the transition towards a sustainable energy for all society. LeNSes ambitions to promote a new shared and articulated disciplinary ground on System Design for Sustainable Energy for all focused on Sustainable Product-Service System (S.PSS) and Distributed Renewable Energy (DRE) models, through a series of exchange activities and pilot courses at the partner institutions.
(http://lenses.polimi.it/index.php?M1=1&M=1&P=p_lensdesc.php).

Project partners:
POLITECNICO DI MILANO UNIVERSITY, DESIGN Department, Italy (Coordinator)
Carlo Vezzoli (project head) Management team: Elisa Bacchetti; Emanuela Delfino; Fiammetta Costa

DELFT UNIVERSITY OF TECHNOLOGY, Industrial Design Engineering, Delft, The Netherlands
Jan Carel Diehl

BRUNEL UNIVERSITY, School of Engineering & Design, London, United Kingdom
Fabrizio Ceschin

UNIVERSITY OF NAIROBI, Nairobi, Kenya
Lilac Osanjo

UNIVERSITY OF BOTSWANA, Gaborone, Botswana
Richie Moalosi (UB team coordinator)
Paulson Letsholo (UB project manager)

MAKERERE UNIVERSITY, Kampala, Uganda
Venny Nakazibwe (MAK team coordinator)
Mary Suzan Abbo (MAK project manager)

CAPE PENINSULA UNIVERSITY OF TECHNOLOGY, Cape Town, South Africa
Mugendi M Rithaa (CPUT team coordinator)
Andrea Broom (CPUT project manager)

Status of project: current
Project website/link: http://lenses.polimi.it/index.php?M1=1&M=1&P=p_lensdesc.php

Expected project outputs:
LeNSes will produce an open learning e-package, a modular package of teaching materials (texts, slide shows, audio, video, etc.) and tools for designers that design educators worldwide will be able to download (free of charge), modify/remix and reuse (copy left). LeNSes will also promote a series of diffusion activities targeting the design community worldwide

Design for Social Innovation and Sustainability (DESIS)
Type*: Lab*
Website: http://www.desis-network.org/content/cput-desis-lab
Head of the Unit: *Mr Rael Futerman*
Main contact points: *Mugendi M'Rithaa / Rael Futerman*
Annual budget: n/a
Nationally/internationally funded: n/a
Outline: The Applied Design department sits within the Faculty of Informatics and Design,and is uniquely placed to deal with realities akin to both advanced (or industrially developed) economies, as well as majority world (or industrially developing) contexts. We are the only ICSID Educational Member (in South Africa) and are consistently recognised for design excellence through the performance of our students in competitions and the invaluable contribution of our staff in professional and research domains.

Our department is a vibrant and inclusive space that emphasises the need of students to become empathic designers, conscious of the needs of communities around us. Our department provides an opportunity for our students to learn using state-of-the-art equipment and software. Our proven leadership is underpinned by expertise in problem-driven design thinking that actively advances knowledge within the design and technology 'cognisphere' resulting in a well-rounded and responsive curriculum that produces design talent that is in tune with the complexities, constraints and challenges of the 21st Century.

Where academically feasible, we collaborate with industry to run projects with our students. The benefit for students is the "straight talking" response from industry. This approach enhances teaching and learning for both students and staff. Two recent collaborative projects we have worked on include an interdisciplinary Biomimicry project and a Design for Sustainability project, both focused within Cape Town's East City known as 'The Fringe'. Further, we are proud to say that we are intimately involved with Cape Town's 2014 World Designing Capital activities and aim to build toward one of the signature events to be held during 2014.

Biomimicry is an overarching theme within the department of Applied Design. Trans- disciplinary collaborations and projects are undertaken to allow students from different design courses to work together toward a common goal. These projects strengthen links between design programs and allow for cross-pollination of ideas and ways of thinking and doing. The focus within the Biomimicry module has been to interrogate human needs through a Biomimetic lens, looking at people not as separate from the natural world but as part of it. This informs the students' systems approach to design, seeing human society as part of a bigger society, inclusive of the natural world, and integrated within multiple eco/systems.

This module has not only strengthened our internal links, but external as well. Adopting Biomimicry as a theme has not only provided relevant curriculum content, but has also provided lecturers with a lens through which to view curricula. We see the design curriculum as an evolving one, constantly being updated to stay relevant and accommodate advances in the field of design and related industries.

The theme of Biomimicry as a tool for sustainable, socially aware design is being cemented in the setting up of the BIOS research unit, the focus of which is looking to nature to inform the design of products, processes and systems. It is this university research unit that will effectively form the base for the DESIS Lab at CPUT. The DESIS Lab, with the suggested name D.N.A Design Lab, will explore the possible linkages between digital, natural and physical artifacts. The DESIS Lab will have its base both in the Faculty of Informatics and Design (FID) and the BIOS research unit, and will activate and support research projects grounded in the needs of broader society. The lab would also benefit from CPUT institutional units that serve to facilitate innovation and research niche areas, for example the Technology Transfer Office. This

office has been established to counsel and support research units of the University to foster new thinking by helping researchers to go beyond publication and into commercialisation through technology innovation.

Projects

Design Strategies for enhancing service delivery in Solid Waste Management

Project focus area (geographical): Doornbach, Cape Town

Funder (if any): CoCT

Project contact person: Mugendi M'Rithaa / Rael Futerman / Bruce Snaddon

Short project description: In alignment with the City of Cape Town's quest to provide adequate basic services to all its residents, this pilot project seeks to establish the effectiveness of existing services to residents at Doornbach, and subsequently to determine appropriate design strategies for enhancing service delivery in solid waste management processes. The research team employed participatory methods to co-design potential solutions in consultation with diverse actors and stakeholders of the said informal settlement.

Centre for Tourism Research in Africa (CETRA)

Faculty: Business and Management Sciences
Department: Tourism and Events Management
Type*: Research Centre*
Website: http://www.cput.ac.za/academic/faculties/business/research/cetra
Head of the Unit: *Mr Snyman Ohlhoff (Ohlhoffs@cput.ac.za)*
Main contact points: *Snyman Ohlhoff/Prof Kamilla Swart/Ms Bukelwa Mbinda (CETRA Administrative assistant)*
Annual budget: Varies according to projects – no annual budget at present. Approx. R700 000 received p.a. for last three years.
Nationally/internationally funded: Mostly nationally, although CETRA, through Prof Swart, is affiliated with the CARNiVAL project which is a multinational project funded by the EU.
Outline: The Centre for Tourism Research in Africa is part of the Department of Tourism and Events Management, which is a department in the School of Sport, Events, Tourism and Hospitality in the Faculty of Business.
The mandate of CETRA is to highlight CPUT's contribution to tourism and hospitality teaching and research in Cape Town, the Western Cape, South Africa and internationally; to facilitate research activities in the tourism, hospitality, sport and events fields; to bring together university researchers/ lecturers and practitioners (including public sector institutions) domestically and internationally in order to find feasible answers to applied research questions; and to encourage focused research clusters incorporating researchers and students from different CPUT departments and from outside the university.
CETRA aims to foster research on tourism development and contact between tourism research centres and individuals globally; to provide research facilities for students and researchers; to create databases and expand current databases relating to tourism, hospitality, sport and events; and to provide facilitation of dissertation supervision.

Projects

Event Impact Study
Project focus areas: Development of an instrument to measure the impact of events of various sizes
Funders: National Department of Tourism
Contact person: Prof Kamilla Swart
Short project description: The National Department of Tourism, in recognition of the niche expertise that CETRA (Prof Swart) has developed in the area of event research has awarded a research project to CETRA to develop an instrument to measure the impact of events of various sizes. The project is currently in the 3rd phase, which is to measure the impact of selected events. Phase 1 was related to the development of the instrument, Phase 2 was related to piloting and refining the instrument.
Project partners: N/A
Status: Currently in Phase 3 which will be completed in 2015/2016.
For more info: Website not available – contact Prof Swart

Developing a standardised methodology to conduct event impact assessment for the five events (Cape Town Cycle Tour, Old Mutual Two Oceans Marathon, Cape Town International Jazz Festival, ABSA Cape Epic & ABSA Klein Karoo Nasionale Kunstefees)
Project focus areas: Event Impact Assessment
Funders: Department of the Premier, Western Cape Provincial Government
Contact person: Prof Kamilla Swart
Short project description: As per title – development and implementation of a methodology/instrument to measure the impact of selected events in the Western Cape.
Project partners: N/A

Status: Ongoing
For more info: Website not available – contact Prof Swart

CARNIVAL
Project focus areas: Mega Event Legacies
Funders: European Union Framework 7 Marie Curie International Research Staff Exchange Scheme Programme
Contact person: Dr Ian Brittain (Coventry - http://www.coventry.ac.uk/research/research-directories/researchers/ian-brittain/) / Prof Kamilla Swart (CPUT)
Short project description: A transcontinental study of why mega events fail to deliver sustainable legacies
Project partners: Coventry University, Munich University of Technology, Federal University of Rio de Janeiro, North Carolina State University
Status: Ongoing
For more info: http://www.coventry.ac.uk/research/research-directories/current-projects/2014/carnival/?theme=main

6.3.2 University of Cape Town

Sustainable Enterprise and Emergent Change (SEEC)

Type: Research group

Department/s: -

Faculty/s: Graduate School of Business (GSB)

Website: http://gsbblogs.uct.ac.za/seec/

Lead: Professor Ralph Hamann (ralph.hamann@gsb.uct.ac.za)

Main contact points: Professor Ralph Hamann

The SEEC consists of a group of researchers at the Graduate School of Business, supported by the African Climate and Development Initiative, focused on organisational innovation and intermediation in complex social-ecological systems.

A three year programme of work is currently underway in the group, focusing attention on the interactions between organisations and social-ecological systems. The programme of work addresses three sub-components, each of which are outlined in more detail under the section on research programmes and projects below.

Research Programmes & Projects

Knowledge on organisational innovation in response to social-ecological problems

Project focus areas: Mainly South Africa **Funder(s):** ACDI **Contact person:** Professor Ralph Hamann

This programme is addressed through five inter-connected subcomponents, which focus on the following aspects: how businesses make sense of and respond to social-ecological changes; developing a better understanding of the effect of organisational culture and leadership on embedding appreciation, understanding and commitment to sustainability in companies; collaborative intermediary organisations as instances of cross-sector partnerships; organisational sensemaking in response to potential social-ecological regime shifts; and on applying the "tipping point" lens to organisations themselves.

Project partners: Various co-authors (South African, American and Canadian) **Status:** Three year programme, due for completion in 2017

For more information: http://gsbblogs.uct.ac.za/seec/files/2010/03/ACDI-Research-Chair-outline-for-blog.pdf

Develop, implement and learn from different models of trans-disciplinary, engaged scholarship

Project focus areas: Mainly South Africa **Funder(s):** ACDI **Contact person:** Professor Ralph Hamann

Responding to recurring and increasingly urgent calls for scholars to engage with each other across disciplines and with practitioners in order to make scholarship relevant in addressing complex social and ecological problems, this programme works to apply knowledge coproduction principles and practises across SEEC programmes. Through this programme Professor Hamann also supports and facilitates interaction between team members' involvement in a selection of intermediary organisations that are directly involved in bridging the research-practice gap.

Project partners: Network for Business Sustainability (nbs.net) and Southern Africa Food Lab (www.southernafricafoodlab.org) **Status:** Three year programme, due for completion in 2017

For more information: http://gsbblogs.uct.ac.za/seec/files/2010/03/ACDI-Research-Chair-outline-for-blog.pdf

The Business of Social and Environmental Innovation: New Frontiers in Africa

Project focus areas: Africa **Funder(s):** The Bertha Foundation **Contact person:** Professor Ralph Hamann

This book, which was launched in February 2015, was co-edited by SEEC team members Verena Bitzer and Ralph Hamann. The book seeks to contribute to the growing body of scholarly work on environmental and social innovation by addressing the role of entrepreneurs, large companies, cross-sector collaboration initiatives, and academia and teachers in this space, with a focus on the African context.

Project partners: 20 co-authors **Status:** Book launched in February 2015
For more information: http://gsbblogs.uct.ac.za/seec/

Allan Gray Centre for Values-based Leadership

Type: Centre

Department/s: n/a

Faculty/s: Graduate School of Buisness (GSB)

Website: http://www.gsb.uct.ac.za/s.asp?p=391

Allan Gray Chair: Professor Walter Baets (walter.baets@gsb.uct.ac.za)

Main contact points: Professor Walter Baets

The Allan Gray Centre for Values-based Leadership is dedicated to exploring new ways of doing business based on purpose, sustainability and responsible practices that create dignity and belonging. It sets out to ask difficult questions about the assumptions supporting current, mostly mechanistic, business management models. Through a combination of research and practice the Centre promotes a more holistic understanding of management and business, promotes and sustains values-based and inclusive business model innovation, and develops tools to apply this practice.

Managing Infrastructure Reforms and Regulation (MIR)

Type: Centre

Department/s: n/a

Faculty/s: Graduate School of Business (GSB)

Website: http://www.gsb.uct.ac.za/s.asp?p=391

Head of the Centre: Professor Anton Eberhard (anton.eberhard@gsb.uct.ac.za)

Main contact points: Professor Anton Eberhard

MIR aims to enhance understanding and to build capacity in infrastructure investment, reform and regulation in support of sustainable development. The main focus of MIR is currently in the electricity and water sectors, with focus also expected to expand into the gas, transport and telecommunications sectors. MIR's work relates to three aspects: providing professional support and policy advocacy; providing executive and professional short courses; and research related to the frontiers of infrastructure reform regulation in Africa.

Development Policy Research Unit (DPRU)

Type: Research Unit

Department/s: School of Economics

Faculty/s: Faculty of Commerce (& Faculty of Humanities)

Website: http://www.dpru.uct.ac.za/

Director of the Unit: Professor Haroon Bhorat (Haroon.Bhorat@uct.ac.za)

Main contact points: Professor Haroon Bhorat, Sarah Marriott (sarah.marriott@uct.ac.za)

The DPRU aims to inform economic and social policy making by producing academically credible research and rigorous policy analysis of labour market challenges such as education and regulation, and their consequences as manifest in poverty and inequality. The DPRU has three core objectives: to foster high quality, policy relevant research within the DPRU; to train a new generation of research economists within the Unit and engage in training and teaching activities; and to disseminate information and knowledge to, and develop effective networks with, decision- and policy-makers in government, the research community, the private sector and civil society.

The DPRU's current key areas of expertise are labour market issues, poverty, and inequality, with a specific focus on South Africa and Africa more generally. While these three thematic areas constitute the core focus of the Unit's research work, researchers do engage in projects concentrating on related issues such as financial development, trade, and demography. The bulk of the Unit's research derives from the analysis and manipulation of micro-level datasets, such as individual and household surveys, firm surveys, national censuses and increasingly, administrative databases.

The DPRU draws funding through both grants and commissioned research from a number of both local and international organisations. Sources of income include provincial and national government departments and international donor organisations.

Research Programmes & Projects

EPP: Community Work Programme (CWP)

Project focus areas: South Africa

Funder: The Employment Promotion Programme (EPP), funded by the UK Government (UK Department of International Development (DFID))

Contact person: Toughedah Jacobs (toughedah.jabobs@uct.ac.za)

The project aimed to provide estimates of the potential poverty-reducing impact that rapidly expanding the Community Work Programme could have.

With EPP support the CWP has piloted new approaches to public employment at the community level, and has now been successfully integrated into the Expanded Works Programme. By December 2010, 80,000 jobs were created at various sites across the country. EPP supported the impact assessment of CWP to secure funding to ultimately upscale CWP to reach one million participants by 2014.

Partners: - **Status:** Completed in 2013 **For more information**: http://www.dpru.uct.ac.za/completed-projects or http://www.epp.uct.ac.za/PhaseIII

Southern Africa Labour and Development Research Unit (SALDRU)

Type: Research Unit

Department/s: School of Economics

Faculty/s: Faculty of Commerce (& Faculty of Humanities)

Website: http://www.saldru.uct.ac.za/

Director of the Unit: Professor Murray Leibbrandt (murray.leibbrandt@uct.ac.za)

Main contact points: Professor Murray Leibbrandt

SALDRU carries out research in applied empirical microeconomics with an emphasis on labour markets, human capital, poverty, inequality and social policy. SALDRU has implemented a range of innovative surveys in South Africa including the Project for Statistics on Living Standards and Development **(PSLSD),** Cape Area Panel Study **(CAPS)** and the National Income Dynamics Study **(NIDS),** among others.

Research Programmes & Projects

Evaluation of the Public Works Programme

Project focus areas: South Africa **Funder:** **Contact person:** Anna McCord (amccord@iafrica.com)

The research focused on the question of state intervention to promote employment and reduce poverty through public works. The work examined the nature and impact of public works programmes (PWPs) in Africa and, especially, South Africa.

Status:

For more information: http://www.saldru.uct.ac.za/projects/completed-projects/evaluation-of-public-works-programme

Environmental Economics Policy Research Unit South Africa (EPRU)

Type: Collaborative association

Department/s: School of Economics

Faculty/s: Faculty of Commerce (& Faculty of Humanities)

Website: http://www.efdinitiative.org/south-africa

Head of the Unit: Dr Jane Turpie (Jane.turpie@uct.ac.za)

Main contact points: Dr Jane Turpie

EPRU is a collaborative association that brings together academic researchers specialising in environmental and natural resource issues. The association aims to promote sustainable development and poverty reduction through research, teaching and policy consultation. EPRU forms part of international research network, The Environment for Development Initiative (EfD).

Research Programmes & Projects

Climate Change and Wildlife Utilization on Private Land in South Africa

Project focus areas: South Africa **Funder:** -

Contact person: Associate Professor Edwin Muchapondwa (edwin.muchapondwa@uct.ac.za)

In South Africa, there are 14,000 game ranches with 10,000 practicing pure wildlife ranching while the remaining 4,000 are integrated wildlife-livestock ranches. This study addresses the impact of climate change on the value of wildlife and welfare of ranchers.

Project partners: - **Status:** -

For more information: http://www.efdinitiative.org/south-africa/projects/l/climate-change-and-wildlife-utilization-private-land-south-africa/4051

Marine Protected Areas and Small-Scale Fishing Behavior: a Comparative Analysis between South Africa, Tanzania and Costa Rica

Project focus areas: South Africa, Tanzania and Costa Rica **Funder:** Environment for Development Initiative (EfD)

Contact person: Professor Heidi J. Albers (jo.albers@oregonstate.edu)

The program examines marine resource conservation, and focuses on improving policy to promote coastal conservation through marine protected areas and related management tools.

Project partners: - **Status:** -

For more information: http://www.efdinitiative.org/south-africa/projects/l/marine-protected-areas-and-small-scale-fishing-behavior-comparative-analysis/3133

Optimal Pricing of Parks and Wildlife Resources in Eastern and Southern Africa

Project focus areas: Kenya, Tanzania and South Africa **Funder:** Environment for Development Initiative (EfD)

Contact person: Associate Professor Edwin Muchapondwa (edwin.muchapondwa@uct.ac.za)

The main goal of the research program is to support the use of optimal pricing of park resources to achieve sustainable park management and to maximize the value of parks in Eastern and Southern Africa for a combination of parks and national interests. The proposed research program aims to provide formal frameworks that could be used by the park agencies in determining the optimal pricing of national park resources in Eastern and Southern Africa.

Project partners: - Status: -

For more information: http://www.efdinitiative.org/south-africa/projects/l/optimal-pricing-parks-and-wildlife-resources-eastern-and-southern-africa/3132

The role of institutions in wildlife conservation in South Africa and Zimbabwe: A social-ecological systems approach

Project focus areas: South Africa and Zimbabwe **Funder:** Environment for Development Initiative (EfD)

Contact person: Associate Professor Edwin Muchapondwa (edwin.muchapondwa@uct.ac.za)

This study seek to i) explore the conditions under which users of common pool wildlife self-organize in South Africa and Zimbabwe, and ii) identify the core attributes of resource units, resource users and local institutions that are associated with sustainable wildlife conservation.

Project partners:- **Status:** -

For more information: http://www.efdinitiative.org/south-africa/projects/l/role-institutions-wildlife-conservation-south-africa-and-zimbabwe-social/2903

Poverty, resource scarcity and climate variability: constraints to adaptation

Project focus areas: South Africa **Funder:** - **Contact person:** Associate Professor Martine Visser (martine.visser@uct.ac.za)

The study explores the complex interactions between resource use/degradation, climate variability (and environmental change in general) and sustainable livelihoods of the rural poor in North Eastern South Africa. It specifically investigates the constraints to adaptation to climate variability and to what extent reliance on natural resources to sustain livelihoods are exacerbated by climate variability. The role of social capital within communities and access to credit and insurance facilities in facilitating adaptation will further be researched.

Project partners: - **Status:** -

For more information: http://www.efdinitiative.org/south-africa/projects/l/poverty-resource-scarcity-and-climate-variability-constraints-adaptation/2902

Evaluation of Dry-lands Ecosystems Services in the area surrounding the Kgalagadi Transfrontier Park in South Africa

Project focus areas: Kgalagadi Tranfrontier Park, South Africa **Funder:** - **Contact person:** Dr Johan Dikgang (DKGJOH001@myuct.ac.za)

This project is concerned with identifying, assessing and valuing ecosystem services found on the section of land belonging to the Khomani San contractual Kgalagadi park and their farms - outside of the Park.

Project partners:- **Status:** -

For more information: http://www.efdinitiative.org/south-africa/projects/l/evaluation-dry-lands-ecosystem-services-area-surrounding-kgalagadi-transfrontier/1915

Policy Research on International Services and Manufacturing (PRISM)

Type: Research and policy unit

Department/s: School of Economics

Faculty/s: Faculty of Commerce (& Faculty of Humanities)

Website: http://www.prism.uct.ac.za/Default.aspx

Director: Professor Mike Morris (mike.morris@uct.ac.za)

Main contact points: Professor Mike Morris

PRISM provides a lens to focus research and policy work broadly on issues of globalization, trade and industrialization. It is home to a number of related research activities, projects and programmes focused around the following issues: globalisation; global value chains; industrialisation; industrial policy; international trade; foreign investment; the defence industry; governance and economic policy; commodities and resource based industrialisation; infrastructure development; knowledge intensive services and innovation; employment intensive growth; international competitiveness of firms and clusters; China's economic impact on Africa; regulatory frameworks for trade, services and sectors; the distributional gains of industrial growth.

Research Programmes & Projects

The Political Economy of Renewable Energy in South Africa

Project focus areas: n/a **Funder:** Institute of Development Studies (via UK Department of International Development (DfID))

Contact person: Mike Morris

Investigating the political economy constraints obstructing and facilitating renewable energy.

Project partners: - **Time frames:** Completed in 2014

For more info: -

Research Unit in Behavioural Economics and Neuroeconomics (RUBEN)

Type: Interdisciplinary group of researchers

Department/s: School of Economics

Faculty/s: Faculty of Commerce (& Faculty of Humanities)

Website: http://www.ruben.uct.ac.za/

Director of the Unit: Professor Harold Kincaid (harold.kincaid@uct.ac.za)

Main contact points: Professor Harold Kincaid

RUBEN brings together an interdisciplinary group of researchers who use economic experiments to examine the role that social, cognitive and emotional factors play in economic decision-making. They use quantitatively analysed laboratory and field experiments, with people earning real monetary rewards for performing experimental tasks. RUBEN is currently the only centre for experimental research economics on the African continent, and a central aspect of their work is therefore to run training workshops.

Research Programme & Projects

Climate change in an experimental setting: The effect of stochastic future disasters and country vulnerability on cooperation

Project focus areas: International **Funder:** **Contact person:** Associate Professor Martine Visser (martine.visser@uct.ac.za)

The project investigates the trade-off between countries' investments in adaptation and mitigation, studying how the investment behaviour in these two types of investment differs between types of countries.

Project partners: **Status:** **For more information**: http://www.ruben.uct.ac.za/ProjectInfo.aspx?PID=6

Impact of Climate Policy and Policy Instruments on Investment on Environment

Project focus areas: International **Funder:** **Contact person:** Associate Professor Martine Visser (martine.visser@uct.ac.za)

The research assesses how investors, government and farmers deal with choices under risk, the overarching theme being the Impacts of Climate Policy and Economic Policy Instruments on Environmental Investments. The investment focus in this regard is stock market investments, investments in renewable energy and investment in adaptation.

Project partners: **Status:** **For more information**: http://www.ruben.uct.ac.za/ProjectInfo.aspx?PID=7

Centre for Information Technology and National Development in Africa (CITANDA)

Type: Research Unit

Department/s: Department of Information Systems

Faculty/s: Faculty of Commerce

Website: http://www.commerce.uct.ac.za/Organisations/CITANDA/default.asp

Director: Prof Jean-Paul Van Belle (Jean-paul.VanBelle@uct.ac.za)

Main contact points: Prof Jean-Paul Van Belle

CITANDA is the vehicle through which research of the Department of Information Systems is branded and a conduit for drawing together research emanating from staff members. It brings together researchers, projects, funders and programmes focused on the use of Information and Communication Technology (ICT) in the service of national development. CITANDA is particularly interested in research and international development studies in the following areas: The Impact of ICTs on Economic Development; Information Systems and Practices in Development Contexts; ICT for Development Projects and Evaluation of such Projects; ICT for Development Field Studies in Southern Africa; e-/m- Commerce for Development Studies and Evaluation and Green Information Systems.

Research Programmes & Projects

CITANDA has a longitudinal (six-year) research project in Green Information Systems which has received a total of R60 000 in funding for integrating Carbon Footprinting into the curriculum and students can elect to research Green Information Systems or Green Information Technology.

Education Programmes

PhD and Masters in Information Systems

Focus areas: n/a **Contact person:** Carolyn McGibbon (carolyn.mcgibbon@uct.ac.za)

In these programmes students can choose to do research on Green IT and Green IS.

For more information: http://www.commerce.uct.ac.za/InformationSystems/Courses

Sample publications provide a further indication of CITANDA's research focus:

- McGibbon C., Ophoff J. & Van Belle J.P. (2014). Our building is smarter than your building: the use of competitive rivalry to reduce energy consumption and linked carbon footprint. *Knowledge Management & E-Learning*, Vol 6 No 4, 464-471. ISSN 2073-7904.
- Kotze C., Van Belle J.P. & McGibbon C. (2014). Key Drivers of Green Information Systems in South African Listed Companies. Proceedings of the 5th International Conference Confluence (IEEE), Noida, Uttar Pradesh, India, pp 935-940. ISBN 978-1-4799-4237-4.
- Thomson S. & Van Belle J.P. (2014). Drivers of Green Information Technology in Higher Education in South Africa. Proceedings of European Conference in Information Systems Management and Evaluation, pp 234-243, ISBN 978-1-910309-41-4.
- McGibbon C. & Van Belle J.P. (2013). Integrating Green Information Systems into the Curriculum Using a Carbon Footprinting Case. Proceedings of the 7th European Conference on Information Systems Management and Evaluation, 12-13 September, Gdansk, Poland, pp.104-113. ISBN 978-1-909507-55-5.

Architecture

Type: Academic Unit

Department/s: School of Architecture, Planning & Geomatics

Faculty/s: Faculty of Engineering & the Built Environment

Website: http://apg.uct.ac.za/

Head of Unit: Professor Iain Low (Iain.Low@uct.ac.za)

Main contact points: Professor Iain Low

The Architecture unit within the School of Architecture, Planning & Geomatics is concerned with buildings and their relationship to society's spaces and places.

Research Programmes & Projects

Space and transformation - Third space typology in Education – [one school situation each year]
Project focus areas: Schools and Education space **Funder:** Western Cape Provincial Government
Contact person: Iain Low (iain.low@uct.ac.za)

The projects is directed at reflective and projective assessment of existing PGWC/ED infrastructure and education facilities with the purpose of contributing design knowledge toward the improvement of these facilities; the aim is to contribute new spatial approaches to contemporary problems of management, maintenace, security, and comfort and wellbeing of users. Community engagement and the interpretive expansion of the contemporary idea of a school is promoted.
Project partners: PGWC/ED PGWC/DPW Individual Schools and members of architecture profession
Status: Ongoing, annual event since 1975 **For more information**: -

Emthonjeni Water points project
Project focus areas: Community Public Infrastructure [informal settlement] Imizamo Yethu / Hout Bay informal settlement **Funder:** Departmental and Sponsors **Contact person:** Mike Louw / Michael.Louw@uct.ac.za

Small design build interventions that utilises the 2nd year BAS curriculum to engage students with communities through addressing community real needs that lead to spatial improvement of everyday life.

Project partners: Imizamo Leadership with Community and various sponsors **Status:** Ongoing, annual event since 2011 **For more information**: -

Emthonjeni Project: Design and Making Epistemology – in Search of an Afrocentric Perspective via the African Informal Settlement
Project focus areas: n/a **Funder:** PERC **Contact person:** Dr Tom Sanya (tom.sanya@uct.ac.za)

The intention of the project was to construct a small public space through a participatory design process. Through a series of participatory design workshops, the public space came to be defined as an Emthonjeni - the Xhosa word for a rural well point. Three participatory design workshops were undertaken with selected community members, after which the design was refined and handed-over to consultants for contract preparation and management pro-bono. The outcome was a constructed public space (an urban Emthonjeni) for use by the Monwabisi Park community.

Project partners: Sustainable Urban Neighbourhood Development (SUN, the executing agent for the City of Cape Town's Violence Prevention through Urban Upgrading Programme (VPUU)), the community of Monwabisi Park, Jacob Parker Architects, Talani Quantity Surveyors and Bergstan Engineering **Status:** Completed in 2012
For more information: -

Sustainable buildings in South Africa

Project focus areas: South Africa **Funder:** Unfunded (sabbatical project) **Contact person:** Dr Tom Sanya

This piece of work, the sabbatical project of Dr Tom Sanya, aims to describe and analyse South African buildings in the context of sustainable design methods and principles. It will combine theory and practice, thus giving a theoretical basis followed by the actual measurement of metrics. The aim is for the research to be published in a book format.

Project partners: - **Status:** Commenced in January 2015 **For more information**: -

Framework for Sustainable building in South Africa

Project focus areas: South Africa **Funder:** **Contact person:** Dr Tom Sanya

Sustainable building in South Africa must address environmental concerns and entrenched socio-economic problems engendered by the country's debilitating Apartheid history. This piece of work resulted in a descriptive-analytical paper of the normative framework for sustainable building in South Africa. The paper critically locates the framework for sustainable building from strategic institutional level and operational scale standpoints. The intention of the paper was to propose a comprehensive conceptual framework for sustainable building.

Project partners: - **Status:** Presented and published in 2014 **For more information**: -

Courses/ short courses

Environment & Services II (APG2038W)

Focus area: n/a **Contact person:** Dr Tom Sanya

The course, which is grounded in sustainable design, offers a broad understanding of building design in the context of the micro- and macro-environment. Its focus is on building performance in relation to human comfort standards. The content is developed around building science approaches and different methods for servicing medium size buildings with the incorporation of sustainable design principles as needed.
For more information:
https://www.uct.ac.za/downloads/uct.ac.za/apply/handbooks/Handbook%207A%20EBE%20Undergraduate%20Studies2015.pdf

Environment & Services III (APG3034W)

Focus area: n/a **Contact person:**

This course, which is grounded in sustainable design, aims to introduce students to sophisticated architectural strategies for passive and hybrid environmental control systems and services for medium-scaled buildings.

For more information:
https://www.uct.ac.za/downloads/uct.ac.za/apply/handbooks/Handbook%207A%20EBE%20Undergraduate%20Studies2015.pdf

Architectural Design Studio I - Sustainable Design: Living [in] Boundaries (APG4042F)

Focus area: n/a **Contact person:** Dr Tom Sanya

This honours course was offered once off, in 2013. Its intention was to engage with sustainable design of a complex building in an urban context. Nature and the built environment occur at multiple overlapping scales. A global imperative for sustainable design arises out of the disproportionate contribution of buildings to contemporary environmental problems. The studio presented a unique opportunity to hone sustainable design skills through design investigation of a complex building in an urban context.

For more information: -

Planning

Type: Academic Unit

Department/s: School of Architecture, Planning & Geomatics

Faculty/s: Faculty of Engineering & the Built Environment

Website: http://apg.uct.ac.za/

Head of Unit: Professor Vanessa Watson (vanessa.watson@uct.ac.za)

Main contact points: Tania Katzschner (tania.katzschner@uct.ac.za)

Planning as an activity is a collective societal effort to imagine or re-imagine an urban or regional environment and to translate this into priorities for investment, conservation, new and upgraded settlement, strategic infrastructure investments and principles of land use regulation. At the core of urban planning is a concern with space and the making of 'place'. Planning is also fundamentally a political activity rather than a neutral, technical activity. It is shaped by values, and planners are constantly called upon to make ethical judgments in relation to different possible futures.

The field of city and regional planning is concerned with understanding and guiding the relationship between society and the environment for the purpose of promoting more just, equitable, sustainable, respectful, and inclusive planning processes and outcomes, in particular for (and with) financially stressed and disadvantaged urban and rural communities. The planning consciousness necessary to carry out this task is ethically driven, and is based on two central pillars: a humanist and an ecological value system (learning nature awareness, and personal and earth stewardship skills). The search for sustainability and the reality of climate change is implicit in all teaching and research. The profession engaged with questions of meaning, value, responsibility and purpose in a time of rapid and escalating change.

As such, teaching and research taking place at the Planning unit includes amongst others aspects of: natural resource and landscape management, urban nature; urban infrastructure, ecological infrastructure, environmental management and assessment, environmental law, technology and networks; community and planning ethics; conflicting rationalities in planning theory; and food security.

Research Programmes & Projects

Studio A: Generating spatial development frameworks for two informal settlements located in Gugulethu through a PAR methodology

Project focus areas: Gugulethu **Funder: -** **Contact person:** Tanja Winkler (tanja.winkler@uct.ac.za)

Having been approached by the Community Organization Resource Centre (CORC), a group of UCT graduate students from the two-year Planning Programme worked together with CORC to assist the community leaders in generating spatial development frameworks for two informal settlements located in Gugulethu. The projected was implemented using the Participatory Action Research (PAR) methodology.

The community-university engagement provided students with valuable practical experience, yet all three parties were disappointed that the project did not lead to security of tenure for residents in the two informal settlements, as was hoped for at the outset.

Project partners: Community Organization Resource Centre (CORC) (a local affiliate of Slum/Shack Dwellers International) and Gugulethu community leaders

Status: Conducted during the course of one semester in 2011

For more information:

Fracking in the Karoo - Planning considerations: Need and desirability – values and attitudes

Project focus areas: The Karoo **Funder:** Self-funded **Contact person:** Tania Katzschner

Tania Katzschner is contributing a planning perspective to a book on fracking in the Karoo.

Based on website with input from representative

Project partners: The institute of Marine and Environmental Law (IMEL) leads the book project, which has a large number of contributing authors

Status: In process, due for completion in 2015 **For more information**: See the section on the Institute of Marine and Environmental Law (IMEL) for further details.

The projects of Masters and PhD students with the Planning Unit provide a further indication of their research focus:

- "Every Last Drop: The role of spatial planning in integrated urban water management in the Cape Town City-region" (2014)
- "Moving Towards a Strategy for the Sustainable Delivery of Emergency Housing and Temporary Residential Accommodation in the City of Cape Town" (2014)
- "Moving towards more meaningful public participation in local government's land use planning decision making process- a comparative case study between Princess Vlei and Philippi Horticultural area" (2014)
- "A Coastal Zone Management Framework for the Overstrand Municipality" (2014)
- "Spatial Planning for Climate Change Adaptation: Developing a Climate Change Local Area Adaptation Plan For Khayelitsha" (2014)
- "Spatial Development Framework for the Princess Vlei (wetland) and surrounding area" (2014)
- "A Waste of Space: An Analysis of the Spatial Implications of the City of Cape Town's Integrated Waste Management Policy" (2013)
- "Food for the Future: Planning for Urban agriculture in Cape Town's City Bowl" (2013)
- "A Natural Resource and Landscape Management Framework for the Bergrivier Municipality" (2013)
- Restor(y)ing relationships with nature – Towards transformative possibilities: 'Cape Flats Nature' (ongoing)

Courses/ short courses

Natural Systems: focusing on natural processes and planning informants at the local scale

Contact person: Tania Katzschner

This course, which is offered in the first year of the Masters of Cities and Regional Planning and which is compulsory for all planning students, engages students around the ideas of nature and people. The course aims to help students develop their own value system in relation to nature, and offers thinking tools relating to people-nature relationships.

The course objective is to develop a **systemic understanding** of the structure and functioning of natural systems and the **reciprocal effects / impacts** of human activities – natural processes. Further its objective is to develop **relational thinking** and an **integrative consciousness** which is both critical and deeply connective and to develop an **ecological way** of thinking and perceiving It is the intention and hope that the course contributes to increasing the knowledge of sustainability and wisdom of natural systems to inspire students to transform themselves and the world in a huge way.

For more information: -

Planning Techniques 3: Environmental impact assessment and management

Contact person: Tania Katzschner

This course, which is offered in the second year of the Masters of Cities and Regional Planning, is an introduction to integrated environmental management.

The general aims of the course are to produce graduates who have developed a more advanced understanding of the concept of planning for socio-ecological resilience in support of ' sustainable development' and 'sustainability', and be able to use a variety of approaches and methods for planning and environmental assessment in support of 'sustainability'. Further the aim of the course is to develop a working understanding of the complex (and contested) relationship between spatial planning and project-level environmental assessment in South Africa. By the end of the course graduates should have a detailed knowledge of the principles and methods of environmental assessment, evaluation and management, and some practical experience of these topics

For more information: -

Regional Planning Theory A & Regional Planning Project A

Contact person: Tania Katzschner

The course expands natural resource and landscape management to the regional scale of natural resource management and landscape design – specifically to river basins and bioregions which contain systems of settlements, as well as extensive rural landscapes (agriculture and forest) and natural – near natural areas ('wilderness').

For more information: -

Based on website with input from representative

Geomatics

Type: Academic Unit

Department/s: School of Architecture, Planning and Geomatics

Faculty/s: Faculty of Engineering & the Built Environment

Website: http://apg.uct.ac.za/?page_id=310

Director: Associate Professor Julian Smit (Julian.Smit@uct.ac.za)

Main contact points: Associate Professor Julian Smit

Geomatics is both an applied science and a professional discipline, and it refers to the integrate approach of measurement, analysis, management and display of spatial data. There are five academics within the Geomatics unit at the School of Architecture, Planning and Geomatics, and their research focus includes: cultural heritage documentation; land administration issues; spatial data infrastructure; remote sensing; and (participatory) GIS mapping. For the latter, academics in the group are interested in the use of mapping to assist conversations between communities and government officials.

The research conducted by the academics at Geomatics often forms a component out of a bigger project that is run by other units at the university. The Geomatics Unit is contributes to the following University of Cape Town (UCT) projects: ACDI's Smart Agriculture Project (see under ACDI's project overview); ACC's Consuming Urban Poverty Project (see under the African Center for Cities (ACC) project overview); and ACC's Flooding in Cape Town under Climate Risk (FLICCR) project (see under ACC's project overview).

Research Programmes & Projects

Cape Urban Observatory

Project focus areas: The Greater Cape Town area **Funder:** Western Cape Provincial Government (WCPG) & the City of Cape Town (CoCT) **Contact person:** Associate Professor Julian Smit

The project was centered around data collection and management, and the provision of spatial data that can support holistic decision making. It involved the development of a technology platform, as well as a tool that can be used for investigating and identifying areas in the City of Cape Town with potential for housing developments.

Project partners: CoCT, WCPG, ACC, South African Environmental Observation Network (SAEON), South African National Biodiversity Institute (SANBI) and the Council for Scientific and Industrial Research (CSIR) **Status:** 3 year project, 2008-2011

For more information: http://www.africancentreforcities.net/programme/applied-urban-research/cape-urban-observatory/

Water as a constraint on development

Project focus areas: The Berg Catchment **Funder:** Western Cape Provincial Department of Economic Development and Tourism (DEDAT) and Water Research Commission (WRC) **Contact person:** Associate Professor Julian Smit

This project, which is led by GreenCape, aims to integrate the existing water resources assessment and planning work within the region, with an analysis of the regional economy. The focus area of this study is the Berg Catchment, with a particular emphasis on water availability for the planned economic development of the Saldanha Bay Industrial Development Zone. The University of Cape Town Geomatics unit is responsible for the project component concerned with the mapping of water demand in Saldanha, based on the variety of land uses, and the development of different future scenarios and how those will impact the economy.

Based on website with input from representative

Project partners: GreenCape and the African Climate and Development Initiative (ACDI) **Status:** 3 year project due to start 1 April 2015

For more information: http://green-cape.co.za/what-we-do/projects/water-as-a-constraint-on-development/

The project titles of current Masters and PhD students within Geomatics provide a further indication of their research focus:

- Estimation of roof top profiles (from imagery and Lidar) in the City of Cape Town for solar energy potential analysis; Analysis of spatial data infrastructure implementation in South Africa
- Calibration of laser scanners
- Analysis of municipal dam water levels and servitudes; Estimation of sea level rise impact on coastal Mozambique town
- Camera lens calibration models for UAV-based photogrammetry
- Extraction of informal settlement dwellings form high resolution imagery and Lidar for settlement growth pattern analysis
- Analysis of remote sensing for wetland monitoring as a means of investigating ground water extraction impacts
- Mapping from panorama imagery.

Based on website with input from representative

African Center for Cities (ACC)

Type: Center

Department/s: School of Architecture, Planning and Geomatics

Faculty/s: Faculty of Engineering & the Built Environment (Faculty of Humanities & Faculty of Science)

Website: http://www.africancentreforcities.net/

Lead: Professor Edgar Pieterse

Main contact points: Professor Gordon Pirie (gordon.pirie@uct.ac.za)

The focus of the ACC is on quality scholarship regarding the dynamics of unsustainable urbanization processes in Africa, with an eye on identifying systemic responses. The mission of the interdisciplinary Center is to facilitate critical urban research and policy discourses for the promotion of vibrant, democratic and sustainable urban development in the global South from an African perspective. The aims of the Centre are two-fold: to partner closely with policy-making centres in the public sector in South Africa (national, provincial, local) and subsequently more widely to provide an alternative perspective on dealing with critical urban issues; secondly to provide an intellectual base and home for interdisciplinary, urban-related research at the University of Cape Town (UCT), from which relations can be established with selected international funders and think-tanks.

The work of the ACC includes the running of seminars and discussion sessions, supporting a Masters Programme in Urban Infrastructure Design and Management and conducting a number of research projects.

Research Programmes & Projects

New Climate Economy - Africa Progress Panel
Project focus areas: Africa **Funder:** World Resources Institute (WRI)
Contact person: Anton Cartwright (anton.cartwright@uct.ac.za)

ACC is writing the ""urbanisation chapter" - Better growth, better climate, better cities - of the report being compiled by the New Climate Economy (NCE) for the African Progress Panel.

Project partners: Overseas Development Institute (ODI) and the NCE
Status: Report will be launched June 2015
For more information: http://www.africaprogresspanel.org/publications/policy-papers/africa-progress-report-2015/

Urban ARK
Project focus areas: Senegal, Nigeria, Malawi, Kenya and Niger **Funder:** Economic and Social Research Council (ESRC)/ UK Department of International Development (DFID)
Contact person: Professor Susan Parnell (susan.parnell@uct.ac.za)

This programme, which involves researchers from Africa, practitioners and international research partners, aims to reduce urban disaster risk in urban sub-Saharan Africa. By studying the interaction of environmental hazards in areas with poor housing and marginalised communities, the research aims to break the cycles by which vulnerability and the incapacity to cope with hazards accrue in society.

Project partners: Led by King's College London, and involves ACC and the Climate Systems Analysis Group (CSAG) at University of Cape Town (UCT), African Population and Health Research Centre, University of Ibadan, Mzuzu University, Université Abdou Moumouni, ARUP, International Alert, Save the Children and United Nations Human Settlements Programme (UN-HABITAT), Development Planning Unit at University College London and the International Institute for Environment and Development
Status: 3 year programme, started in 2015 **For more information**: -

Hungry Cities Partnership

Based on website with input from representatives

Project focus areas: Cape Town, Mozambique, Nairobi, Kingston (Jamaica), Mexico City, Nanjing, India (City yet to be formalised)
Funder(s): Canada's International Development Research Centre (IDRC)/Social Sciences and Human Research Council (SSHRC)
Contact person: Prof Jonathan Crush (jcrush@balsillieschool.ca)/ Jane Battersby-Lennard (jane.battersby.lennard@gmail.com)
The goal of this project is to promote inclusive growth in the informal food sector through research on policy and measures that support entrepreneurship and decent employment. The research team will analyze formal and informal urban food systems in large cities in Africa, Asia, and the Caribbean, exploring how they interact, how they are governed, and their respective contribution to food security and inclusive growth.

Project partners: Balsillie School, Waterloo University (Canada), UCT, Eduardo Mondlane University, APHRC, Nanjing University, National Autonomous University of Mexico, University of the West Indies
Timeframes: 2014-2019 **For more information**: -

Consuming Urban Poverty: governing urban food systems to alleviate poverty in secondary cities in Africa
Project focus areas: Kenya (Kisumu), Zambia (Kitwe), Zimbabwe (Epworth, Harare) **Funder(s):** ESRC/DFID
Contact person: Prof Vanessa Watson (Vanessa.watson@uct.ac.za)
This project aligns itself with Carolyn Steel's assertion that "In order to understand cities properly, we need to look at them through food" (Steel 2008, 10). It argues that important contributions to debates on urbanization in sub-Saharan Africa, the nature of urban poverty, and the relationship between governance, poverty and the spatial characteristics of cities and towns in the region can be made through a focus on urban food systems and the dynamics of urban food poverty. There is a knowledge gap regarding secondary cities, their characteristics and governance, and yet these are important sites of urbanization in Africa. This project therefore focuses on secondary cities in three countries: Kisumu, Kenya; Kitwe, Zambia; and Epworth, Zimbabwe.

Project partners: Environmental & Process Systems Engineering Research Group (UCT), Kisumu Local Interaction Platform, Copperbelt University **Timeframes:** Nov 2014-Oct 2017
For more information: https://consumingurbanpoverty.wordpress.com

Centre of Excellence in Food Security
Project focus areas: South Africa **Funder(s):** The National Research Foundation (NRF)
Contact person: Prof Julian May (Julian.may@uwc.ac.za) / Jane Battersby-Lennard
Food security and nutrition are imperative for human survival with dignity. Achieving food security must take into account economic vitality, social justice, human and environmental health. Our goal is to undertake research, capacity building and dissemination activities to promote a sustainable food system that brings about food security for poor, vulnerable and marginal populations. Our research is transdisciplinary and involves using innovative methodologies for high-impact science through understanding and taking action on complex societal problems. We adopt a partnership approach to the organisation of our activities by building purposive strategic relationships for the co-design and co-ownership of research problems, methodologies and solutions. Through a transformative agenda, we provide leadership, evidence for decision making and critique of policies and programmes aimed at reducing food insecurity. Our comprehensive and systems approach to development recognises the underlying causes of food insecurity such as poverty, unemployment and inequality.

Project partners: Centre of Excellence in Food Security (University of Western Cape) and University of Pretoria, Researchers in the Centre are drawn from Universities of Cape Town, Fort Hare, Johannesburg, Nelson Mandela, North West, Limpopo, Stellenbosch and Venda, Tshwane University of Technology, the Agricultural Research Council and the Water Research Council. Our international partners are the Australian National University, City University of New York, Institute of Development Studies, International Food Policy Research Institute, Michigan State University and Missouri University.
Timeframes: 2014-2019 **For more information**: -

Mistra Urban Futures
Project focus areas: Cape Town **Funder:** The Mistra Foundation for Strategic Development, the Swedish International Development Agency (SIDA), and seven consortium members
Contact person: Zarina Patel (zarina.patel@uct.ac.za)
In this programme the ACC is part of an international network of cities (Gothenburg; Manchester; Kisumu and Cape Town), known as Local Interaction Platforms (LIPs). Here efforts are underway to better understand and enact urban sustainability through innovative knowledge production and sharing practices through emphasis on three focus areas: fair; green; and dense cities.

The Cape Town LIP (CTLIP) facilitates four projects at the African Centre for Cities, in close partnership with the City of Cape Town – the Knowledge Transfer Programme, Contributing to broader urban debates in South Africa, the Africa Peer Learning, Knowledge and Dissemination Programme and the CityLab Programme.

Project partners: - **Status:** Phase 1 due for completion in 2015, phase 2 planned for 2016 - 2020
For more information: http://www.africancentreforcities.net/programme/mistra-urban-futures/ / www.mistraurbanfutures.se

Flooding in Cape Town under Climate Risk (FliCCR)

Project focus areas: Cape Town **Funder:** IDRC and DFID **Contact person:** Gina Ziervogel (gina@csag.uct.ac.za)

This project aimed to understand and strengthen the governance system that determines how risks associated with flooding and sea-level rise are addressed in the city of Cape Town, South Africa. The project worked at the City level, with the Flood and Storms task team and associated departments, and at the local level in Philippi.

Project partners: The African Climate and Development Initiative (ACDI), the Centre of Criminology, the Environmental and Geographical Science (EGS) Department, The City of Cape Town Environmental Resource Management Department and the Stockholm Environment Institute (Oxford Centre)
Status: 3 year project, completed in 2014
For more information: http://www.acdi.uct.ac.za/research/flicccr-flooding-cape-town-under-climate-risk and https://weadapt.org/knowledge-base/urban-adaptation-to-climate-change/governing-climate-risks-in-cape-town

Socioecological Movements and Urban Ecosystems (MOVE)

Project focus areas: Cape Town and New Orleans **Funder: -** **Contact person:** Henrik Ernstson (henrik.ernstson@uct.ac.za)

The project builds on a 'transformative collective action' approach to study urban ecology and civic-led urban ecological changes. The study compares how civic organizations in Cape Town and New Orleans, two port-cities with a long history of systematic apartheid and racial segregation, have produced both cultural and political changes, and indeed ecological changes.

Project partners: Centre for Bioregional Research at Tulane University (New Orleans), Stockholm Resilience Centre Stockholm and KTH Royal Institute of Technology (Stockholm) **Status:** Ongoing
For more information: http://www.situatedecologies.net/archives/portfolio/move / http://www.africancentreforcities.net/programme/ways-of-knowing-urban-ecologies-wok-eu/socioecological-movements-urban-ecosystems-move/

Socio-institutional prerequisites for climate adaptation at the local scale: a comparison of three South African municipalities

Project focus areas: Three South African municipalities **Funders:** Agence Française de Développement (AFD)
Contact person: Anna Taylor (annactaylor@gmail.com)

ACC conducted research focusing on the political, institutional and social factors shaping the initiation of climate adaptation in three South African municipalities – Cape Town, Durban and Theewaterskloof – considered local leaders in addressing climate concerns. The findings show that, with little political or fiscal support, climate change adaptation currently remains in the realm of technical planning and management, where progress is contingent on the energy, efforts and agency of individuals. There is, however, some evidence that the efforts of local champions, in concert with rising global awareness of climate change and increasing impacts on the poor and the rich alike, are beginning to create a political opportunity to make climate change a central development issue, linked to public services, markets and employment.

Project partners: University of KwaZulu Natal **Status:** Completed in 2014
For more info: http://www.africancentreforcities.net/programme/applied-urban-research/socio-institutional-prerequisites-climate-adaptation-local-scale/

Working with informality to build climate resilience in African cities

Project focus areas: African cities **Funders:** Climate Development Knowledge Network (CDKN)
Contact person: Anna Taylor

In 2013, the African Centre for Cities was contracted by CDKN to develop a conceptual and methodological framework for climate compatible development in African cities, focussing on issues of informality. The development of this framework was an exploratory and iterative process from conception to execution. It involved meetings and interviews with researchers, officials and practitioners in three African cities (Kampala, Uganda; Accra, Ghana; and Addis Ababa, Ethiopia), as well as a creative three-day workshop that brought

together government representatives, NGO practitioners and university-based researchers from the three cities with CDKN representatives, ACC researchers and other key stakeholders in Cape Town. The workshop tackled the question: what needs to be taken account of when building climate resilience through addressing informality and promoting integrated urban development? The resulting framework document is available here: http://cdkn.org/wp-content/uploads/2014/05/CDKN_ACC_WP_final_web-res.pdf

Project partners: None **Status:** Completed 2014
For more info: https://weadapt.org/knowledge-base/urban-adaptation-to-climate-change/strengthening-climate-resilience-in-african-cities-a-framework-for-working-with-informality and http://cdkn.org/project/working-with-informality-to-build-climate-resilience-in-african-cities/

ACC's innovative **CityLab Programme** involves interdisciplinary engagement between researchers and practitioners on the production of policy-relevant research on key issues facing Cape Town. The CityLab programme is a partnership between the ACC, the Western Cape Government and City of Cape Town, and is also part of the Mistra Urban Futures CTLIP.

Climate Change CityLab / Cape Town Climate Change Think Tank
Project focus areas: The City of Cape Town **Funder:** Phase 1 Danida and phase 2 Mistra Urban Futures **Contact person:** Anton Cartwright

The Climate Change CityLab examined climate change adaptation and mitigation in the Cape Town city region. The Lab was the basis for the book *Climate Change at the City Scale* (Routledge, 2012), co-written by Cape Town city officials and academics. A start has been made on a second volume of papers co-produced between City of Cape Town officials and UCT academics, focused around urban climate change.

Project partners: City of Cape Town (phase 1 and 2), Sustainable Energy Africa (phase 1)
Status: Initial book published in 2012, second book currently under development **For more information**: -

Urban Flooding CityLab
Project focus areas: The City of Cape Town **Funder:** Various funders, including the Western Cape Provincial Government (WCPG), City of Cape Town and Mistra Urban Futures
Contact person: Warren Smit (warren.smit@uct.ac.za)

The Urban Flooding CityLab, which involved City officials and community groups, focused on the causes and impacts of flooding of informal settlements on the Cape Flats and on reducing flooding risks. The project showed that most blockages to flood risk management are institutional, not technical. Project outputs included 5 journal articles, 10 postgraduate theses, 8 reports, 11 conference presentations and a full-colour 32-page booklet on flooding in Cape Town. Three journal articles and 2 book chapters are underway.

Project partners: UCT EGS Department, Centre of Criminology and the Geomatics Unit, the Stockholm Environment Institute (SEI) and the City of Cape Town **Status:** Started late 2008, completed late 2013
For more information: -

Sustainable Human Settlements CityLab
Project focus areas: Western Cape **Funder:** WCPG **Contact person:** Liza Cirolia (lizacirolia@gmail.com)

The Sustainable Human Settlement CityLab focuses on key issues relating to human settlements policy and delivery in the Cape Town city-region. The Lab aims to help the Department of Human Settlements to make policy decisions that are more grounded and responsive to the needs of the many stakeholders who participate in the production of sustainable human settlements, and that will allow other stakeholders to better understand the logics and complexity of the state.

Project partners: UCT's Planning Department and Property Studies Department **Status:** Due for completion in 2015
For more information: http://www.africancentreforcities.net/programme/citylab/sustainable-human-settlements/

Urban Ecology CityLab
Project focus areas: Cape Town **Funder:** City of Cape Town, WCPG
Contact person: Pippin Anderson (pippin.anderson@uct.ac.za)

The Urban Ecology CityLab focused on the interface between the urban environment and the natural environment in Cape Town, particularly in terms of the provision of ecosystem services and maintenance of biodiversity.

Project partners: City of Cape Town, Western Cape Provincial Government (but sought to engage broader society too) **Status:** Broadly completed in 2013, following a special issue publication in Ecology and Society
For more information: http://www.africancentreforcities.net/programme/citylab/urban-ecology/

Education Programmes

Masters in Urban Infrastructure: Design and Management

Focus area: Urban Africa **Contact person:** Edgar Pieterse
This Masters Programme is aimed at building capacity amongst government and the private sector practitioners who are committed to the future of African cities, and in particular, to the servicing of poorer urban inhabitants. The programme, presented by the Department of Civil Engineering, and supported by the ACC, has a strong interdisciplinary focus, and draws on staff from engineering, architecture, planning, environmental sciences, geography, the social sciences, and management.

For more information: http://www.africancentreforcities.net/programme/mphil-in-urban-infrastructure/

Courses/ short courses

Executive Courses

Focus area: Urban Africa **Contact person:** Gordon Pirie
The ACC will offer specialized executive training courses on critical urban development issues, such as: urban public finance, economic development, climate change, and so on.

For more information: http://www.africancentreforcities.net/programme/executive-courses/

The Energy Research Centre (ERC)

Type: Research centre

Department/s: Mechanical Engineering Department

Faculty/s: Faculty of Engineering & the Built Environment

Website: http://www.erc.uct.ac.za/

Director: Professor Harald Winkler (harald.winkler@uct.ac.za)

Main contact points: Brenda Martin (brenda.martin@uct.ac.za)

The ERC is a multi-disciplinary energy research centre focused on technology, policy and sustainable development research, education and capacity building programmes. It offers two Masters Programmes, MSc in Engineering: Sustainable Energy Engineering Programme and MPhil in Energy and Development Studies Programme, as well as supervision for PhD students and a variety of short courses.

ERC research is conducted within four thematic groups, namely: Energy, poverty and development; Energy efficiency; Energy systems analysis and planning (modelling); Renewable Energy; and Energy, environment and climate change. All of these groupings are represented within the ERC's education programme offering.

Research Programmes & Projects

Projects, as per each focus area:

The Energy, Poverty and Development (EPD) group

Contact person: Dr Bothwell Batidzirai Bothwell.batidzirai@uct.ac.za

Ongoing projects:

- **The Rising Powers, Clean Development and the Low Carbon Transition in Sub-Saharan Africa**
  Funder: University of Durham, UK
- **Collaboration Agreement for Understanding the Barriers to the Introduction and Uptake of Clean/Improved Cookstoves in Southern Africa Project**
  Funder: Nottingham University
- **The impact of rising electricity prices on the poor – developing a communication strategy and tool**
  Funder: Oxfam
- **Building the evidence base for improving energy interventions' effectiveness by taking a gender approach**
  Funder: Energia/ UK Department of International Development (DFID)
- **Energy, Poverty and Climate Change**
  Funder: Southern Africa Labour and Development Research Unit (SALDRU-UCT)

Projects completed in 2014:

- Assessing energy needs, challenges, resources, energy usage practices and consumption patterns and opportunities
- Monitoring and assessing energy supply programmes
- Tracking the progress of electrification programmes (both grid and non-grid electrification) and advocating a broader "integrated development" approach
- Sectoral considerations for energy access e.g. subsidies, gender, the benefits/constraints of using renewable energy, and energy sector re-structuring

Based on website with input from representative

- Action research to improve perceptions of energy supply and use (in co-operation with energy suppliers and government)
- Evaluating the electrification programme in urban settlements in South Africa

The Energy Efficiency (EE) group

Contact person: Mr Andrew Hibberd Andrew.hibberd@uct.ac.za

Ongoing projects:

- **Eskom Demand Side Management (DSM) programme monitoring and evaluation, particularly the potential for DSM with industrial electrical loads**
  Funder: Eskom, the South African national Utility
- **Energy footprint and energy savings potential study for heavy industry in South Africa** **Funder**: Aveng EPC, for the Department of Energy

Projects completed in 2014:

- SE4All energy efficiency initiatives in Africa.

  Funder: United Nations Environment Programme (UNEP)
- Energy End-use study

  Funder: The International Atomic Energy Agency (IAEA)
- Research extending from M&V work for Eskom in the areas of persistence of energy efficient technologies such as compact fluorescents (CFLs) and solar water heaters

Energy Systems Analysis and Planning (Modelling)

Contact person: Mr Adrian Stone Adrian.stone@uct.ac.za

Ongoing projects:

- **Second phase of an assessment of the energy demand of the Transport Sector - scope and impacts of future technology change**

  Funder: South African National Energy Development Institute (SANEDI)
- **Development of a public energy data resource**

  Funder: SANEDI
- **Regional growth and development in Southern Africa**

  Funder: UNU-WIDER
- **Supporting Sub-Saharan Africa's municipalities with sustainable energy transactions (SAMSET)**

  Funder: University College, London
- **Climate, Land, Energy and Water Strategies: City of Cape Town**

  Funder: IAEA
- **Transition to sustainable energy systems in emerging economies: A South African focused comparative project-SANCOOP**

  Funder: National Research Foundation (NRF)
- **Climate Change/Water Nexus in the Zambezi**

  Funder: World Bank
- **Review and Enhance Energy Data Collection and Management Tools, Process and Systems for a 12-Month Period**

Funder: Enerweb

- **Planning for an emerging natural gas economy for South Africa**
  Funder: British High Commission, South Africa

- **South African Low Carbon Modeling for U.N. Deep Decarbonization Pathways Project (DDPP)**
  Funder: United Nations (UN)

Projects completed in 2014:

- Consideration of single segments of the energy system, such as least cost expansion planning, or renewable energy strategies for the electricity sector

  Funder: National Planning Commission

- A detailed assessment of the potential future energy demand of the transport sector and the potential for mitigation within the sector

  Funder: SANEDI

- Developing new tools for various applications to simulate aspects such as energy use behaviour in low income areas or multi-criteria decision analysis tools and environmental (externality) costing tools

- Continued development of a national Computational General Equilibrium model for assessing economic impacts of energy system decision on indicators such as GDP and employment

  Funder: CDKN

- Energy-Water Nexus Initiative: Case study for South Africa

  Funder: World Bank

- South African 2050 Calculator

  Funder: British High Commission and the Department for Environment Affairs (DEA)

Renewable Energy

Contact person: Dr Amos Madhlopa amos.madhlopa@uct.ac.za

Ongoing projects:

- **Water-Energy nexus in the context of climate change: investigating trade-offs between water use efficiency and renewable energy options for South Africa**
  Funder: Water Research Commission (WRC)

- **Development of the Western Cape Agricultural Sector Climate Change Framework and Implementation Plan**
  Funder: Department of Agriculture, Western Cape Provincial Government

- **Development of an advanced high-efficient low-cost power-generation with minimum carbon emission from hybrid-fuel supplies**
  Funder: ERAfrica

Projects completed in 2014:

- Technology needs assessment
  Funder: UNEP/Technical University of Denmark (DTU)

Energy, Environment and Climate Change (E2C2)

Contact person: Dr Katye Altieri Katye.altieri@uct.ac.za

Ongoing projects:

- **Climate Change Mitigation and Poverty Reduction (CliMip) – Trade-Offs or Win-Win Situations**
  Funder: German Institute of Global and Area Studies (GIGA)

- **Co-Operation agreement on Climate Change Research/INDC**

  Funder: DEA

- **Preparation for the Third National Communication under the United Nations Framework Convention on Climate Change**

  Funder: DEA

- **Mitigation Action Plans and Scenarios (MAPS) Project**

  Funder: Children Investment Fund Foundation (CIFF)

- **MAPS Africa**

  Funder: CDKN

- **South African Low Carbon Modeling for U.N. Deep Decarbonization Pathways Project (DDPP)**

  Funder: UN

- **Development of Desired Emission Reduction Outcomes (DEROS) and Mix of Measures (MOMs)**

  Funder: Camco Clean Energy for DEA

- **Water-Energy Nexus in the Context of Climate Change: Investigating Trade-Offs Between Water Use Efficiency and Renewable Energy Options for South Africa**

  Funder: WRC

Education Programmes

MSc. (Eng) in Sustainable Energy Engineering

Focus area: n/a **Contact person:** Ms Jesse Burton jesse.burton@uct.ac.za

The MSc Eng Programme includes the following components: Introduction to energy policy and sustainable energy engineering; Energy efficiency and demand side management; Energy project; Energy modelling; New and renewable energy technologies; Energy and climate change; and Masters dissertation on sustainable energy engineering.

For more information: http://www.erc.uct.ac.za/education/masters-1.htm

MPhil in Energy and Development Studies

Focus area: n/a **Contact person:** Ms Jesse Burton

The MPhil Programme includes the following components: Introduction to energy policy and sustainable energy engineering; Energy poverty and development; Energy project; Energy and climate change; Energy governance and markets; New and renewable energy technologies; and Masters dissertation on energy and development.

For more information: http://www.erc.uct.ac.za/education/masters-2.htm

The Centre For Bioprocessing Engineering Research (CeBER)

Type: Research Unit

Department/s: Department of Chemical Engineering

Faculty/s: Faculty of Engineering and the Built Environment

Website: http://www.ceber.uct.ac.za/

Director: Professor Sue Harrison

Main contact points: Prof Sue Harrison, Dr Siew Tai, Dr Caryn Fenner, Dr Madelyn Johnstone-Robertson, Dr Rob Huddy, Dr Melinda Griffiths, Dr Marijke Fagan-Endres

CeBER aims to provide South Africa with an advancing knowledge of bioprocess engineering that is relevant and excellent, through both fundamental and contract research using an inter-disciplinary approach to knowledge generation, its transfer and application. This knowledge has potential for application in the chemical, food and pharmaceutical industries, in extractive metallurgy, provision and treatment of water, bio-energy and bio-environmental technologies, with focus on resource productivity, green chemistry and sustainable process technology. The Centre maintains a diversity of disciplines across its researchers and collaborators to nurture the inter- and trans-disciplinary approach to research. CeBER strives to equip scientists at the postgraduate level with expertise that will allow them to excel in every sector of the bioprocess arena, from research to industry.

Research focus areas at CeBER include: Green biotechnology; Hydrometallurgy; White/Red Biotech; Biominerals; and Algae. CeBER collaborates with**:** University of Cambridge, U.K; Imperial College London, U.K; University of California, Berkeley, USA; University of Mumbai, India; Universidad Catolica del Norte, Chile; Universidade Federal do Rio Grande do Sul, Brazil; University of the Free State, South Africa; Exeter University, U.K.; University of Birmingham, U.K.; CSIRO Land and Water, Australia; Curtin University, Australia

Research Programmes & Projects

Examples of specific projects currently underway in CeBER:

Biofunctionalisation of linear alkanes to produce value-added chemicals
Project focus areas: n/a **Funder:** Department of Science and Technology (DST)/ National Research Foundation (NRF) Centre for Catalysis (c*change)
Contact person: Dr Caryn Fenner (Caryn.Fenner@uct.ac.za)/ Prof Sue Harrison (sue.harrison@uct.ac.za)

The functionalisation of linear alkanes presents an opportunity for significant value addition within the petrochemical industry in South Africa and globally. In the South African context, it is particularly valuable owing to linear alkanes being a product of the coal to fuel technology and gas-to-liquid-fuel technology in which we excel. There is a growing use of gas-to-liquid-fuel technology yielding large amounts of linear alkanes. Production of diverse platform chemicals and, subsequently, fine chemicals from alkanes can be achieved through chemo-catalytic and biocatalytic routes. In CeBER, the focus of the project is to investigate the bioconversion of alkanes by recombinant microbial systems capable of alkane and/or fatty acid hydroxylation. This includes characterisation of biocatalysts, microbial and enzyme kinetics of the rate-limiting steps, process safety considerations and optimisation of process conditions, addressing inhibition by product and reactant, enzyme expression and stability, co-factor regeneration, mass transfer. There are currently two academics, one post-doctoral fellow, three PhD and one MSc students contributing to this project.

Project partners: Prof M. Smit (Dept Microbial, Biochemical & Food Biotechnology, University of the Free State)
Status: 2004 – 2018 **For more information**: -http://www.ceber.uct.ac.za/
Production of natural pigments from various microbial sources
Project focus areas: n/a **Funder:** Several
Contact person: Prof Sue Harrison / Dr Madelyn Johnstone-Robertson (m.johnstonerobertson@uct.ac.za)

Based on website with input from representative

There is a movement towards replacing synthetic colourants with natural pigments in foodstuffs, feeds, dyestuffs, cosmetic and pharmaceutical manufacturing processes. Traditionally, natural pigments are obtained from the extraction of animal and plant sources but there are drawbacks using these raw materials. Alternatively, natural pigments can be sourced from micro-organisms, such as bacteria, yeast, algae and fungi. Several projects in CeBER focus across a cross-section of natural pigments from these microbial sources, including red, yellow, pink and blue pigments, as both carotenoids and proteins. The current team includes three research staff, two postdoctoral researchers and 2 Masters candidates.

Project partners: Quorus Biotech, various **Status:** 2001-2016
For more information: -http://www.ceber.uct.ac.za/

Selection and characterization of CO_2 sequestering algal strains for carbon mitigation of coal-derived flue gas and waste water remediation at a power production plant

Project focus areas: n/a **Funder:** Anglo Coal
Contact person: Dr Mariette Smart (mariette.smart@uct.ac.za) / Prof Sue Harrison

Autotrophic organisms, s0u ch as algae, utilise CO_2 for photosynthesis to produce carbohydrates for growth, development and secondary metabolism and may therefore be used to sequester or cycle CO_2 emitted in flue gas or other CO_2 rich sources. Algae may also be used for the bioremediation of waste water containing dissolved solids and heavy metals, which are often produced during industrial processes.

A number of algal strains have been isolated from three environmental sites around the Western Cape and an algae collection, containing more than 500 strains collected from around South Africa, has been obtained from the CSIR. These algal strains will be screened to identify high carbon dioxide (CO_2) sequestering algae with water bioremediation qualities. Refinement of the reactor or pond systems used for such large scale cultivation is considered as these are of critical importance to process feasibility. The downstream biotechnological value of the strains for efficient growth and CO_2 assimilation for production of commodity products such as food and feed supplements, soil conditioners or bio-energy products as well as high value products is being considered.

Project partners: - **Status:** 2013-2016 **For more information**: http://www.ceber.uct.ac.za

Large-scale production of Spirulina

Project focus areas: n/a **Funder:** DST/NRF via SARChI Chair in Bioprocess Engineering; UCT Seed grant
Contact person: Prof Sue Harrison (sue.harrison@uct.ac.za) /Dr Melinda Griffiths (Melinda.griffiths@uct.ac.za)

Spirulina is a cyanobacteria or blue-green algae, known for a variety of health benefits. It is grown commercially as a health food supplement, as well as for extraction of other products such as the blue pigment phycocyanin.

The project aims to enhance biomass productivity, reduce production costs and improve product quality through an improved inoculation strategy, innovative carbon delivery, reduced bacterial contamination, improved media formulation and process integration.

Project partners: Biodelta **Status:** 2011 – 2015 **For more information**: www.ceber.uct.ac.za

Phycocyanin Extraction from Spirulina

Project focus areas: n/a **Funder:** TIA Seed fund/UCT RCIPS
Contact person: Prof Sue Harrison / Dr Marijke Fagan

Phycocyanin is a blue pigment that can be extracted from *Spirulina*. It is highly desirable as one of very few natural blue pigments for use in the food and cosmetic industries.

This project aims to develop innovative process technology solutions to produce high quality phycocyanin from *Spirulina* in a globally competitive manner in South Africa. Specific goals are to develop an efficient and economic large-scale extraction process and further to improve this process by enhancing the phycocyanin content of the *Spirulina* produced on large scale.

Project partners: **Status:** 2014 – 2015 **For more information**: www.ceber.uct.ac.za

Beneficiation and recycling of wastewater from the olive industry

Project focus area: Western Cape agricultural areas
Funder: WRC & commercial investment and DST/NRF via SARChI Chair in Bioprocess Engineering
Contact person: Dr Clive Garcin (clive.garcin@uct.ac.za) / Prof Sue Harrison

Wastewaters generated by the olive industry are of the most polluting agro-industrial effluents, and present an environmental disposal problem due to their toxicity and resistance to biological degradation, this mostly a consequence of high phenolic content, salinity and acidity. The wastewaters, however, contain an abundance of

powerful and valuable antioxidant compounds that can be used as natural ingredients in the food and beverage, cosmetics, personal care and health supplement industries.

A process has been developed at CeBER to treat these wastewaters, which would otherwise be disposed of in evaporation ponds. The process results in recovery of the antioxidants, purification of brine such that it can be re-used, and minimization of the final volume of effluent for disposal. A pilot scale treatment system was constructed and has been operational at one of the largest local olive farms for over 2 years; the IP generated has subsequently been licensed to a start-up company for further development to full scale operation, commercial exploitation, and roll-out to other olive producers.

Project partners: African Biological Extracts, CSIR, various local olive producers **Status:** 2010 - ongoing
For more information: -

Low energy bioreactors for energy efficient bioconversions

Project focus areas: **Funder:** DST/NRF via SARChI Chair in Bioprocess Engineering
Contact person: Prof Sue Harrison

The development of bioprocesses for commodity products requires efficient reactor systems to ensure appropriate contacting of micro-organisms and nutrients, removal of products and provision of gas liquid mass transfer in aerobic systems. This challenge is increased in the presence of low biomass systems such as algal ponds or the treatment of dilute feed streams required in recovering value from waste. Hence CeBER has developed a key focus on bioreactor design. For conventional bioprocesses, we focus on the provision of gas-liquid mass transfer in aerobic processes as this has been identified through life cycle assessment studies to demand the highest environment burden, together with supply of organic feedstocks. Novel reactor systems are considered. Similarly, novel approaches to the photobioreactors and pond systems for algal culture are considered. In processes to recover value from wastewaters as well as production of commodity products such as bio-energy products, reactor designs enabling cell retention and preferential establishment of efficient consortia are under investigation. In all cases, the design focus is on attaining process intensification while minimizing energy requirements. The project involves three academic researchers, one postdoctoral researcher, 3 PhD and 3 MSc(Eng) candidates.

Project partners: - **Status:** 2011 – 2017 **For more information**: -

Value addition in the South African sugar industry through bioconversions

Project focus areas: KwaZulu Natal **Funder:** Sugar Milling Research Institute (SMRI)
Contact person: Prof Sue Harrison

The abundance and overflow of sugar as a raw material has led the industry to look for different areas for key mid to high value products that could supplement the economy of South Africa.

This project aims to investigate the various routes through bioconversion of sugar and associated byproducts such as vinasse, molasses and cane syrup to platform chemicals that could be beneficial for the South African industry as well as bio-energy. A techno-economic analysis of potential process flowsheets for bioconversion of the various starting materials will be investigated, taking into account the economic, social and technological aspects related to the South African climate. From this analysis, experimental work will be carried out. As one example, the bioconversion of sugars into biobutanol will be examined independently, with focus on the bioreactor configuration. The project involves three academic staff, two postdoctoral researchers, 1 PhD and 3 Masters students.

Project partners: **Status:** 2015 – 2018 **For more information**: -

Anaerobic digestion

Project focus areas: n/a **Funder:** Water Research Commission (WRC), Moss Group, SMRI, DST/NRF via SARChI Chair in Bioprocess Engineering
Contact person: Prof Sue Harrison

Anaerobic digestion utilizes the natural processes of a consortium of bacteria to convert organic matter (e.g. plant materials, fats, sewage, food waste) into methane, which can be converted into electricity and/or heat. It is a simple, cheap process with the potential to convert waste to energy in a variety of different scenarios. Other potential products of anaerobic digestion are the nutrient-rich streams containing simple organic compounds which can be used as a source of carbon and energy for other microbial processes and/or N and P components as nutrients for other processes.

CeBER has several projects aiming to integrate anaerobic digestion into bioprocesses. Current focus areas are the digestion of wastes and organic fraction of wastewaters for biogas production as part of maximizing resource productivity, the digestion of algae to provide a dissolved organic carbon source for sulphate-reducing bacteria

as well as biogas as part of a process to treat acid rock drainage, and using anaerobic digestion to recycle energy and nutrients within algal processes e.g. production of algal biofuels and high value products. Currently three academic researchers and 4 Masters students are involved in these projects.

Project partners: Water Research Commission, Moss Group, SMRI **Status:** 2014 - 2018
For more information: www.ceber.uct.ac.za

Thiocyanate and Cyanide biodegradation

Project focus areas: **Funder:** Biomin (Ltd); DST/NRF via SARChI Chair in Bioprocess Engineering
Contact person: Prof Sue Harrison/ Dr Robert Huddy (Robert.Huddy@uct.ac.za)

During the processing of refractory gold ores, cyanide reacts with reduced sulphur species to form thiocyanate. Due to their toxicity, the presence of residual cyanide, metal cyanide complexes and thiocyanate in the effluent streams necessitated the development of processes for remediation of these effluents. The Activated Sludge Tailing Effluent Remediation (ASTER™) process was developed by BHP Billiton and Goldfields researchers in the 1990's as a means of biologically removing these toxic compounds. The ASTER™ technology is owned and licenced by BIOMIN Ltd, South Africa. This bioprocess relies on the metabolic capability of a mixed microbial culture catalysing the destruction of cyanide and thiocyanate. The process has been successfully operated at a commercial scale, in South Africa and Kazakhstan, and is capable of constantly reducing thiocyanate concentrations from ±100 mg/L to <1 mg/L. In-depth investigations of the ASTER™ process operating conditions have been successfully conducted by CeBER researchers and applied within the industrial plants. Despite the significant research conducted during the development of this process, much remains to be learnt about the thiocyanate- and cyanide-degrading microorganisms associated with this industrial bioprocess. We anticipate that a more defined appreciation of the microbial community composition, and its response to changes in the operating conditions, will lead to further improvements in the efficiency of industrial ASTER™ processes. Hence our approach integrates generating understanding of the dynamics of the microbial consortium with optimization of process conditions and bioreactor design and configuration. Two academic researchers and two PhD students are involved with this project currently.

Project partners: Prof. Jill Banfield (UC Berkeley, USA) **Status:** Ongoing
For more information: -http://www.ceber.uct.ac.za/ / http://www.biomin.co.za/aster/overview.html

Acid Mine Drainage remediation with value recovery

Project focus areas: **Funder:** WRC; Moss Group; DST/NRF via SARChI Chair in Bioprocess Engineering
Contact person: Prof Sue Harrison / Dr Rob van Hille (Rob.vanhille@uct.ac.za) / Dr Rob Huddy

Acid mine drainage (AMD) represents a significant threat to the sustainability of South Africa's fresh water resources. AMD is characterized as having a low pH, high sulphate concentrations and, elevated levels of metals and heavy metals. There is a need for the development of sustainable remediation systems to address the challenge of AMD treatment. Biological treatment systems, based on biological sulphate reduction, offer a sustainable alternative to conventional physical and chemical AMD remediation processes. Significant understanding of the biological sulphate reduction process with specific focus on biokinetics has been developed within CeBER. A biological process configuration, catalyzed by sulphate reducing bacteria within a novel reactor configuration, has been developed by CeBER researchers. Within this system, sulphate reducing bacteria reduce the sulphates present within AMD to hydrogen sulphide as well as producing alkalinity, in the form of bicarbonate, to reduce the acidity of the AMD. In turn, under micro-aerobic conditions, hydrogen sulphide is oxidized to elemental sulphur which can also be recovered as a value product. Alternatively, the hydrogen sulphide associates with metals within the AMD, to form sparingly soluble precipitates, from which the metal sulphides can be subsequently recovered. The project considers the development of the integrated process, the cost-effective provision of carbon source and electron donor through anaerobic digestion of algal biomass as well as development of understanding of the dynamics of the microbial consortium. One PhD and 3 Masters students are associated with this project currently.

Project partners: **Status:** 1998 – 2018 **For more information**: -

Acid Mine Drainage Prevention

Project focus areas: n/a **Funder:** WRC **Contact person:** Prof Sue Harrison / Dr Jennifer Broadhurst (jennifer.broadhurst@uct.ac.za)

The generation of acid mine drainage (AMD/ARD) from waste mine tailings is a major environmental issue in South Africa. Its formation is due to sulfide mineral oxidation through the penetration of oxygen and water into the waste. The result is the release of acidic water containing high amounts of dissolved sulfates and trace metals into the environment.

This project aims to develop a suite of process approaches for AMD prevention through the removal of the risk associated with waste tailings. These include the development of controlled accelerated AMD generation which can be brought to completion prior to mine closure; and an optimised and sustainable 2-stage flotation process for the recovery of additional values and desulfurisation of waste tailings materials to produce benign product that can be safely disposed of or, preferably, used as feedstock in other processes e.g. building materials for benign sulphide lean tailings. Use of covers or other disposal strategies which prevent penetration of water and oxygen into the wastes thereby preventing the AMD reactions from progressing are also under consideration. In this work, it is clear that the currently used suite of tests for AMD generation capacity are insufficient, not taking into account role of microbial action or the relative rates of acid formation and consumption. An improved approach to AMD characterization and prediction is under development, including a standardized biokinetic test for the characterisation of the AMD potential of a sample; sequential chemical leaching tests to characterize metal deportment and modelling approaches for AMD prediction, based on fluid flow, liberation etc. The project currently involves one postdoctoral researcher, 2 PhD and 2 MSc candidates

Project partners: **Status:** 2007 – 2017 **For more information**: -

Metal recovery from low-grade ores and complex concentrates through biomining

Project focus areas: **Funder:** Biomin SA (Ltd), DST/NRF via SARChI Chair in Bioprocess Engineering

Contact person: Prof Sue Harrison

Biomining, either by heap or tank bioleaching, involves the use of microorganisms to facilitate metal recovery from low grade ores and complex concentrates. These technologies have become increasingly important as they enable the economically viable recovery of metals from lower grade and more mineralogically complex ores while reducing the environmental footprint of the processes. Further, through ability to treat low grade resources, biomining provides potential for improved resource productivity through recovering a larger fraction of the metals from the deposit with reduced waste burden.

Current heap leaching research within CeBER is focused on the juxtaposition of microbial colonization, surface attachment and dissemination throughout the heap with the characterization of solution-mineral contacting through characterizing the ore bed, fluid flow and hold-up, mineral liberation and mineral leaching from ore particles within the heap system. Here development of tomographic techniques to track the phases has been essential. We have investigated the effect of acid tolerance and stress response of the microbial consortium catalysing bioleaching systems.

Tank-based bioleaching is usually applied to the treatment of complex mineral concentrates derived from sulfidic ores, following flotation. CeBER is currently involved in the development and maintenance of bioleaching microbial consortia to be used as commercial inocula alongside microbial speciation and tracking of the community structure of key bacterial and archaeal species in laboratory and industrial systems. Furthermore, we are investigating the effect of process-specific inhibitory compounds and the synergy between several microbial species, linking these findings to process performance, efficiency and intensification.

There are currently 5 PhD and 3 MSc researchers involved with these projects.

Project partners: Biomin SA (Ltd) **Status:** Ongoing **For more information**: -

Biological routes to metal recovery from electronic waste

Project focus areas: **Funder:** DST/NRF via SARChI Chair in Bioprocess Engineering

Contact person: Prof Sue Harrison

With the increasing number of electronic devices that we all use and rapidly developing technologies producing ever-new functionalities, electronic waste (e-waste) generation is increasing at a staggering rate, from 35 million tonnes globally in 2005 to 49 million tones in 2012. Hence recycling and re-processing of these wastes is critically important for both resource utilization and to prevent environmental burden. Many of the metals in e-waste are valuable and present at concentrations far above those in ores currently mined. Low grade e-waste has potential for processing using technologies similar to the bioleaching of sulphide minerals for the dissolution and recovery of metals. Challenges exist around the regeneration of leaching agents, inhibition of the microbial agents used by high metal concentrations, separation of mixed metals in solution etc. This forms part a new development for CeBER.

Project partners:- **Status:** 2013 onwards **For more information**: -

Education Programmes

CeBER recognises the need to train postgraduate students with first degrees in engineering, life sciences, physical sciences and maths to provide the skills set required for the bioeconomy. The degrees offered include the 120 credit MSc thesis with associated coursework, full research MSc and PhD.

- A MSc in Bioprocess Engineering (p 88, 89 in Faculty of EBE Postgraduate studies Handbook 7b)
- New Bioprocess Engineering undergraduate stream (including BIO1000F - Cell Biology; CHE2006S - Introduction to Biotechnology; CHE30XXS – Bioprocess Engineering Fundamentals; CHE40XXF – Bioprocess Engineering Design - See more at: http://www.chemeng.uct.ac.za/chem/undergraduate/new%20curriculum/science%20courses#sthash.XuhI4Eu6.dpuf
- Under construction: Honours course in Bioprocess Engineering starting in 2017.

Based on website with input from representative

Crystallisation & Precipitation Unit

Type: Research Unit

Department/s: Department of Chemical Engineering

Faculty/s: Faculty of Engineering and the Built Environment

Website: http://crystal.uct.ac.za/

Director: Professor Alison Lewis (alison.lewis@uct.ac.za)

Main contact points: Dr Marcos R. Pascual (marcos.rodriguezpascual@uct.ac.za)

The main aim of the research unit is to advance existing fundamental knowledge in the fields of crystallization and precipitation, especially related to the South African and international mineral processing and extractive metallurgy industries. The unit focuses on two main areas of research: Optimising precipitation in hydrometallurgical processes. Our work on both Rhodium and Mixed Metal Sulphide precipitation are examples of this; Development of innovative technologies for mining wastewater treatment. Our Eutectic Freeze Crystallization project is an example of this. The tools used in the research include **modelling and simulation** approaches to industrial research, such as the **particle rate process** approach for modelling of industrial crystallization processes; **aqueous chemistry** modelling and **computational fluid dynamics modelling**. All of these modelling techniques are aimed at deepening the understanding of these chemically complex, multiphase processes.

Research Programmes & Projects

Systematic comparison of the effectiveness of water treatment processes

Project focus areas: n/a **Funder:** **Contact person:** Hilton Heydenrych

This project is based on the hypothesis that existing processes for treatment of wastewater streams are not necessarily the most effective, partly because both the range of contaminants and treatment methods is very broad. This project is focused on testing this hypothesis by modelling (on a single simulation platform) a wide range of proven water treatment technologies. From the findings of this analysis, it is expected that new heuristic principles for the design of water treatment processes will be derived.

Project partners: **Status:**

For more information: http://crystal.uct.ac.za/project/systematic-comparison-of-the-effectiveness-of-water-treatment-processes

Improving colloidal particle settling in metal sulphide precipitation

Project focus areas: n/a **Funder:** **Contact person:** Sibongiseni Gqebe

Acid mine drainage is a large environmental concern arising from the mining industry in South Africa. This project looks at improving the solid-liquid separation and increasing process efficiency of *metal sulphide precipitation*, a method that can theoretically achieve higher metal removal from industrial wastewater.

Project partners: **Status:**

For more information: http://crystal.uct.ac.za/project/improving-colloidal-particle-settling-in-metal-sulphide-precipitation

Assessment of organic influence on crystals characteristics from petrochemical brine treatment by EFC

Project focus areas: Brazil petrochemical plant **Funder:** **Contact person:** Emily Becheleni

This project focuses on pure water recovery from a saline wastewater stream that originates from a reverse electrodialysis process at a Brazilian petrochemical plant.

Project partners: **Status:**

For more information: http://crystal.uct.ac.za/project/assessment-of-organic-influence-on-crystals-characteristics-from-petrochemical-brine-treatment-by-efc

Based on website only

Environmental & Process Systems Engineering (E&PSE) Research Group

Type: Research Group

Department/s: Chemical Engineering Department

Faculty/s: Faculty of Engineering & the Built Environment

Website: http://epse.uct.ac.za/

Head of the Group: Professor Harro von Blottnitz (Harro.vonBlottnitz@uct.ac.za)

Main contact points: Professor Harro von Blottnitz

Clean air, a society running on renewable energy, clean efficient production, recycling of resources after use, a diverse biosphere protected for the future: these are some of the aims of the E&PSE Research Group. The group contributes to these aims by:1) Training the next generation of academics, researchers and top end consultants through PhD and MSc research; 2) Generating and publishing new knowledge through critical research and scholarship; 3) Questioning unsustainable practices and supporting sustainable development in the real world, by making knowledge and research products accessible and adoptable.

Research Programmes & Projects

Cleaner Production in Informal Food Processing Projects

Project focus areas: Cape Town, Kitwe, Epworth and Kisumu **Funder:** The German Academic Exchange Service (DAAD), Organisation for Women in Science for the Developing World (OWSDW), UK Department of International Development (DFID)/ Economic and Social Research Council (ESRC) **Contact person:** Rissa Niyobuhungiro (PhD student), main contact person still to be appointed

This research focuses on informally operating caterers in urban African spaces. The group's earlier work indicated that in townships they may burn wood treated with Copper, Chromium and Arsenic (CCA) for cooking purposes. Such cooking tends to happen in densely populated area, such as transport interchanges, making the exposure risk high and prevalent. Based on the group's Cape Town experiences, they are expanding this work through the ACC's Consuming Urban Poverty Project to three other African cities form 2015 onwards (see ACC's project overview). The aims are primarily to quantitatively describe social and environmental externalities of urban food processing activities, and then to explore and test technology which would reduce the emissions.

Project partners: ACC **Status:** PhD and CUP project ongoing (just started)

For more information: http://epse.uct.ac.za/project/caterers-project

Life Cycle Assessment for SA food & agriculture reduced impacts (LCA-safari)

Project focus areas: South Africa **Funder:** Swiss South African Joint Research Programme (SSAJRP)

Contact person: Dr Valentina Russo

This is a clean technology and green technology project whose objectives are: Identification of environmental hotspots in the life cycle of ~10 most relevant agriculturally produced food products in South Africa; Quantification of environmental mitigation potentials from applying green and clean technologies in these agri-food product life cycles; Development and dissemination of sustainable practise recommendations for public authorities and the agri-food industry; and Preparation of agri-food inventory datasets for the ecoinvent database. The project seeks to form partnerships to build on already completed work, adding scientific rigour to develop tools for modelling clean tech or green tech interventions in product supply chains. Regional impact relevance will be considered. Project outputs will be published so as to be available to the scientific and expert community, and project findings communicated to be understandable by the general public. Research work is done so as to train students in South African and in Switzerland in related tools and methods.

Project partners: Zurich University of Applied Sciences (ZHAW) and The Green House **Status:** 2014-2016 **For more information**: -

Based on website with input from representative

Nutrient and Energy Recovery from Sewage: towards an integrated approach

Project focus areas: n/a **Funder:** The Water Research Commission (WRC)

Contact person: Professor Harro Von Blottnitz

The global paradigm for sewage treatment is shifting to include considerations of nutrient and energy recovery. This project investigates the link between the two in the South African context and aims to improve phosphorus recovery technology. The aims of the project are to: Describe the current status of sewage nutrient and energy recovery technologies globally in relation to their respective emerging South African markets; and strongly reduce the cost of phosphate recovery by investigating seeding in electrochemical precipitation.

Project partners: eawag aquatic research **Status:** Ongoing (just started) **For more information**: -

Towards a technology specific innovation system for harnessing water-based bio-energy

Project focus areas: Limpopo and the Western Cape **Funder:** National Research Foundation (NRF)

Contact person: Professor Harro Von Blottnitz

This project supported biogas demonstration projects, both in the urban settings in Cape Town and in rural settings, collaborating with the Department of Physics at the University of Venda (Limpopo), which has already developed some expertise in biogas technology in rural settings.

Project partners: University of Venda **Status:** 3 year project: 2012-2014 **For more information**: -

Evaluation of the Biomethane potential of different types of organic wastes in Cape Town

Project focus areas: Cape Town **Funder:** The Solid Waste Department of the City of Cape Town **Contact person:** Gracia Munganga, Rethabile Melamu, Professor Harro von Blottnitz

This was an exploratory study, involving both sample collection at points of waste generation, and laboratory work, generously hosted by CeBER. The main objective was to develop an understanding of the range of organic wastes available in Cape Town, and what their key properties are if they are to be considered for energy recovery via anaerobic digestion. A secondary objective was to learn how to do biomethane characterizations in the laboratory.

Project partners: n/a **Status:** Completed in 2012

For more information: http://epse.uct.ac.za/project/evaluation-of-the-biomethane-potential-of-different-types-of-organic-wastes-in-cape-town

Courses/ short courses

Business, Society & Environment (CHE4048F)

Focus area: n/a **Contact person:** Professor Harro Von Blottnitz

The course aims to provide a foundation for students to engage with their future roles as practising professionals or entrepreneurs relative to the expectations of society, and of employers. The course covers: benefit indicators, physical risk in the process industries, environmental sustainability, social impacts and license, innovation and entrepreneurship, business planning, capital and operating cost estimation, profitability assessment and engineering ethics.

For more information: -

Agro-industrial Biogas Training Seminar

Focus area: South Africa **Contact person:** Professor Harro Von Blottnitz

The seminar, aimed at farmers, projected developers, consultants, investors and the banking sector, addresses topics of project procedures and approvals, quality features and case studies in the field of electricity generation from biomass waste. This seminar was offered once, in December 2014, but with the intention of making it a regular, formal UCT short-course.

For more information: -

Minerals to metals

Type: Research Initiative

Department/s: Department of Chemical Engineering

Faculty/s: Faculty of Engineering & the Built Environment

Website: http://mineralstometals.uct.ac.za/

Director: Dr Jennifer Broadhurst (acting)

Main contact points: Dr Jennifer Broadhurst (jennifer.broadhurst@uct.ac.za)

The Minerals to Metals Research Initiative was established as a UCT Signature Research Theme within the Department of Chemical Engineering in 2007, with a view to addressing global key challenges in the mineral beneficiation sector in an integrated and holistic manner. The research collaboration draws together the skills of world-renowned academic and research staff in existing research groupings both within and beyond UCT, to advance the provision of metal and mineral related products and services to society in a manner which maximises development opportunities for its stakeholders, and which minimises adverse environmental impacts due to mining, processing and related activities. The continually evolving research program which falls under this umbrella body is underpinned by a number of industry based projects and case studies, which together explore the sustainability challenges facing the minerals sector from both a systemic and fundamental perspective, and serve to establish linkages between traditional separate but cognate research areas.

Minerals to Metals Research themes can be divided into two categories. Firstly, *systemic research themes*, which are concerned with the performance of the minerals processing and beneficiation systems as a whole, and their interface with the environment and society. Systemic-based research projects are concerned with the mitigation of acid mine drainage; deriving added value from mine wastes; tools for the effective and holistic evaluation and optimisation of sustainability performance; energy efficiency and minimisation of the carbon footprint; water usage and degradation, mine safety; and mine-community stakeholder engagement. Secondly, *fundamental research themes*, which are aimed at developing an understanding of the underlying fundamental physical and chemical principles that govern processes within the minerals beneficiation chain and the interactions with or impact on the remainder of the system. Fundamental, cross-cutting themes include positron emission particle tracking; electrochemistry; turbulent multiphase processing; rheology; and ion-exchange.

Research Programmes & Projects

Development of a Minerals Beneficiation Strategy for KwaZulu-Natal Province

Project focus areas: KwaZulu-Natal **Funder:** KZN Department of Economic Development and Tourism **Contact person:** Prof Harro von Blottnitz

The KZN Department of Economic Development and Tourism has appointed the Minerals to Metals Initiative, in collaboration with The Green House, to develop a beneficiation strategy that will help to drive the minerals sector in KwaZulu-Natal towards a more profitable, socially accountable and environmentally sustainable future. This project is supported by the following masters-level research projects: Sustainability performance analysis and decision-making for minerals beneficiation: a South African iron and steel case study; An economic impact analysis of mineral beneficiation in the KZN Province; Youth entrepreneurship in the context of minerals development; and Development of multi-stakeholder engagement models for the establishment of linkages across mineral value chains.

Project partners: The Green House **Time frames:** Vary for each student project within the period March 2013 – April 2016

Assessing the performance of mineral processing and beneficiation systems

Project focus areas: n/a **Funder:** The National Research Foundation (NRF) SARChI on Minerals Beneficiation and one self-funded (by student) **Contact person:** Dr Jennifer Broadhurst

Based on website with input from representative

This focus area links into many of the projects that are described under the theme "mine waste-acid mine drainage and value recovery." There are currently two Masters research projects that are specific to this focus area: Life cycle based approaches to enhance eco-efficient processing of Platinum Group Metals; and *Improving the sustainability signature of mining assets: An integrated approach.*

Project partners: - **Time frames:** Vary for each student within the period February 2014-December 2015

Mine waste-Acid mine drainage mitigation and value recovery

Project focus areas: n/a **Funder:** NRF, the South African Minerals to Metals Research Institute (SAMMRI), industry and some self-funded (by students) **Contact person:** Dr Jennifer Broadhurst

Two inter-related systemic research focus areas falling under this theme are those that are aimed at reducing waste burden and impacts, particularly acid mine drainage, and maximising the recovery of values from large volume mine waste. Current post-graduate projects include: *Comparison of froth flotation and gravity separation of the Waterberg and Witbank coal ultrafines in terms of mitigating ARD potential; Pre-pilot feasibility study on the use of froth flotation for coal recovery and sulphur removal from fine coal waste;* Life cycle assessment of the production of xanthate salts and of their application for ARD mitigation; The development of an integrated approach for the prediction of acid rock drainage from waste rock; Valorisation and risk reduction of sulphidic fine coal waste: from early stage design to technology transfer; and *Recycling and utilization of mine waste: An alternative management approach to gold tailings in South Africa.*

Project partners: - **Time frames:** Vary for each student project within the period February 2013 – 2017

CO_2 sequestration through mineral carbonation of mine waste

Project focus areas: n/a **Funder:** NRF and SAMMRI **Contact person:** Dr Jennifer Broadhurst

Previous studies have identified magnesium-rich tailings from the platinum industry in South Africa as a potentially viable and attractive feedstock for CO_2 sequestration through mineral carbonation. However, many of the strategies proposed to enhance the dissolution kinetics of silicate minerals are energy intensive and will thus reduce the net CO_2 sequestration capacity of the overall mineral carbonation process system. This Masters student project seeks to investigate the viability of using pyroxene-rich PGM tailings for the sequestration of CO_2. This involves identifying and evaluating potentially feasible mineral carbonation process systems, with specific emphasis on net carbon neutrality.

Project partners: - **Time frames:** January 2014 – December 2015

Education Programmes

Master of Philosophy specialising in Sustainable Mineral Resource Development

Focus area: Africa **Contact person:** Professor Harro Von Blottnitz (harro.vonblottnitz@uct.ac.za)

This trans-disciplinary and inter-institutional Master of Philosophy (MPhil) Degree course aims to educate and train graduates who have a high-level understanding of, and sensitivity to, the critical factors of sustainable development in the context of mining and minerals in Africa: and who can develop knowledge at an advanced level in and around the African mining industry, through research.

For more information: http://mineralstometals.uct.ac.za/MPhil_Degree/index.html

Centre for Research in Computational and Applied Mechanics (Cerecam)

Type: Research centre

Department/s: Organizationally based at the Department of Mechanical Engineering, but also associated with the Department of Civil Engineering, the Department of Chemical Engineering, the Department of Mathematics & Applied Mathematics, the Department of Physics and the Department of Biological Sciences

Faculty/s: Faculty of Engineering & the Built Environment (and Faculty of Science)

Website: http://www.cerecam.uct.ac.za/

Director: Professor Daya Reddy (daya.reddy@uct.ac.za)

Main contact points: Professor Daya Reddy

The principal objective of Cerecam is to provide a coherent focus and point of interaction for research and postgraduate study in theoretical and computational mechanics, and related areas. While established as a research group located in Civil Engineering, members now include staff and students from six related Departments, and, consequently, multidisciplinarity has become embedded in the objectives of the Centre. Cerecam activities span a wide range of topics of computational engineering and sciences. This includes abstract mathematical work as well as industry related projects.

Research Programmes & Projects

Modelling and simulation of efficient solar collectors

Project focus areas: n/a **Funder:** Claude Leon Scholarship **Contact person:** Dr Michelle MacDevette (Michelle.MacDevette@uct.ac.za)

A recent development in renewable energy is that of the direct absorption solar collector (DASC) which absorbs solar energy directly within the working fluid. This project investigates making these DASCs more efficient. The objective of this project is to develop and analyse mathematical models of DASCs with the purpose of improving their design and efficiency and ultimately ensuring that this clean and renewable energy source can be efficiently exploited.

Project partners: - **Status:** 3 year project, due for completion in mid-2016 **For more information**: -

Based on website with input from representative

Water Distribution Systems

Type: Research Group

Department/s: Department of Civil Engineering

Faculty/s*:* Faculty of Engineering & the Built Environment

Website: -

Lead: Professor Kobus van Zyl (kobus.vanzyl@uct.ac.za)

Main contact points: Professor Kobus van Zyl

The main aim of their research is to better understand the mechanisms of leakage in water distribution systems and consist of theoretical, experimental, modelling and field work. Currently the work focuses on pressure management and the factors responsible for the high sensitivity of leakage to network pressure.

Another research aim is to better understand the relationship between reliability of water supply systems and the factors that affect it. A core theme of this work has focussed on reliability estimation of bulk water supply systems using stochastic analysis. Bulk water supply systems supply municipal storage reservoirs (or tanks), and fail whenever these reservoirs run dry. Three processes determine the behaviour of municipal storage reservoirs: pipe failures, consumer demand and fire water demand. The research can be categorised under the themes of: I) stochastic analysis of bulk water supply systems, II) pipe failure behaviour and III) other related research.

Other research on water distribution systems include hydraulic modelling, water demand management, smart water metering and operation and maintenance.

Research Programmes & Projects

The effect of system pressure on leakage from water distribution systems

Project focus areas: n/a **Funder:** Mainly the Water Research Commission (WRC), but also some Univeristy of Cape Town (UCT) funding and some students supporting their own research **Contact person:** Professor Kobus van Zyl

Leakage from water distribution systems is becoming a serious problem world wide as systems age and water resources are placed under increasing strain. The aim of this project is to investigate the various mechanisms involved in the pressure-leakage response.

Project partners: Cerecam, City of Cape Town, JOAT consulting **Status:** Continuous research effort. Current funding on soil-leak interaction to end in March 2016, but further funding is expected

For more information: http://www.cerecam.uct.ac.za/research/ , email kobus.vanzyl@uct.ac.za

Advanced water metering and its potential for South Africa

Project focus areas: South Africa **Funder:** WRC **Contact person:** Professor Kobus van Zyl

The aim of this project is to investigate the latest developments of smart water metering (including prepaid metering) and how it can be best implemented in South Africa.

Project partners: none **Status:** 3 year project, due for completion in March 2017

For more information: email kobus.vanzyl@uct.ac.za

Leak detection through pressure testing

Project focus areas: n/a **Funder:** funding under application **Contact person:** Professor Kobus van Zyl

The aim of this project is to develop a device that can determine the condition of a pipe using a pressure test, including the status of the valves, illegal connections, the initial area of the leaks and the sensitivity of the leaks to pressure (related to the type of leaks present).

Project partners: University of Stellenbosch and Jasco. **Status:** 2 year project, due for completion in 2016

Based on website with input from representative

For more information: email kobus.vanzyl@uct.ac.za

Aqualibrium water competition

Project focus areas: n/a **Funders:** The South African Institute of Civil Engineering (SAICE), WRC, UCT and several civil engineering companies. **Contact person:** Professor Kobus van Zyl

The Aqualibrium competition is a fun way for high school students to learn about water supply, what civil engineers do and the importance of protecting water resources. The aim of the competition is for teams of students to distribute three litres of water equally between three reservoirs (containers) placed randomly on a grid of 16 points. Participants build a pipe network between a water source and the three reservoirs using pipes of different diameters. The competition presents an excellent reference point to discuss the importance of preserving natural water resources and the need to use water sparingly, as well as the application of physics and mathematics to a real-life engineering problem.

Project partners: none **Status:** Continuous

For more information: http://www.aqualibriumcompetition.net; www.facebook.com/aqualibriumcompetition

Introduction to operation and maintenance of water distribution systems

Project focus areas: n/a **Funders:** WRC **Contact person:** Professor Kobus van Zyl

This book, written by Professor Kobus van Zyl, aims to assist service delivery by making information on proper operation and maintenance practices available in a practical and accessible way. The book focuses on water distribution systems including pipes, pumps, valves, storage reservoirs, meters and other fittings.

Project partners: - **Status:** Published in 2014

For more information: http://www.wrc.org.za/Pages/KH_DocumentsList.aspx?dt=1&su=16&ct=4&ms=4;11;

Introduction to Integrated Water metering Management

Project focus areas: n/a **Funders:** WRC **Contact person:** Professor Kobus van Zyl

Water metering is an essential function of municipalities since a lot of their income depends on water sales, and it is impossible to properly manage a water distribution system without knowledge of how water is used and distributed in the system. However, few municipalities have proper water metering systems in place. This book, written by Professor Kobus van Zyl and published by the Water Research Commission provides practical guidelines on all aspects of water metering.

Project partners: - **Status:** Published in 2011

For more information:
http://www.wrc.org.za/Pages/DisplayItem.aspx?ItemID=9186&FromURL=%2FPages%2FDefault.aspx%3F

Courses/ short courses

Pressure Management in Water Distribution Systems

Focus area: n/a **Contact person:** Professor Kobus van Zyl

The aim of this five-day course is to provide a structured introduction to the theoretical and practical aspects of pressure management in water distribution systems. The course is aimed at engineering and technical staff at municipalities, bulk water suppliers and consultants who deal with pressure management. It will be run several times during the course of 2015.

For more information: email kobus.vanzyl@uct.ac.za

Design and Modelling of Water Distribution Systems

Focus area: n/a **Contact person:** Professor Kobus van Zyl

The aim of this course was to provide a structured and practical introduction to the design and modelling of water distribution systems based on the textbook "Introduction to Urban Water Distribution." The five-day course is aimed at engineering and technical staff at municipalities, bulk water suppliers and consultants who deal with water distribution systems.

For more information: email kobus.vanzyl@uct.ac.za

Introduction to integrated water meter management

Focus area: n/a **Contact person:** Professor Kobus van Zyl

This one-day course has been run at different locations around the country since 2012, following the publication of the book "Introduction to Integrated Water Meter Management." It covered all the material covered in the book, from the basics of water metering to advanced topics including data management and integration. The

course was aimed at staff at municipalities, bulk water suppliers, consultants and NGOs dealing with any aspect of water metering or metering data.

For more information: email kobus.vanzyl@uct.ac.za

Operation and maintenance of water distribution systems

Focus area: n/a **Contact person:** Professor Kobus van Zyl

This two-day course is based on the book "Introduction to Operation and Maintenance of Water Distribution Systems." It covered all the material covered in the book, from the basics of operation and maintenance to advanced topics. The course was aimed at staff at municipalities, bulk water suppliers, consultants and NGOs dealing with any aspect of water metering or metering data.

For more information: email kobus.vanzyl@uct.ac.za

Centre for Transport Studies

Type: Research and postgraduate teaching body

Department/s: Department of Civil Engineering

Faculty/s: Faculty of Engineering & the Built Environment

Website: http://www.cfts-uct.org/

Head of the Unit: Professor Roger Behrens (roger.behrens@uct.ac.za)

Main contact points: Associate Professor Marianne Vanderschuren (marianne.vanderschuren@uct.ac.za)

The purpose of the Centre for Transport Studies is to stimulate debate and undertake research that focuses on the equity, sustainability and efficiency problems associated with urban passenger transport systems in South African cities, and on the development of practices and skills that are consistent with the goals and objectives of contemporary and progressive policies. The Centre's priorities in curriculum development, and in undertaking research, are to contribute to the equitable, efficient and safe accommodation of the travel needs of poorer households within urban passenger transport systems, and to the promotion of more efficient and sustainable travel behaviour patterns and transport system operations.

Research Programmes & Projects

City Restructuring

Project focus areas: Cape Town, Dar es Salaam and Nairobi **Funder:** Volvo Research and Educational Foundations **Contact person:** Associate Professor Romano Del Mistro (romano.delmistro@uct.ac.za)

The aim of this research is to estimate the positive and negative effects that would result from restricted private and even public motorised travel and the effect of informality in Cities of the South on these estimates.

Project partners: University of Dar es Salaam & University of Nairobi **Status:** Completed at the end of 2013

For more information: http://www.cfts-uct.org/projects/city-restructuring/

Intelligent transport systems

Project focus areas: n/a **Funder:** Volvo Research and Educational Foundations **Contact person:** Associate Professor Marianne Vanderschuren (marianne.vanderschuren@uct.ac.za)

A research project on intelligent transport systems, led by A/Prof Marianne Vanderschuren and funded by the Volvo Research and Educational Foundations, is exploring 'intelligent transport systems' that improve the service level of public transport vehicles through prioritisation in road space management, as well as improve quality of service to passengers by providing better information on public transport service offerings.

Project partners: WhereIsMyTransport **Status:** Completed at the end of 2013

For more information: http://www.cfts-uct.org/projects/intelligent-transport-systems/

Non-motorised travel and infrastructure in Cape Town

Project focus areas: Cape Town **Funder** Volvo Research and Educational Foundations **Contact person:** Associate Professor Marianne Vanderschuren (marianne.vanderschuren@uct.ac.za)

This research project on non-motorised travel and infrastructure in Cape Town is focused on the safety of non-motorised transport users, and their interaction with other road users and infrastructure measures associated with 'traffic calming'.

Project partners: N/A **Status:** Completed at the end of 2013 **For more information**: http://www.cfts-uct.org/projects/non-motorised-travel-and-infrastructure-in-cape-town/

Paratransit operations and regulation in Cape Town

Project focus areas: Cape Town **Funder:** Volvo Research and Educational Foundations **Contact person:** Professor Roger Behrens (roger.behrens@uct.ac.za)

Based on website with input from representative

This research project on paratransit operations and regulation in Cape Town is exploring appropriate policies with respect to urban public transport system transformation. Using information obtained from international case studies, the project is exploring appropriate regulatory frameworks for hybrid public transport systems in which formal and informal services coexist in a complementary manner.

Project partners: n/a **Status:** Completed at the end of 2013 **For more information**: http://www.cfts-uct.org/projects/paratransit-operations-and-regulation-in-cape-town/

Transport and environment, science technology network

Project focus areas: Sub-Saharan Africa **Funder:** The EC African, Caribbean and Pacific Group of States (ACP) Science and Technology Programme **Contact person:** Associate Professor Marianne Vanderschuren (marianne.vanderschuren@uct.ac.za)

This project involves the establishment of a Transport and environment, science technology network (TEST), in which A/Prof Marianne Vanderschuren is a participating partner. The TEST network aims to support Sub-Saharan African countries in formulating and implementing sustainable transport policies, which contribute to poverty reduction and sustainable economic development. The network is focused on traffic congestion, air pollution and road safety.

Project partners: Universities and research institutes from the United Kingdom, Germany, Uganda, Tanzania, Zambia, Zimbabwe, Mozambique and South Africa, as well as the United Nations Human Settlements Programme (UN-Habitat), and the International Forum for Rural Transport and Development **Status:** Completed in 2013 **For more information**: http://www.cfts-uct.org/projects/transport-and-environment-science-technology-network/

Travel behaviour change

Project focus areas: Cape Town and Dar es Salaam **Funder:** Volvo Research and Educational Foundations & the Global Environmental Facility (GEF) **Contact person:** Professor Roger Behrens (roger.behrens@uct.ac.za)

This research project on travel behaviour change is exploring the prospects of increasing the use of public and non-motorised transport modes and reducing private vehicle kilometres travelled.

Project partners: University of Dar es Salaam & University of Nairobi **Status:** Completed at the end of 2013

For more information: http://www.cfts-uct.org/projects/travel-behaviour-change/

Non-Motorised Transport Facility Guidelines

Project focus area: South Africa **Funder**: National Department of Transport

Project contact person: Marianne Vanderschuren

The update of the Non Motorised Transport Facility Guidelines with the aim to improve transport infrastructure implementation and promote the use of green modes.

Project partners: SMEC **Status of project**: In final stage **For more information**: -

Non-Motorised Transport climate value tool

Project focus area: Developing World **Funder**: United Nations Environment Programme (UNEP)

Project contact person: Mark Zuidgeest (mark.zuidgeest@uct.ac.za)

The Development of a climate value tool for developing world non-motorised transport projects.

Project partners: n/a **Status of project**: In final stage **For more information**: -

Education Programmes

1.1.1.1. Master of Philosophy specialising in Transport Studies

The taught Master of Philosophy specialising in Transport Studies(EM027) requires the completion of three core courses, approved elective courses and an approved minor dissertation. Core courses include: Integrated land use-transport planning (END5038Z); Transport demand analysis and project assessment (END5047Z); and Management of transport supply and demand (END5035Z)

Master of Engineering specialising in Transport Studies

The Master of Engineering specialising in Transport Studies degree is available to candidates with undergraduate degrees in engineering. It requires the completion of three core courses, approved elective (engineering-

focussed) courses, and an approved (engineering-focussed) minor dissertation. Core courses include: Transport demand analysis and project assessment (END5047Z); Transport modelling (END5048Z); and Intermodal public transport planning and economics (END5045Z).

Postgraduate Diploma in Transport Studies

The Postgraduate Diploma in Transport Studies (EG009) requires the completion of three core courses, and approved elective courses. The PGDip will cease to be offered after 2013, and is to be replaced a 'professional master' degree.

For more information: http://www.cfts-uct.org/degree-options/

Courses/ short courses

- Rail planning and operations management (END5067Z)
- Bus planning and operations management (END5068Z)
- Public transport policy and regulation (END5070Z)
- Local area transport planning, management and design (END5036Z) (offered biennially)
- Non-motorised transportation (END5039Z) (offered biennially)
- Discrete Choice Modelling (END5127Z) (offered biennially)

The project of a current PhD student with the Centre for Transport Studies provides a further indication of their research focus:

PhD project: Freight transportation and energy in South Africa

Candidate: Tanya Visser (tanyav@sun.ac.za) (PHD supervised by Prof Vanderschuren) (ongoing)

This Doctoral thesis research on freight transportation and energy in South Africa is intended to pave the way for informed decision making on the principles, technologies, energy systems and transport modes required to improve the energy efficiency, effectiveness and sustainability of freight transportation globally and in South Africa specifically.

For more information: http://www.cfts-uct.org/phd-research-projects/tanya-visser/

The Concrete Materials & Structural Integrity Research Unit (CoMSIRU)

Type: Research Unit

Department/s: Department of Civil Engineering

Faculty/s: Faculty of Engineering & the Built Environment

Website: http://www.comsiru.uct.ac.za/

Head of the Unit: Professor Mark Alexander (mark.alexander@uct.ac.za)

Main contact points: Professor Mark Alexander

CoMSIRU has been developing technologies and procedures for the design and assessment of concrete structures for more than 20 years. The key areas of interest are service life prediction, deterioration science, assessment technologies and repair/rehabilitation strategies for concrete structures. Work in these areas involves laboratory-based investigations, field measurements and advanced numerical modelling. The integration of laboratory work, field measurements and computational modelling of materials and structures places the unit in a unique position to develop realistic and practical solutions.

Research Programmes & Projects

Investigation of the durability performance of South African's Portland limestone cement blends

Project focus areas: n/a **Funder:** **Contact person:**

The process of cement production is highly energy-intensive and generates enormous amount of greenhouse gases (GHG), especially carbon dioxide (CO_2), to the environment. The most effective driver to reducing CO_2 emission is by replacing all or some percentage of clinker in cement. This on-going experimental study is investigating the engineering properties and durability performance of concretes made with the six available Portland limestone cement blends in South Africa.

Project partners: **Status:**

For more information: http://www.comsiru.uct.ac.za/research/current-projects/item/164-investigation-of-the-durability-performance-of-south-africans-portland-limestone-cement-blends.html

The South African Cement Industry: A critical analysis of its energy and environmental impacts since 1980

Project focus areas: South Africa **Funder:** **Contact person:**

This thesis analyses the energy and environmental performance of the South African cement industry since 1980 with respect to cement production, as well as options for energy conservation and environmental pollution reduction as aligned to the requirements for the mitigation of greenhouse gas emissions – with emphasis on CO_2, the predominant GHG – in terms of the issues of climate change and sustainable development.

Project partners: **Status:**

For more information: http://www.comsiru.uct.ac.za/research/current-projects/item/160-the-south-african-cement-industry-a-critical-analysis-of-its-energy-and-environmental-impacts-since-1980.html

Thermo-mechanical modelling of arch dams for performance assessment

Project focus areas: n/a **Funder:** **Contact person:**

Past research has revealed that stresses caused by temperature change can be larger than those from reservoir loading. The proposed finite element model for this study focuses on the performance assessment of arch dams in operation due to thermal loading.

Project partners: **Status:**

For more information: http://www.comsiru.uct.ac.za/research/current-projects/item/156-thermo-mechanical-modeling-of-arch-dams-for-performance-assessment.html

The effect of a diverging reservoir on the dynamic characteristics of the Roode Elsberg Dam

Based on website only

Project focus areas: The Roode Elsberg dam in Worcester **Funder:** **Contact person:**

As part of an attempt to ensure the safety of the Roode Elsberg dam this research is inspired by the need of an effective analytical method which will monitor and assesses the arch dam under varying ambient conditions.

Project partners: The Department of Water Affairs (DWA) and the Concrete Materials **Status:**

For more information: http://www.comsiru.uct.ac.za/research/current-projects/item/154-the-effect-of-a-diverging-reservoir-on-the-dynamic-characteristics-of-the-roode-elsberg-dam.html

Production of low clinker cements

Project focus areas: n/a **Funder:** **Contact person:**

The production of cement has been identified to release a large proportion of greenhouse gases (mainly CO2). In order to ensure sustainable production, several researchers and studies undertaken propose to reduce the proportion of clinker in cements and substitute with supplementary materials. This research looks at evaluating the viability of production and use of low clinker cements.

Project partners: **Status:**

For more information: http://www.comsiru.uct.ac.za/research/current-projects/item/151-production-of-low-clinker-cements.html

Sustainability of concrete structures

Project focus areas: South Africa **Funder:** **Contact person:**

This PhD study aims to research design and construction solutions that will lead to sustainable concrete infrastructure in South Africa. The study output aims to ensure that future concrete structures have the lowest possible carbon footprint, emissions, energy use and impact on the environment and society.

Project partners: **Status:**

For more information: http://www.comsiru.uct.ac.za/research/current-projects/item/127-sustainability-of-concrete-structures.html

Urban Water Management

Type: Interdisciplinary research unit

Departments: Architecture, Planning & Geomatics; Civil Engineering; Construction Economics & Management; Environmental & Geographical Science; Political Studies; and School of African & Gender Studies, Anthropology and Linguistics

Faculties: Engineering & the Built Environment; Humanities; and Science

Website: http://wsud.co.za/

Lead by: Professor Neil Armitage, Dr Kirsty Carden (Civil Engineering), and Dr Kevin Winter (Environmental and Geographical Science)

Main contact points: Professor Neil Armitage (Neil.Armitage@uct.ac.za) (Director), and Dr Kirsty Carden (Kirsty.Carden@uct.ac.za) (Research Officer) – both based in the Department of Civil Engineering at the University of Cape Town.

The Urban Water Management (UWM) research unit is an interdisciplinary accredited research unit at the University of Cape Town, with the principal aim of providing integrated and sustainable approaches to addressing problems of water management in the urban areas of southern Africa. It subscribes to the concept of Integrated Urban Water Management (IUWM) by which is meant "the practice of managing fresh water, waste water and stormwater as links within the resource management structure, using an urban area as the unit of management" (UNEP, 2003). Particular emphasis is placed on the urban drainage (sewerage, stormwater management) side of the urban water cycle. It three main focal areas aimed at integrating the management components of socially relevant and sustainable urban water use, i.e.:

1. Water as a resource – focused on adding value, rather than creating / discarding waste

2. Water management – focused on low impact development, both ecologically and socially

3. Building resilience to climate change

Research Programmes & Projects

The control and removal of litter from urban drainage systems

Project focus area: South African towns and cities **Funder:** Water Research Commission (WRC)

Contact person: Neil Armitage (Neil.Armitage@uct.ac.za)

The estimation of the quantities of litter (trash, solid waste) washing off urban catchment areas, and the development of an integrated catchment management system for its reduction and removal. The work included an extensive review of various litter trapping devices.

Project partners: City of Cape Town **Status:** Completed in 2003 **For more information**: -

The management of greywater in the non-sewered areas of South Africa

Project focus area: Mainly South African urban informal settlements **Funder:** WRC

Contact person: Dr Kirsty Carden (Kirsty.Carden@uct.ac.za)

The estimation of the quantities of greywater being disposed of in the non-sewered areas of South Africa; the measurement of typical greywater quality; and various strategies for its safe disposal.

Project partners: Various municipalities **Status:** Completed in 2011 **For more information**: -

The development of sustainability and risk indicators for urban water management

Project focus area: South African cities **Funder:** National Research Foundation (NRF)

Contact person: Dr Kirsty Carden (Kirsty.Carden@uct.ac.za)

Based on website with input from representative

An examination of the concept of sustainability in the context of Integrated Urban Water Management (IUWM) in South Africa, and the development of a sustainability index to measure the potential for any municipality to be sustainable w.r.t. water management.

Project partners: None **Status:** Completed in 2012 **For more information**:

Alternative sewerage systems in low-income settlements

Project focus area: South African low-income settlements **Funder:** WRC

Contact person: Neil Armitage (Neil.Armitage@uct.ac.za)

A study of the major technological, institutional, social and servicing lessons learnt from the implementation of various alternative sewerage systems by South African municipalities in low-income settlements

Project partners: City of Cape Town **Status:** Completed in 2013 **For more information**:

Sanitation for the Urban Poor

Project focus area: Low-income settlements in sub-Saharan Africa and Southeast Asia

Funder: Bill & Melinda Gates Foundation (BMGF) **Contact person:** Neil Armitage (Neil.Armitage@uct.ac.za)

An international study into how the impediments to the provision of sanitation to the urban poor can be overcome in sub-Saharan Africa and Southeast Asia.

Project partners: City of Cape Town **Status:** Due for completion in 2016 **For more information**: -

Sustainable Drainage Systems (SuDS)

Project focus area: South African human settlements **Funder:** WRC

Contact person: Neil Armitage (Neil.Armitage@uct.ac.za)

The development of guidelines for the adoption of Sustainable Drainage Systems (SuDS) in South Africa. SuDS attempt to manage surface water drainage systems holistically in line with the ideals of sustainable development. In addition to the traditional objective of flood control, SuDS attempt to improve stormwater quality treatment, amenity, and the maintenance of biodiversity. In so doing, many of the negative environmental impacts of stormwater are mitigated and some benefits may in fact be realised.

Project partners: Cities of: Cape Town, eThekwini, Johannesburg and Tshwane **Status:** On-going

For more information: -

Water-Sensitive Urban Design (WSUD) / Water Sensitive Design (WSD)

Project focus area: South African human settlements **Funder:** WRC

Contact persons: Kirsty Carden (Kirsty.Carden@uct.ac.za) or Neil Armitage (Neil.Armitage@uct.ac.za)

The development of tools for the planning, design and maintenance of water-sensitive settlements – where the holistic management of water, in all its forms, becomes a central consideration. The promotion of a 'community of practice' for WSUD/WSD

Project partners: The Cities of Cape Town, eThekwini, Johannesburg and Tshwane **Status:** On-going

For more information: -

The Integrated Infrastructure Network

Project focus area: The towns and cities of the world **Funder:** The Worldwide Universities Network (WUN)

Contact person: Neil Armitage (Neil.Armitage@uct.ac.za)

The development of an international network to study the potential benefits of an integrated infrastructure (water, energy, transports) approach for the building of resilience to the likely impact of global climate change.

Project partners: Various universities, companies and local authorities from around the world.

Status: Due for completion (first phase) in 2016 **For more information**: -

Feasibility Study in Urban Water Research

Project focus area: Undecided **Funder:** WRC

Contact person: Saul Nurick (sd.nurick@uct.ac.za) and Dr Kirsty Carden

The management of water in urban areas is an area of strategic importance, and there is a need to adopt an alternative approach to conventional urban water management, which aims to facilitate a change from 'water-wasteful' to 'water-sensitive' environments. The 'business case' for the implementation of the various aspects of this approach (known as water sensitive urban design, WSUD) is still to be established, however – through determining the unit costs of specific WSUD technologies and the potential economic benefits that accrue. The research could highlight the perceptions of people living and/or working near a natural water feature. This could

potentially be quantified in terms of how residential property owners recognise to what degree a river can add value, both financially (property value) and non-financially (quality of life). A similar investigation could be conducted to determine the impact of a close natural water feature on productivity within a corporate environment.

Project partners: - **Status:** Started in 2015 **For more information**: -

Courses/ short courses

Integrated Urban Water Management (CIV5107Z)

Contact person: Neil Armitage

The aim of this course is to introduce students to integrated urban water management (IUWM). This includes: social imperatives; environmental considerations; politics and water service delivery. Planning for water in the City of Cape Town; servicing the informal settlements of Cape Town. Water supply: key considerations for water reticulation systems; water supply options; household management of water; water demand management; public health considerations. Sanitation: options; managing sanitation in informal settlements. Stormwater: managing stormwater in the the City of Cape Town; rehabilitating urban rivers; groundwater issues; Sustainable Drainage Systems (SuDS); catchment litter management. Water Sensitive Urban Design (WSUD); water management systems; sustainability indicators.

For more information: Neil.Armitage@uct.ac.za

Urban Water Services (CIV3047S)

Contact person: Neil Armitage

This course aims to develop an understanding of the design and operation of water ervices in urban areas, including: water supply and distribution; sanitation and urban drainage.

For more information: Neil.Armitage@uct.ac.za

Water Research Group

Type: Research Group

Department/s: Department of Civil Engineering

Faculty/s: Faculty of Engineering & the Built Environment

Website: http://www.civil.uct.ac.za/water-research-group

Head of the research group: Professor George Ekama (george.ekama@uct.ac.za)

Main contact points: Professor George Ekama

The main aim of this interdisciplinary research group is conservation of both water quality and quantity for domestic, industrial, agricultural, recreational and ecological uses in South Africa. The group seeks to generate solutions to water quality problems of national importance through basic and applied research, and actively participates in the technology transfer of these solutions. Research focuses mainly on environmental systems engineering, which seeks to develop an understanding of the fundamental chemical, physical and biological processes operating in various water-related systems. Masters and PhD students from various Departments are involved in the group's research.

Based on website only

Advanced Machinery and Energy Systems (AMES)

Type: Research Group

Department/s: Department of Electrical Engineering

Faculty/s: Faculty of Engineering & the Built Environment

Website: http://www.ames.ee.uct.ac.za/

Head of the Unit:

Main contact points: Professor Paul Barendse (paul.barendse@uct.ac.za)

The AMES group has developed significant expertise in the management of energy systems, grid integration of renewables, and asset management. The current research areas include: monitoring and fault diagnosis of machines, PM machine design, induction motor efficiency estimation, fuel cell emulators and converters, wind turbine emulation and control, grid-tied inverters for renewable energy applications, load balancing converters, etc.

Based on website only

Department of Construction Economics & Management (CEM)

Type: Department

Department/s: -

Faculty/s: Faculty of Science

Website: http://cons.uct.ac.za/

Head of Department: Professor Keith Cattell (Keith.Cattell@uct.ac.za)

Main contact points: Karen Le Jeune (Karen.lejeune@uct.ac.za)

The Department of Construction Economics and Management in the Faculty of Engineering and the Built Environment at UCT offers a world-class suite of construction and project management related degrees at undergraduate (BSc) and postgraduate (BSc hons and MSc) levels.

Research is regarded as a crucial activity within the department. The department aims to foster the production of high quality research, which is defined as being excellent in terms of the standard of methodology and analysis and relevant to the problems being encountered in the field of the built environment. The Department's research touches on "green" issues through focus on aspects such as green finance and green building construction.

Research Programmes & Projects

The projects of Masters and PhD students with CEM provide an indication of their research focus:

- Establishing the importance of specifying certified green materials and/or products in 5 or 6 Star Green Star SA Office rated buildings in the Western Cape
- An investigation of green star SA design vs. as built certification of South African commercial buildings
- Incorporating green building features and initiatives into commercial property valuation: perceptions of south African valuers
- "Green building is wicked" – how are UCT students from the engineering and the built environment faculty (ebe) talking about green building concepts
- The "business case" for building green: using life cycle costs to motivate energy saving development
- Development strategies/models that encourage professionals to proactively promote green building features and initiatives (BGFIs) into building projects
- Business case for PV installation in retail buildings as an alternative or supplement to energy supply

Based on website with input from representative

HySA/Catalysis

Type: Research Centre

Department/s: Chemical Engineering

Faculty/s: *Faculty of Engineering & the Built Environment*

Website: http://www.hysacatalysis.uct.ac.za/

Director: Dr Sharon Blair (sharon.blair@uct.ac.za)

Main contact points: Dr Sharon Blair (sharon.blair@uct.ac.za)

HySA/Catalysis is one out of three Centres of Competence tasked with the establishment of a technical and scientific base for distinctly South African contributions to the global hydrogen and fuel cell technology know-how. Thecentre is co-hosted by the University of Cape Town and Mintek, South Africa's national mineral research organisation.

Research Programmes & Projects

Fuel processing

Project focus areas: n/a **Funder:** Department of Science and Technology (DST)

Contact person: Prof Jack Fletcher (jack.fletcher@uct.ac.za) and Niels Luchters (niels.luchters@uct.ac.za)

This project involves research and development of catalysts and catalytic components (reactors) for the generation of hydrogen from hydrocarbon fuels. The focus is on the development of highly active and durable platinum group metal based catalysts and modular reactor components.

This project is a step towards a sustainable or green economy in the sense that it is a more efficient way of generating hydrogen. Whilst it still uses hydrocarbon based fuels as feed, it is much more efficient to convert the hydrocarbon fuels to hydrogen and then feed it to a fuel cell than to burn the fuels directly to produce electricity.

Project partners: University of KwaZulu-Natal **Status:** On going – part of 15 year DST HySA project initiated in 2008 **For more information**: Contact niels.luchters@uct.ac.za

Fuel cells

Project focus areas: n/a **Funder:** DST **Contact person:** Dr Sharon Blair (sharon.blair@uct.ac.za) Dr Pieter Levecque (pieter.levecque@uct.ac.za)

This projects involves research and development of catalysts, catalytic components (electrodes) and fuel cell stacks for low temperature polymer electrolyte fuel cells. Materials and components are being development for stationary and automotive power applications.

These are energy conversion devices which efficiently convert the hydrogen directly to electricity. If the hydrogen is generated from renewable energy sources (electrolysis of water using energy from the sun or wind), then fuel cells will form a crucial part of a completely renewable and pollution free energy system.

Project partners: Mintek **Status:** On going – part of 15 year DST HySA project initiated in 2008

For more information: Contact pieter.levecque@uct.ac.za

Education programmes

MSc and PhD in Chemical Engineering, specializing in Catalysis

Focus area: n/a

Contact person: pieter.levecque@uct.ac.za

As part of the Centre for Catalysis Research, housed within the Department of Chemical Engineering at the University of Cape Town, HySA/Catalysis offers (i) an MSc (Eng) comprising coursework and a research project and (ii) a PhD (Eng) comprising research only.

Based on website with input from representative

For more information: http://www.hysacatalysis.uct.ac.za/?page_id=559

Courses/ short courses

Post-graduate - Hydrogen technology, electrochemical characterization techniques

Undergraduate - Introduction to Catalysis, Chemical Engineering Laboratory

Focus area: n/a **Contact person:** pieter.levecque@uct.ac.za

Fuel cell short courses are embedded in several undergraduate and postgraduate courses in the chemical engineering curriculum at the University of Cape Town.

Based on website with input from representative

Centre for Environmental and Occupational Health Research (CEOHR)

Type: Research Centre

Department/s: School of Public Health and Family Medicine

Faculty/s: Faculty of Health Sciences

Website: http://www.publichealth.uct.ac.za/phfm_centre-environmental-and-occupational-health-research

Director: Associate Professor Aqiel Dalvie (Aqiel.Dalvie@uct.ac.za)

Main contact points: Associate Professor Aqiel Dalvie (Aqiel.Dalvie@uct.ac.za); Associate Professor Andrea Rother

CEOHR is made up of several research programmes reflecting their research interests, expertise, and areas of masters and PhD supervision. Its major focus areas include, among other things: Workplace Allergens and Asthma; Allergens and Dermatitis; Pesticides; Endocrine disrupting chemicals, Mining, Metal and Environmental Pollution; Public health issues with strong environmental & occupational health interface; Environmental and Occupational Health Systems Research; Capacity building approaches for environmental health, Intervention development and Climate Change and Health.

The Centre has for some years arguably concentrated the most substantial concentration of skills in clinical occupational medicine and occupational epidemiology research in the country and is building a strong environmental health burden of disease research capacity. The Centre is very active in social responsibility activities at many levels and has played an influential role in national and regional governments, labor, industry, international policy through the United Nations and the general community in respect of health advocacy, policy research and development, applied research and consultancy.

Research Programmes & Projects

Climate change, variability, pest infestation and vector borne disease

Project focus areas: n/a **Funder:** currently seeking **Contact person:** A/Prof HA Rother

There are various stages to this project. Currently an MPH student is conducting a systematic review on climate change and heath generally. Funding proposals are currently being written to investigate pest infestation in Cape Town's townships and the impact of climate change on these.

Project partners: Wake Forest University **Status:** on-going **For more information**: -

Climate change and implications for endocrine disrupting chemicals

Project focus areas: Zimbabwe **Funder:** Applied Centre for Climate & Earth Systems Science (ACCESS)

Contact person: A/Prof A Rother (supervisor)

PhD research entitled: *Characterising the Role of Climate Change in Perpetuating Zimbabwean Farmers' Health Risks from Exposures to Endocrine Disrupting Pesticides.* The aim of this study is to assess whether climate change is a key factor in perpetuating Zimbabwean cotton farmers' and their families' exposures to, and health risks particularly from, endocrine disrupting pesticides.

Project partners: Co-supervising with the Council for Scientific and Industrial Research (CSIR) **Status:** due for completion end of 2016/2017 **For more information**: -

Climate change, heat and workers

Project focus areas: The Western Cape **Funder:** Department for Environment Affairs (DEA) & CSIR **Contact person:** A/Prof Rother

The pilot aimed to collect perceptions of Working for Water teams and contractors regarding the risks of heat, chemical and sun exposure experienced among those working outdoors. These risks are expected to increase with future climate change that will very likely result in hotter conditions in the Western Cape. The project is currently working on developing a model for DEA to use to plan alien vegetation removal taking into account climate predictions, herbicide toxicity and plant species in order to reduce worker's exposures to intense heat, sun and increased herbicide exposures due to evaporation and the need to use more herbicides as a result.

Project partners: CSIR and Working for Water Programme **Status:** Completed pilot in March 2015; currently submitting full proposal for funding **For more information**: -

Climate change and air quality

Project focus areas: n/a **Funder:** The National Research Foundation (NRF) **Contact person:** A/Prof Dalvie

Relationship between climate change, chemical pollution and health.

Project partners: Swiss TPH Status: At start of project **Status:** IM **For more information**: -

Health effects due to air pollution

Project focus areas: The Western Cape **Funder:** Department of Environmental Affairs and Development Planning (DEADP) **Contact person:** A/Prof Dalvie

Airpollution and Health – health effects due to airpollution on school children in the Western Cape.

Project partners: Swiss TPH Status **Status:** Due for completion in 2016 **For more information**: -

Health effects due to water pollution

Project focus areas: The Western Cape **Funder:** NRF **Contact person:** A/Prof Dalvie

Water quality and Health – An Ecohealth Health approach to investigating health risks due to chemical and biological exposure to polluted water sources in the Western Cape.

Project partners: Swiss TPH **Status:** At the start of the project **For more information**: -

Education programmes

Post Graduate Diploma in Pesticide Risk Management (PG DPRM), MPhil in Public Health (MPH), PhD in Public Health, Masters of Public Health (current thesis topics; Environmental Health Course Pending)

Focus area: Africa, Low and Middle Income Countries **Contact person:** A/Prof HA Rother

These programmes are offered by the Division of Environmental Health, with teaching support from CEOHR, using the categories below:

- The PG DPRM focuses on providing students how to manage pesticide risks around the life cycle approach of a pesticide. As part of this programme, students learn decision making and risk management in relation to the impact of climate change on agriculture, health and pesticides.
- Students currently conduct MPH thesis and PhD research on climate change related topics.
- The Division of Environmental Health, in conjunction with the CEOHR, is currently developing an Environmental Health track and core module to be taught in 2017. Climate change will be taught in relation to the impact on burden of diseases and risk management.

For more information:

http://www.publichealth.uct.ac.za/phfm_postgraduate-teaching
http://www.publichealth.uct.ac.za/phfm_environmental-health

Courses/ short courses

In addition to the various courses that fall under the programmes listed above, the CEOHR has been running a short course for the National Department of Health malaria control directorate on sound management of chemicals in four provinces.

The Centre for Film & Media Studies (CFMS)

Type: Department

Department/s: -

Faculty/s: Faculty of Humanities

Website: http://cfms.uct.ac.za/

Director: Professor Herman Wasserman

Main contact points: Dr Ian-Malcolm Rijsdijk (ian.rijsdijk@uct.ac.za); Dr Ibrahim Saleh (ibrahim.saleh@uct.ac.za)

The CFMS offers two majors and programmes in Film and Media Production: a major in Film and Television Studies; and a major in Media & Writing. There is also an undergraduate production program in the areas of screen production, screenwriting, print production and broadcast journalism.

At the postgraduate level CFMS offers a variety of research possibilities, programme based or by dissertation.

While the CFMS does not have a research program looking at environmental communication, individual scholars have published papers on the topic and there have been some honours dissertations on the topic. There is also a Masters of Arts in Documentary Arts which offers the possibility to produce films or photographic projects in the field of climate change.

Research Programmes & Projects

Fracking and the Media

Project focus areas: The Karoo **Funder:** Self-funded **Contact person:** Dr Ian-Malcolm Rijsdijk

Dr Ian-Malcolm Rijsdijk is contributing to a book on fracking in South Africa, through a chapter focused on fracking and the media. See the section on the Institute of Marine and Environmental Law (IMEL) for further details.

Project partners: IMEL leads the book project, which has a large number of contributing authors **Status:** In process, due for completion in 2015 **For more information**: Please contact the author.

Courses/ short courses

Film & the Environment (FAM4036S)

Focus area: n/a **Contact person:** Dr Ian-Malcolm Rijsdijk

This course examines several debates concerning the representation of the natural environment in film, particularly narrative film. Taking the ecocritical debate that has grown in scope and intensity in literary criticism since the early 1980s as a departure point, the course will investigate the value of this discourse and its applicability to films that either explicitly or implicitly use the natural environment as a key component of the film narrative.

For more information: http://cfms.uct.ac.za/courses/fam4036s-film-and-environment/

Environmental Documentary (FAM4015S)

Focus area: n/a **Contact person:** Dr Ian-Malcolm Rijsdijk

This course consists of an analytical and historical examination of environmental and ecological documentary and a fieldwork component. It examines some of the major works of and trends in Environmental and Ecological Criticism, ranging from Thoreau, Aldo Leopold and Rachel Carson through to David Guggenheim's *An Inconvenient Truth* and debates around climate change. The course emphasises how the environmental movement has interacted with and influenced wildlife documentary, particularly in South African productions. Students are expected to read widely in environmental literature and watch a wide range of film and television documentary.

For more information: http://cfms.uct.ac.za/courses/fam4015s-environmental-documentary/

Crisis Communication in Africa (FAM4018S)

Focus area: n/a **Contact person:** Dr Ibrahim Saleh

High-stress situations dramatically change the rules of communication. When people are stressed and upset during crisis or emergency, they can become less trusting, have difficulty processing information, and often become prone to negative thinking. This course covers basic elements of crisis communications in Africa and procedures for creating crisis communications plans and for reacting to crises when they occur. The course helps students to master skills and acquire knowledge on how best to develop various communication plans for different critical audiences. It equips students with the most effective strategies for communicating their organizations' messages during a crisis. The course examines various types of media risk and vulnerability for natural and technological hazards, terrorist threats, health and medical issues, as well as environmental hazards and security concerns.

For more information: http://cfms.uct.ac.za/courses/fam4018s-crisis-communication-in-africa/

Institute for Humanities in Africa (HUMA)

Type: Research Initiative

Department/s: -

Faculty/s: Faculty of Humanities & Faculty of Law

Website: http://huma.co.za/

Director: Associate Professor Shamil Jeppie (shamil.jeppie@uct.ac.za)

Main contact points: Elaine Atkins (elaine.atkins@uct.ac.za)

Huma intends to create a space of dynamic interdisciplinary community for scholars and students in the humanities at large. Fostering top-end academic research, Huma seeks also to draw on that work to nurture critical public debate, promoting University of Cape Town's (UCT's) vision of itself as a civic university contributing to the making of democratic citizenship.

Huma's intellectual agenda is driven by two broad and expansive research themes, On Being Human and Circuits of Consumption, and individual researchers at Huma make their own way into the issues as they see fit. These themes inform and structure the three primary objectives of Huma: to conduct and promote research that is historically grounded and theoretically engaged, with an eye to the 'big' theoretical and ethical questions that anchor South African issues in wider fields of experience and analysis; to nurture the expertise and enthusiasm of graduate students interested in an academic career; to bring scholars and graduate students into conversation with interested publics, around issues of shared and topical concern.

Within Huma a research group is working on environmental securities under the *Global Risk Governance (GRG) Programme* (http://www.grgp.uct.ac.za*),* lead by Professor Clifford Shearing (clifford.shearing@uct.ac.za). A core focus of the GRG Programme's current work is on the environmental insecurities that established circuits of consumption have helped create. In light of the sharp deterioration in the global environment, and the effect this is having on ecosystems and communities across Africa, environmental security governance draws on the programme's established research on the governance of physical security – crime control and policing. Projects linked to this programme are described in more detail below.

Research Programmes & Projects

Fulcrum Institutions and Sustainability Programme (FISP)

Project focus areas: South Africa and beyond **Funder:** The National Research Foundation (NRF)
Contact person: Elaine Atkins

The project investigated the governance of environmental change and how society is, and can, adapt to the myriad threats presented by climate-risk both in South Africa and elsewhere. The project explored how 'fulcrum institutions', those institutions with the capacity to lever large-scale societal change, can be enrolled to help realise sustainable solutions in the face of global environmental change.

Project partners: The World Wildlife Fund (WWF) **Status:** 3 year project, due for completion in 2015
For more information: http://www.grgp.org.za/research/a-fulcrum-institutions-and-sustainability-programme-fiser/

Transition to Sustainable Energy Systems in Emerging Economies: A South African Focused Comparative Project

Project focus areas: South Africa, Brazil, China and India **Funder:** NRF & the Research Council of Norway **Contact person:** Elaine Atkins

This project aims to enhance knowledge-based policies for facilitating transitions to more decentralized, flexible and sustainable electricity systems in South Africa and other emerging economies, focusing on how regulatory environments condition such transitions.

Based on website with input from representative

Project partners: University of Bergen **Status:** 3 year project running from 2014 to 2016 **For more information**: http://www.grgp.org.za/research/a-fulcrum-institutions-and-sustainability-programme-fiser-2/

Empowering Women to reach Leadership Potential

Project focus areas: South Africa **Funder:** Mauberger Foundation **Contact person:** Elaine Atkins

The project aims to support women, who are already making a difference in enhancing ecological human well being, to use a 'theory of change' framing to reflect upon, and through this reflection, enhance their impact on ecological sustainability. Funding has been received for a 5 year period.

Project partners: WWF **Status:** 5 year project running from 2014 to 2018 **For more information**: http://www.grgp.org.za/research/empowering-women-to-reach-leadership-potential/

Based on website with input from representative

Environmental Humanities South

Type: Initiative

Department/s: Department of Social Anthropologies

Faculty/s: Faculty of Humanities

Website: http://www.envhumsouth.uct.ac.za/

Director: Dr Lesley Green (Lesley.Green@uct.ac.za)

Main contact points: Dr Lesley Green

Annual budget: Funded by the Andrew Mellon Foundation

The Environmental Humanities South initiative evolved from the Contested Ecologies programme (see description below). The initiative is working to create a hub of scholars in the environmental humanities, with close ties to emerging interdisciplinary work at University of Cape town (UCT) on climate change.

The initiative includes a Network, the Environmental Humanities South Research Network. The Network currently works around four research themes, including Science, Nature, Democracy and Decoloniality; the Militarisation of Conservation; Extractive Natures, and the Anthropocene in Public Life. Current research projects range from work on scientific modelling to government policy, from social justice movements to the creative arts. The Network aims to provide an intellectual space that enables researchers, students, artists, writers, scientists, policy-makers and practitioners to reflect critically on the concepts that underlie contemporary environmentalism.

Research Programmes & Projects

The Contested Ecologies Programme

Project focus areas: Southern Africa, Latin America and Australia **Funder:** The Andrew Mellon Foundation
Contact person: Assoc. Prof. Lesley Green (lesley.green@uct.ac.za)
This two year research seminar process resulted in the publication of a book, "Contested Ecologies," in which researchers critically reflect on the relationship between sciences, states and publics across the South, as well as the development of 7 PhD and 6 M.Soc.Sc dissertations. The book focuses on contests over environments where different versions of nature are in play.

Project partners: A number of researchers from Universities in Southern Africa, Latin America and Australia
Status: Completed in 2013

For more information:
http://www.academia.edu/3646294/Contested_Ecologies_Dialogues_in_the_South_on_Nature_and_Knowledge

Education Programmes

Master of Philosophy specialising in Environmental Humanities & PhD in the Faculty of Humanities, affiliated to the Environmental Humanities South Research Network

Focus area: Southern Africa, Latin America and Australia **Contact person:** Assoc. Prof Lesley Green (lesley.green@uct.ac.za)

Teaching in the M.Phil and the PhD programmes centre on two core courses. *Earth, Ecology, Humanities* is an interdisciplinary seminar which considers the rich and difficult terrain where questions of ecological thought and environmental science interact with humanities. *Researching the Anthropocene*, offers an introduction to research methods that are needed in order to bring interconnectivities and parts and wholes, into public discussion and decision-making. It specifically seeks to build on current conversations across the south on the intersection of decolonial literatures and the post-humanities.

Based on website with input from representative

For more information: http://www.envhumsouth.uct.ac.za/core-courses

Based on website with input from representative

Department of Sociology

Type: Department

Department/s: -

Faculty/s: Faculty of Humanities

Website: http://www.sociology.uct.ac.za/

Director: Professor Ari Sitas

Main contact points: Dr Frank Matose (Frank.Matose@uct.ac.za)

The Department of Sociology has contributed to the development and understanding of South Africa through its teaching and research activities. It has maintained its record of researching pressing and relevant South African issues. Important collaborative work is currently being conducted on poverty, HIV/Aids, worker participation and productivity, identity and diversity, changes in higher education, and urbanization and urban mobility.

Research Programmes & Projects

Hidden Politics in Conservation: Forests and the Power of the Weak in Southern Africa

Project focus areas: Southern Africa by a variety of actors over the years **Funder:** Book is unfunded, but based on research that has been funded **Contact person:** Dr Frank Matose

Bringing together research that he has been conducting over the years Dr Frank Matose is currently writing this book, offering an African perspective on local agency and resistance around natural resources.

By digging into the particularity of place and listening to the voices of the people who live in or near nature, a much more nuanced perspective emerges. These are the 'hidden' struggles that outsiders often do not see.

Project partners: - **Status:** Due for completion in 2015

For more information: -

Based on website with input from representative

The Intellectual Property (IP) Unit

Type: Research unit

Department/s: Department of Private Law

Faculty/s*:* Faculty of Law

Website: http://ip-unit.org/

Director: Dr. Tobias Schonwetter (tobias.schonwetter@uct.ac.za)

Main contact points: Dr. Tobias Schonwetter

The IP Unit strives to add an African voice to the global debate on IP-related issues. Their focus is on examining the link between IP, innovation, development and public policy. The IP Unit aims at creating a leading IP programme in Africa that translates cutting edge research into excellent teaching and increases the number of highly-skilled African IP experts.

Important issues range from the way in which knowledge is accessed and shared to strategies on how to commercialise inventions and avoid misappropriation. IP is a key determinant of human development, economic growth and competitiveness; and IP rules impact on various public policy areas including health, research and development, bio-diversity, clean technologies, food security, and education.

Research Programmes & Projects

Empowering Indigenous Peoples and Knowledge Systems Related to Climate Change and Intellectual Property Rights' Project

Project focus areas: South Africa **Funder:** Open and Collaborative Science in Development Network (OCSDNet) **Contact person:**

The project examines processes of open and collaborative science related to indigenous peoples' knowledge, climate change, and intellectual property. Participatory action research ("PAR") is carried out together with indigenous KhoiSan peoples to assess the following: (1) how climate change has impacted their communities; (2) how they have produced indigenous knowledge related to addressing climate change and alternative strategies; (3) how such knowledge is characterized (or not) as indigenous intellectual property and openly shared (or not) with the outside public; (4) and what types of laws and policies (including intellectual property rights) promote and/or hinder these strategies and open collaboration with the public?

Project partners: Natural Justice **Status:** 2 year project

For more information: http://ip-unit.org/research-projects-2/

The Institute of Marine and Environmental Law (IMEL)

Type: Research and teaching institute

Department/s: Department of Public Law

Faculty/s: Faculty of Law

Website: http://www.imel.uct.ac.za/

Director: Professor Jan Glazewski (Jan.Glazewski@uct.ac.za)

Main contact points: Professor Jan Glazewski

The mission of the Institute of Marine and Environmental Law is to conduct high quality research, teaching and consultancy work in the fields of marine and environmental law, and to produce publications and outputs of international excellence. It is currently housed within the Department of Public Law (Faculty of Law) at the University of Cape Town (UCT). It is the oldest and largest dedicated grouping of marine and environmental law scholars in Africa.

The staff of the Institute undertake research and consultancy projects, individually and in partnership, in the fields of international, regional and domestic marine and environmental law. The Institute also collaborates in research and teaching with other faculties and departments at the University of Cape Town that specialise in marine and environmental subjects.

The Institute teaches postgraduate courses for the specialist LLM (Master of Laws), MPhil and Diploma qualifications in marine law and environmental law. It also offers environmental law courses in the undergraduate LLB programme and inter-disciplinary courses in environmental law and marine law for postgraduate students from the science departments.

Research Programmes & Projects

Shale gas extraction or fracking in the Karoo: Critical sustainability and governance perspectives
Project focus areas: The Karoo **Funder:** **Contact person:** Professor Jan Glazewski (Jan.Glazewski@uct.ac.za)
This book brings together a number of perspectives on fracking in the Karoo, including: Biophysical and ecological perspectives; Social, humanities and philosophical perspectives; and Legal and governance aspects. Professor Jan Glazewski is contributing author, as well as editor of the book.

Project partners: Contributing authors from: The Sustainability Institute (University of Stellenbosch), The World Wildlife Foundation South Africa (WWF-SA), University of the Western Cape (UWC), Groundwater Studies University of the Free State, South African Environmental Observation Network (SAEON), Kimberly Museum, North-West University, Wits University, and various University of Cape Town Departments and research units, including: The Centre for Film & Media Studies (Dr Ian Rijsdijk), School of Architecture, Planning and Geomatics (Tania Katzchner), Environmental Humanities South (Lesley Green), *Centre for Environmental and Occupational Health Research (CEOHR) (*Aqiel Dalvie)

Status: Ongoing
For more information: http://www.imel.uct.ac.za/usr/law/imel/downloads/FracturingLegalReportApril2012.pdf
Carbon Capture and Storage
Project focus areas: South Africa **Funder:**
Contact person: Professor Jan Glazewski (Jan.Glazewski@uct.ac.za)

Jan Glazewski co-authored a report titled Carbon Capture and Storage (CCS): Towards a Regulatory and Legal Regime in South Africa. The report was launched at a workshop on carbon capture and storage (CCS) hosted by IMEL, together with UCT's African Climate and Development Initiative and University College of London's Carbon Capture and Storage Programme. The aim of the workshop was to bring together experts from different fields (including engineering and law) to discuss issues regarding the viability of, and challenges for, CCS in South Africa.

Based on website with input from representative

Project partners: ACDI and University College of London **Status:** Report launched in September 2012
For more information: http://www.imel.uct.ac.za/usr/law/imel/downloads/CCS_Report.pdf

Protected Areas Law & Governance Project

Project focus areas: National and International
Funder: University Research Co (URC); the National Research Foundation (NRF); and the International Union for Conservation of Nature (IUCN) Environmental Law Centre
Contact person: Professor Alexander Paterson (Alexander.Paterson@uct.ac.za)

Alexander Paterson is exploring the notion of protected areas governance and particularly novel forms of governance which can be used to traverse the divide between land reform imperatives, conservation imperatives and the interest of indigenous peoples and local communities. Outputs of this project include the publication of academic papers and the development of an array of global teaching and learning resources.

Project partners: IUCN Academy of Environmental Law; IUCN Environmental Law Centre, World Commission on Environmental Law **Status:** Ongoing **For more information**: -

Spatial Planning Project

Project focus areas: International and National
Funder: German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB)
Contact person: Professor Alexander Paterson (Alexander.Paterson@uct.ac.za)

Alexander Paterson is currently participating in a global legal study on the current and potential role of spatial planning to facilitate biodiversity conservation. He has specifically been commissioned to prepare a South Africa case study focusing on the links between South Africa's land-use planning and conservation regime. The outcomes/key lessons emerging from the domestic case studies will be amalgamated and form the basis of a new international policy document to be prepared by the IUCN Environmental Law Centre based in Bonn.

Project partners: IUCN Environmental Law Centre
Status: Ongoing
For more information: N/A

Promoting Ecosystem-Based Adaptation in the Dassenberg Coastal Catchment Partnership: A Critical Reflection of the Relevant Conservation Regime (Mistra Urban Futures Knowledge Transfer Project)

Project focus areas: National & International
Funder: Mistra Urban Futures
Contact person: Professor Alexander Paterson (Alexander.Paterson@uct.ac.za)

In February 2012 the City of Cape Town entered into a three year partnership with the University of Cape Town's African Centre for Cities (ACC) as part of the Mistra Urban Futures Knowledge Transfer Project. Mistra Urban Futures (MUF) is an international centre supporting sustainable urban futures with the belief that co-production of knowledge is a winning concept for achieving sustainable urban futures and creating fair, green and dense cities. One component of this broader project is the commissioning of a book focusing on climate change, how it is affecting the City of Cape Town, and how City departments can (or already have) moved away from "business as usual" to better address climate change. Alexander Paterson is currently co-authoring a chapter for this book (together with Clifford Dorse), provisionally titled *Promoting Ecosystem-Based Adaptation in the Dassenberg Coastal Catchment Partnership: A Critical Reflection of the Relevant Conservation Regime*

Project partners: City of Cape Town, ACC at University of Cape Town

Status: Ongoing

For more information: N/A

Student research topics, Masters and PhDs, ongoing or completed in the last three years, have included:

- Towards policy and a legislative framework for renewable energy in South Africa: essential elements for a regulatory regime
- South Africa's proposed carbon tax and the reduction of greenhouse gases: lessons from Australia
- The place of international law and relevant bodies in addressing climate change displacement – the move towards cooperation
- Climate change governance in the Southern African Development Community (SADC) region: towards development of an integrated and comprehensive framework policy or protocol on adaptation
- The development of Namibia's renewable energy regime

- Towards the design of a policy and legal regulatory framework to 'Reduce and Control Emissions from Land Deforestation and Degradation and Enhancing Carbon Stocks' (REDD+) in Africa: A perspective from select developing countries
- Promoting Renewable Energy in South Africa: With specific reference to the inclusion of market-based instruments in South Africa's environmental regulatory framework

Education Programmes

Environmental Law Programme

Focus area: National and International **Contact person:** Professor Alexander Paterson (Alexander.Paterson@uct.ac.za)

The core course for this programme is Principles of Environmental Law. Students must then select three of the following courses: Land Use Planning Law; Natural Resources Law; Pollution Law; and International Environmental Law.

For more information:
http://www.imel.uct.ac.za/usr/imel/IMEL/documents/Enviro%20Law%20Brochure%20%28web%20format%29.pdf

Marine and Environmental Law Programme

Focus area: National and International **Contact person:** Professor Alexander Paterson (Alexander.Paterson@uct.ac.za)

The two core courses for this programme are International Law of the Sea and International Environmental Law. Students undertaking this Programme can then select two further courses from: Principles of Environmental Law; Land Use Planning Law; Natural Resources Law; and Pollution Law.

For more information:
http://www.imel.uct.ac.za/usr/imel/IMEL/documents/Marine%20&%20Enviro%20Brochure%20%28web%20format%29.pdf

Courses/ short courses

Environmental Law (PBL4101F)

Focus area: National **Contact person:** Ms Micha Young (Micha.Lau@uct.ac.za)

The course examines the various branches of law applicable to selected environmental problems. The terrestrial and marine environments are considered from an international and national perspective. The following are covered: (1) an introduction to environmental problems; (2) the nature of environmental law; (3) land-use management (land-use planning, environmental impact assessment, protected areas); (4) resource conservation (water, marine living resources, biodiversity); and (5) pollution law (water, land, air).

For more information: http://www.imel.uct.ac.za/course/undergrad/environmental/

Environmental Law for Non-Lawyers (PBL5045S)

Focus area: National and International **Contact person:** Professor Alexander Paterson (Alexander.Paterson@uct.ac.za)

This course provides students undertaking postgraduate studies relevant to the environment with an insight into relevant principles of international and domestic environmental law. Key content covered in the course includes: an introduction to basic legal principles and resources; constitutional aspects (environmental rights, access to information, administrative justice and access to courts); framework environmental laws; land-use planning laws (planning law, environmental impact assessment and protected areas); natural resource laws (biodiversity, water and marine living resources); and pollution laws (fresh water, land and air pollution).

For more information: http://www.imel.uct.ac.za/course/crossfaculty/environmental/

Climate Law and Governance (PBL5046S)

Focus area: National and International **Contact person:** Professor Jan Glazewski (Jan.Glazewski@uct.ac.za)

This course will provide postgraduate students with an insight into principles of international law, regional law and South African national law of relevance to climate change. Key content covered in the course includes: an introduction to basic international and domestic legal principles and institutions; environmental governance systems and theories; and an introduction to various branches of the law relevant to climate change such as energy law, planning and environmental impact assessment law; natural resource law (biodiversity, protected

areas, water and marine living resources), pollution laws (marine, fresh water, land and air pollution) and fiscal law (in the context of climate financing).

This course will be discontinued in 2016, and in its place the law faculty is proposing a Climate Change and Energy Law course that will be available for law and non-law students.

For more information: http://www.imel.uct.ac.za/course/crossfaculty/environmental/

Based on website with input from representative

Democratic Governance & Rights Unit (DGRU)

Type: Research Unit

Department/s: Department of Public Law

Faculty/s: Faculty of Law

Website: http://www.dgru.uct.ac.za/

Director: Professor Richard Calland

Main contact points: Vanja Karth (vanja.karth@uct.ac.za)

The DGRU is an applied research unit, established in order for the Law Faculty, and UCT more generally, to have a greater influence on democracy and human rights in South Africa and the region.

The DGRU is primarily concerned with the relationship between rights and governance. Its work focuses on the intersection between public administration, with the challenge of public accountability, on the one hand, and the realisation of constitutionally-enshrined human rights on the other. Sub-components of these focus areas include aspects of climate governance and climate finance.

Research Programmes & Projects

African Climate Finance
Programme focus areas: Sub-Saharan Africa
Funders: Deutsche Gesellschaft fur Internationale Zusammenarbeig (GIZ), KfW Development Bank, the Organisation for Economic Co-operation and Development (OECD), African Union (AU), United Nations Environment Programme (UNEP) and United Nations Development Programme (UNDP).
Contact person: A/Professor Richard Calland

The DGRU works with the African Climate Finance Hub (ACFH), an independent entity, on a variety of aspects related to climate finance. This includes work on both the supply and demand side of climate finance, to identify the key issues and transformational levers. It also includes supporting countries seeking to develop the necessary governance and administrative architecture for enhanced access to new sources of climate finance, and collaborating with development partners to convene conversations between key role-players aimed at forging consensus about how best to use such finance to transition African economies to a lower carbon climate-resilient growth pathway in line with national development goals.

Programme partners: ACFH and Overseas Development Institute (ODI) **Status:** Continuous Programme

For more info: http://www.africanclimatefinancehub.net/
The Governance of Climate finance
Project focus areas: Africa (and global, as necessary).
Funders: Heinrich Boell Foundation.
Contact person: A/Professor Richard Calland

As the international climate finance landscape changes fast and becomes ever more complex, so the need for serious thought about nature, standards and normative basis for the governance of the sector becomes more pressing. Academically, there is great opportunity to fill the lacuna and to present applied research that can influence the development of governance practices, for example in role of transparency and access to information principles and practice in climate finance decision-making at both global and national level.

Programme partners: Afican Climate and Development Initiative (ACDI) **Status:** on-going **For more info:** -

Based on website only with input from representative

Centre of Criminology

Type: Research Centre

Department/s: Department of Public Law

Faculty/s*:* Faculty of Science

Website: http://www.criminology.uct.ac.za/

Director: Professor Mark Shaw (mark.shaw@uct.ac.za)

Main contact points: Professor Mark Shaw

The Centre of Criminology at the University of Cape Town, through the provision of a grant from the National Research Foundation, and its links to the Global Initiative against Transnational Organised Crime and the United Nations Office on Drugs and Crime, is increasingly at the forefront of research work on organised crime, with a particular focus on Africa.

This includes on-going research projects on illicit trafficking and instability in West Africa and the greater Sahara, work for the UN on illicit trafficking in Somalia and the Horn, and a focus on the evolution and impact of organised crime in South and Southern Africa. The Centre is also working on a major international research project on the convergence of security challenges – organised crime, illicit trafficking and corruption – in ten key cities in the global south. This work builds on the historical foundation provided by the Centre's long track-record on issues of community safety, police and criminal justice reform.

Research Programmes & Projects

Illicit economies & criminal networks
Project focus areas: International
Funder: The Global Initiative Against Transnational Organized Crime and the NRF
Contact person: Professor Mark Shaw

The Centre has embarked on this programme of work which, as part of broader research into illicit economies and criminal networks, will focus on international criminal networks and the illicit trafficking of wildlife. While the specific research focus is still to be determined, it is likely that the research will investigate local level illicit wildlife markets with focus on Rhino trade on the Mozambican boarder and Perlemon trade on the West Coast.

Project partners: The Global Initiative Against Transnational Organized Crime **Status:** Started in 2015
For more information: -

Environmental Security Observatory
Project focus areas: International
Funder: The Global Initiative Against Transnational Organized Crime
Contact person: Professor Mark Shaw and Professor Clifford Shearing (Clifford.Shearing@uct.ac.za)

The Environmental Security Observatory is a programme aimed at establishing a monitoring system for global environmental crime.

Project partners: Institute for humanities in Africa **Status:** 3 year programme, due to start in 2015
For more information: -

Investigating the role of environmental crime in funding insurgencies
Project focus areas: Africa
Funder: The Global Initiative Against Transnational Organized Crime
Contact person: Laura Freeman

This piece of research aims to link social and economic instability and natural resources by looking at the role of environmental resources in fuelling insurgencies and sustaining wars.

Based on website only with input from representative

Project partners: SAVI **Status:** Short term (few months) research project, due for completion in April 2015
For more information: -

Toward a Global Legal Framework on Transnational Organized Environmental Crime
Project focus areas: International
Funder: The Global Initiative Against Transnational Organized Crime and the World Wildlife Fund for Nature (WWF)
Contact person: Professor Mark Shaw, Amanda Cabrejo le Roux

The Centre of Criminology contributed to this report, which was commissioned in the context of a collaboration between the World Wide Fund for Nature (WWF) and the Global Initiative against Transnational Organized Crime. The report is the result of a cross-sectoral fertilization of ideas, and it is envisioned as a thought-provoking starting point for examining legal frameworks currently available to combat transnational organized environmental crime, at the global, regional and national levels. The study seeks not to be prescriptive but to stimulate an open discussion and to explore potential avenues regarding means of moving this important dialogue forward.

Project partners: The Global Initiative Against Transnational Organized Crime and WWF
Status: Published in March 2015
For more information: -

Courses/ short courses

Seminar series: Wildlife in Crisis – Wars, Laws & Consumers
Focus area: International **Contact person:** Kat Couzyn (kat.couzyn@uct.ac.za)

This three-part seminar series, due to take place in May 2015, will be looking at illicit markets. The seminars will focus on the following topics: the current poaching situation and related strategies, nature of Asian markets and global strategies; legal and judicial weaknesses, required changes to the relevant laws, resources for effective prosecution and sentencing; and improved governance in source, transit and consumer states with suggestions for political and diplomatic pressure.

For more information: -

Based on website only with input from representative

Department of Archaeology

Type: Department

Department/s: -

Faculty/s*:* Faculty of Science

Website: http://web.uct.ac.za/depts/age/

Head of Department: Professor Simon Hall (simon.hall@uct.ac.za)

Main contact points: Professor Simon Hall

The Department of Archaeology has strong programmes in a variety of topics. Some are closely affiliated with the arts and humanities; others lie nearer to the natural sciences. Academic staff and students in the department interact widely with a number of other departments and external institutions. Specific research interests include issues related to human evolution, the emergence of modern humans, and the history of hunter-gatherer, pastoralist and farming communities in southern Africa, as well as the archaeology of more recent colonial settlement. In addition, the Department is home to archaeometric and materials research, focusing on paleoanthropology, past environments, early human diets and materials analysis. More recently, the Department of Archaeology has developed expertise in Cultural Resource Management, working with both government and private sectors to mitigate the effects of development and widen public awareness of the importance of the past.

The Department's research projects are largely archeological in focus, yet often with smaller components that speak to aspects such as the relationship between past climates and ecological and anthropogenic factors. These components tend to require collaborations with external researchers, or researchers from other Departments at UCT.

Research Programmes & Projects

The North of Kuruman Project

Project focus areas: Northern Cape and Western Cape **Funder(s):** TBD **Contact person:** Jayne Wilkins (Jayne.wilkins@uct.ac.za)

This research focuses on the archaeology of human-environment interaction during the Middle Stone Age of South Africa. Over the next five years, this research programme will investigate early human adaptation in the southern Kalahari Basin. By comparing well-dated Middle and Late Pleistocene archaeological sequences in the Kalahari Basin to more well-known coastal sequences, it will test coastal-centric hypotheses for the origins and evolution of *Homo sapiens* and compare early human adaptations to different environments.

Project partners: Curtis Marean (Arizona State University) **Status:** Continuous, at least 5 years
For more information: -

Department of Biological Sciences

Type: Department

Department/s: n/a

Faculty/s: Faculty of Science

Website: http://www.biologicalsciences.uct.ac.za/bio/about

Head of Department: Professor Anusuya Chinsamy-Turan (Anusuya.Chinsamy-Turan@uct.ac.za)

Main contact points: Ms Sarojini Pillay (sarojini.pillay@uct.ac.za)

The Department of Biological Sciences at the University of Cape Town (UCT) was established in 2013 as a result of a merger between the long standing Botany and Zoology Departments. The Department houses the Bolus Herbarium, the Percy FitzPatrick Institute of African Ornithology (a Department of Science and Technology (DST)/ National Research Foundation (NRF) Centre of Excellence), and two formal URC research units - the Plant Conservation Unit (PCU) and the Animal Demography Unit (ADU) and hosts the Marine Research Institute (Ma-Re). Research strengths range from marine biology, conservation biology, biodiversity, ecology, entomology, evolutionary biology, palaeobiology, physiology and systematics. The Department hosts NRF/DST South African Research Chairs in Evolution & Systematics and in Marine Ecology & Fisheries.

Research Programmes & Projects

Alien invasions and nutrient deposition

Project focus areas: Western Cape **Funder(s):** Mellon **Contact person:** J Neff

This project has two components. In one we attempted to discover the nature of resilience of native vegetation to invasion by alien acacias and the ecophysiological components of the interactions between aliens and native vegetation. In the other we determined the role of nutrient deposition in supplying nutrients to coastal ecosystems. Both projects are being written up for publication. The research will result in two PhDs and five research papers.

Project partners: **Status:** Near complete **For more information**: None

Ecosystem d^{15}N determinants

Project focus areas: South Africa/global **Funder(s):** NRF **Contact person:** Professor Michael Cramer (michael.cramer@uct.ac.za)

The causes of variation in d^{15}N between soil and plants remain mysterious. We are elucidating the physiological mechanisms responsible for this discrimination against ^{15}N. We are also investigating the environmental drivers of ecosystem d^{15}N and the association of d^{15}N with d^{13}C in soils. The research will result in two Masters Thesis and four research reports.

Project partners: - **Status:** Current **For more information**: None

Plant nutrient acquisition under elevated CO2 environments

Project focus areas: Kenya-South Africa **Funder(s):** UKAID **Contact person:** Professor Michael Cramer (michael.cramer@uct.ac.za)

We are attempting to ascertain the link between atmospheric CO_2 and decreased availability of nutrients in C_3 and C_4 crops.

Project partners: **Status:** Current **For more information**: None

Courses/ short courses

GLOBAL CHANGE ECOLOGY (BIO3013F)

Focus areas: n/a **Contact person:** Dr Adam West (adam.west@uct.ac.za)

How are organisms and ecosystems affected by the drivers of global environmental change? This course begins with a brief overview of key drivers of global environmental change, including both natural (e.g. Milankovich cycles) and anthropogenic "forcings" (e.g. greenhouse gas emissions, nitrogen deposition and pollution, land-use change). It then examines how these drivers influence (and are influenced by) primary productivity, nutrient cycling, water relations and vegetation-climate feedbacks. Biological responses to global change are examined in the context of marine, freshwater and terrestrial ecosystems. The course provides an integrated knowledge of contemporary environmental issues related to global change (e.g. carbon sequestration, climate change mitigation, and dynamic global vegetation models).

For more information: http://www.biologicalsciences.uct.ac.za/bio/undergrad/thirdyear

CONSERVATION: GENES, POPULATIONS & BIODIVERSITY (BIO3014S)

Focus areas: n/a **Contact person:** Associate Professor Lindsey Gillson (lindsey.gillson@uct.ac.za)

This course introduces students to the science and practice of conservation biology, beginning with an overview of conservation issues, the value of biodiversity, extinction risks and the history and philosophy of conservation. The conservation of biodiversity at the level of genes, species, populations and ecosystems, starting with the understanding of conservation at the genetic level as well as the management of genetic diversity are explored. At the species and population levels, the life history, behaviour and the management of populations in the real world is covered. The conservation and management of ecosystems is considered in terms of important processes, such as disturbance, and threats by alien plants and animals. This course concludes by considering conservation and society. Issues to be considered here include: incentives, access, who benefits from conservation, legal aspects and management policies.

For more information: http://www.biologicalsciences.uct.ac.za/bio/undergrad/thirdyear

Animal Demography Unit (ADU)

Type: Research unit

Department/s: The Department of Biological Sciences

Faculty/s: Faculty of Science

Website: http://adu.org.za/about.php

Director: Professor Les Underhill (les.underhill@uct.ac.za)

Main contact points: Professor Les Underhill

Annual budget:

The ADU, established in 1991, was initially built on the nucleus of the South African Bird Ringing Unit and the Southern African Bird Atlas Project. The mission of the Animal Demography Unit is to contribute to the understanding of animal populations, especially population dynamics, and thus provide input to their conservation. They achieve this through mass participation projects, long-term monitoring, innovative statistical modelling and population-level interpretation of results. The emphasis is on the curation, analysis, publication and dissemination of data.

Research Programmes & Projects

Birds and Environmental Change: building an early warning system in South Africa
Project focus areas: South Africa **Funder:** The Royal Danish Embassy **Contact person:** Professor Les Underhill

The project centers around the development of a booklet which demonstrates how South Africa is using long-term bird monitoring and research to build an early warning system for climate change impacts on its biodiversity.

Project partners: The South African National Biodiversity Institute (SANBI) **Status:** Completed in 2009

For more information: http://www.adu.org.za/docs/climate_change_booklet.pdf

Based on website only

The Animal Evolution & Systematics Group (AES)

Type: Research Group

Department/s: Department of Biological Sciences

Faculty/s*:* Faculty of Science

Website: http://aduweb.uct.ac.za/biologicalsciences/httpdocs/content.php?serial=32

Director: Associate Professor David Jacobs (David.Jacobs@uct.ac.za)

Main contact points: Associate Professor David Jacobs (David.Jacobs@uct.ac.za)

The AES focuses on conducting and popularizing high quality scientific research in evolutionary biology, drawing on their diverse expertise in systematics, phylogeography, biogeography, ecology and behaviour. The group also recruits and trains of postgraduate students, and provides consultancy services that address the specific needs of public and private sector concerns. The latter is aimed at ensuring the group's relevance to the broader community.

In terms of climate change related the research the AES focuses on the impacts of climate change on animals that use airborne acoustic signals for orientation, foraging, communication and reproduction.

Research Programmes & Projects

Geographic variation in morphology and acoustic signals among several species of horseshoe bats in southern Africa

Project focus areas: [geographical]: Throughout southern Africa (South Africa, Botswana, Zimbabwe, Mozambique, Malawi, Zambia, Botswana and Namibia).
Funders: National Research Foundation (NRF), University Research Committee (URC) of University of Cape Town (UCT)
Contact person: Associate Professor David Jacobs

The group currently has several projects that investigate the likely impact of climate change on the sensory ecology of animals. Their focus is on the impact of climate change on animals that use airborne acoustic signals for orientation, foraging, communication and reproduction.

The propagation of sound through the atmosphere is heavily influenced by temperature and humidity. AES currently uses bats as focal group because they are very reliant on airborne acoustic signals. There are several projects that investigate, amongst other factors, the influence of climatic factors on the morphology and acoustic signals of bat species that have distributions throughout southern Africa. The projects are divided on the basis of the distribution of species; one group has distributions restricted to the mesic eastern half of the subcontinent and the other on the arid western half of the continent. The effects of climate will be compared between these two groups at the group and species level.

Project partners: Greg Mutumi (PhD candidate); Tinyiko Maluleke (PhD candidate), Sarah Catto (Honours candidate) **Status:** Ongoing (for 2 years so far)/2 manuscripts about to be submitted for publication
For more info: Project website currently under construction

Percy FitzPatrick Institute of African Ornithology (PFIAO)

Type: Research institute

Department: Biological Sciences Department

Faculty*:* Faculty of Science

Website: http://www.fitzpatrick.uct.ac.za/docs/current.html

Director: Professor Peter G. Ryan *(*peter.ryan@uct.ac.za)

Main contact points: Professor Peter G. Ryan

Members of PFIAO are committed to developing a greater understanding of the vast biological resources on the African continent, through the training of scientists and the pursuit of primary research, from evolutionary ecology to conservation biology.

The research currently undertaken by members of PFIAO can be broadly placed within the themes of: Characterising Biodiversity; Evolutionary Ecology; and Maintaining Biodiversity. Several research programmes are co-ordinated by staff members and include the research projects of the Institute's postgraduate students.

Research Programmes & Projects

Predicting the impacts of climate change on desert birds: the "Hot Birds Programme"
Project focus areas: The Kalahari Desert, Western Cape, The USA and Australia
Funder: National Research Foundation (NRF), University Research Committee (URC) at University of Cape Town (UCT)
Contact person: Dr Susan Cunningham (susan.cunningham@uct.ac.za)

This project seeks to predict the ways in which climate change will affect birds living in hot, arid environments. Although most work is focused on bird communities of the southern Kalahari Desert, the project has recently expanded to consider Fynbos birds, as well as desert birds in the southwest US and Australia. The research focuses on the links between temperature, behaviour and physiology, including how temperature affects fitness in breeding birds.

Project partners: A number of Universities and institutions in South Africa and around the world.
Status: Started in 2009, continuous **For more information**: http://www.fitzpatrick.uct.ac.za/docs/physiol.html

Climate change and fynbos endemic birds
Project focus areas: Western Cape
Funder: The South African National Biodiversity Institute (SANBI), UCT Research Committee, National Research Foundation, Leverhulme Foundation, BirdLife South Africa
Contact person: Dr Phoebe Barnard (p.barnard@sanbi.org.za)

South Africa's Cape Floral Kingdom, centred on the fynbos biome, is one of the planet's smallest biodiversity hotspots. In this programme PFIAO researchers are studying the six birds endemic to mountain fynbos, using insights from global change biology, epidemiology, stress ecology and conservation biology, to try to ensure the long-term future of the biome and its birds. The programme aims to assess how fynbos birds are affected by a complex web of challenges.

Project partners: A number of Universities and institutions in South Africa and around the world.
Status: Started in 2008, continuous **For more information**: http://www.fitzpatrick.uct.ac.za/docs/climate.html

Conserving Southern Ocean seabirds
Project focus areas: The Southern Ocean
Funder: Agreement on the Conservation of Albatrosses and Petrels (ACAP); Centre national de la recherche scientifique (CNRS); European Union; Royal Society for the Protection of Birds (RSPB); South African National Antarctic programme; World Wildlife Fund (WWF) Australia

Contact person: Professor Peter Ryan (peter.ryan@uct.ac.za)

The Seabird Research Programme assesses the severity of threats faced by seabirds, and attempts to provide practical management solutions to reduce these threats. This section deals with Southern Ocean species, which face threats at sea through fishing mortality and climate change.

Project partners: A number of Universities and institutions in South Africa and around the world. ACAP, RSPB, South African National Antarctic Programme.
Status: Started in the 1980s, continuous
For more information: http://www.fitzpatrick.uct.ac.za/docs/seabird.html

Plastics in the ocean
Project focus areas: South African EEZ oceans and the Southern Ocean
Funder: Plastics Federation of South Africa
Contact person: Professor Peter Ryan (peter.ryan@uct.ac.za)

A variety of research related to plastics in the ocean has taken place over the last years, under the lead of Professor Peter Ryan. The most recent research has focused on assessing the abundance and distribution of marine plastics, and understanding how plastics move through marine systems. Related student research includes research into: litter accumulation rates at the Milnerton and Koeberg Beaches; abundance of litter in the surf zone of False Bay; and the importance of plastic size and buoyancy on the time taken for biofouling to cause litter items to sink.

Project partners: United Nations joint group of experts on the scientific aspects of marine environmental protection (GESAMP) working group. **Status:** Started in the 1980s, continuous
For more information: http://www.fitzpatrick.uct.ac.za

Spatial resilience of protected areas
Project focus area: South Africa
Funders: James S. MacDonnell Foundation's Complex Systems Program; NRF, South African National Parks (SANParks); numerous private nature reserve owners and managers.
Contact person: Professor Graeme Cumming (Graeme.Cumming@uct.ac.za)

The protected areas programme focuses on understanding influences on the long-term sustainability of protected areas in South Africa, the contributions of protected areas to the national biodiversity estate, and the ways in which they function as both members and creators of socioeconomic networks.

Project partners: International Resilience Alliance, Stockholm Resilience Centre
Status: Started in 2010, due for completion in 2015
For more information: http://www.fitzpatrick.uct.ac.za/gcumming/protected_area_networks.htm

Courses/ short courses

Climate change and conservation (Module in PFIAO's Conservation Biology MSc Programme)
Focus area: n/a **Contact person:** Dr Phoebe Barnard

This module provides an introductory overview of key concepts, methods and principles for the development of conservation approaches to help give most biodiversity "a fighting chance to survive the first (and maybe the last) few centuries of the Anthropocene era." It also focuses on ways in which humans can maximize biodiversity's capacity to adapt to climate change through conservation action, spatial planning and other means.

For more information: http://www.fitzpatrick.uct.ac.za/pdf/MSc%20Con%20Bio%20Handbook.pdf

Plant Conservation Unit (PCU)

Type: Research unit

Department/s: Department of Biological Sciences

Faculty/s: Faculty of Science

Website: http://www.pcu.uct.ac.za/

Director: Professor M Timm Hoffman (Timm.Hoffman@uct.ac.za)

Main contact points: Associate Professor Lindsey Gillson (Lindsey.Gillson@uct.ac.za)

The PCU works to understand plant conservation in the context of landscape change, using a wide range of disciplines including ecology, environmental history, palaeoecology, and social sciences. Their aim is to enable sound management decisions for the sustainable use, conservation and restoration of African Biomes, with a particular focus on the Greater Cape Floristic Region, which thereby contributes to the people's quality of life and well-being. The PCU aims to develop human and institutional capacity through Research, Education and social Responsiveness.

The PCU's repeat photography database is the first of its kind in Africa. The centre's four research programmes are: Landscape History & Palaeoecology; Land Use & Sustainable Development; Disturbance & Restoration Ecology; and Biodiversity, Conservation and Management.

Research Programmes & Projects

Landscape History & Palaeoecology
Project focus areas: South Africa **Funders:** African Climate and Development Initiative (ACDI) and others
Contact person: Timm Hoffman
In this research programme the PCU employs techniques like repeat photography and fossil pollen analysis to study long-term landscape change. Repeat fixed-point photography is a major tool used in this programme and an extensive database (rePhotoSA) on historical photographs forms part of the outputs of this programme. One of the main projects in this theme is called "Benchmarks for the future." This research uses an innovative combination of approaches incorporating analyses of historical climate and land use data, repeat photography, palaeoecology and long-term ecological monitoring to assess changes in the vegetation over the last millennium along a 1,500 km transect from Namaqualand in the west to the former Transkei region in the east.

Project partners: Animal Demography Unit (AEU) and others **Status:** Continuous

For more info: http://www.pcu.uct.ac.za/pcu/research/landscape
Multi-year rainfall manipulation and warming experiment for the three main biomes of the CFR
Project focus areas: The Cape Floristic Region (CFR) **Funders:** The National Research Foundation (NRF)
Contact person: Adam West (adam.west@uct.ac.za)
There is much uncertainty about the projection of future rainfall in the CFR. While "warmer and drier" seems to be the general trend, there is some indication of increased orographic rainfall and a possible increase in rainfall in the east of the CFR. This research project explores the relative sensitivities to changes in rainfall of the three main biomes (Fynbos, Renosterveld and Succulent Karoo) of the Cape Floristic Region (CFR).

Project partners: Department of Biological Sciences (lead) and the Nature Conservation Corporation (NCC)

Status: 3 year project, started in February 2015 and due to be completed in December 2017

For more info: -

The projects of Masters and PhD students with the PCU provide a further indication of their research focus:

- **PhD project**: Patterns and extent of bush encroachment in the mesic savannas of southern Africa. **Candidate:** James Puttick (ongoing)

This study uses a combination of repeat ground and aerial photography to document the nature, extent and rate of change in woody plant cover in the eastern parts of southern Africa. Changes in climate, fire, land use and CO2 are analysed in relation to the major drivers of woody plant increase in southern Africa.

- **PhD project:** *Using social-ecological systems thinking for managing natural resources in mountain catchments in South Africa* **Candidate:** Petra de Abreu (ongoing)

This study uses mountain catchments identified as critical Water Source Areas in South Africa to assess the effect of past conservation policies and interventions on resource protection and exploitation.

- **PhD project:** *Vegetation dynamics at the fynbos- succulent karoo and fynbos – forest boundaries.* **Candidate:** MacPherson, J. (ongoing)

This study looks at gaining insights in to vegetation dynamics at the boundaries between fynbos and other biomes, in order to contribute to the understanding of resilience for the species rich Mediterranean biome.

- **PhD project:** *Tree grass dynamics in the savannas and grasslands of Kwa-Zulu Natal* **Candidate:** Dabengwa, A. (ongoing)

This project examines tree-grass dynamics along an altitudinal gradient from the savannas of HluHluwe – iMfolozi, to the grasslands of the Drakensberg. It aims to provide insights into the relative importance, interactions and changing dominance of fire, herbivory, climate and human management on tree-grass dynamics at long timescales.

- **PhD project:** *Fire management in the complex socio-ecological systems of north-east Namibia* **Candidate:** Humphrey, G.

This interdisciplinary study reconstructs fire history and vegetation change using palaeoecological and GIS data, with the aim of assessing the effects of changing climate, vegetation and land-use on fire regimes at decadal and centennial timescales, and the effectiveness (or otherwise) of fire suppression policies over the past 100+ years.

- **PhD project:** *Understanding the role of human practices in arid South Madagascar for promoting ecosystem health* **Candidate:** Razanatsoa, Estelle

The aim of the project is to understand the interplay between ecological, socio-economic, and climatic factors that have sustained or impacted biodiversity on the Plateau Mahafaly, with an overall aim to identify traditional practices that promote ecosystem health.

- **Masters project:** *Understanding the relationship between the environment, land use change and the natural vegetation, over the last hundred years, in the Klein Karoo* **Candidate:** Amy Murray (ongoing)

This study documents vegetation change in the Ladismith area of the Klein Karoo over the past hundred years in order to deepen understanding about the influences of climate and land use change and contribute knowledge towards future land use management strategies.

- **Masters project:** *Changes in distribution of indigenous forest in Table Mountain National Park from 1880-2012* **Candidate:** Zoë Poulsen (completed in 2013)

The distribution of South Africa's indigenous forest is highly fragmented, and historically extensive exploitation has led it to be perceived as one of the country's most vulnerable vegetation types. This research examined changes in distribution of Western Cape Afrotemperate Forest and Western Cape Milkwood Forest in Table Mountain National Park.

- **Masters project:** *Long-term vegetation change in the Cape of Good Hope Section of Table Mountain National Park, in response to climate, fire and land use* **Candidate:** Robyn Faye Powell (completed in 2013)

The overall objective of this study was to document the extent, nature and rate of vegetation change in the Cape of Good Hope reserve using repeat photography and to relate these changes to the key drivers of climate, fire and land use.

- **Masters project:** *Historical changes on rocky shores in the Western Cape, as revealed by repeat photography* **Candidate:** Brett Reimers (completed in 2012)

This study used repeat photography to illustrate changes that have occurred on rocky shores in the Western Cape over the past hundred years. Changes were documented under four categories; changes in range, climate change, intertidal invasion and direct anthropogenic effects.

Centre in Information & Communication Technologies for Development (ICT4D)

Type: Research Centre

Department/s: Department of Computer Science

Faculty/s: Faculty of Science

Website: http://ict4d.cs.uct.ac.za/

Director: Professor Edwin Blake *(*Edwin@cs.uct.ac.za*)*

Main contact points: Professor Edwin Blake

The ICT4D serves as a focal point for researchers who wish to create Information and Communication Technologies that address problems in the African Continent and other developing regions. They are a multi-disciplinary Centre that seeks to create new technologies for the developing world, as well as study the impacts of existing technology.

Within the context of ICTs the ICT4D works on research related to: Education; Health; Networks; Creative Digital Media; Information Security; Heritage; Co-design; and Cloudlets.

Research Programmes & Projects

Telecommunications for Development

Project focus areas: **Funder:** **Contact person:**

The aims of the project are to use ICT for socio-economic development. The essential idea is to develop software frameworks and processes for producing reliable, cost-effective, scalable and efficient solutions on a variety of network platforms. Our work has shown that people can use telecommunications systems for work, for improving their lives and strengthen their culture. Our research method is to build applications that satisfy user needs and consider what the outcomes mean in terms of infrastructure on the one hand and impact on people on the other.

Project partners: The Centre of Excellence for Broadband Networks and Applications
Status:
For more information: http://ict4d.cs.uct.ac.za/projects/t4d

The Department of Environmental & Geographical Science

Type: Department

Department/s: -

Faculty/s*:* Faculty of Science

Website: *http://www.egs.uct.ac.za/index.html*

Head of Department: Professor Michael Meadows (michael.meadows@uct.ac.za)

Main contact points: Professor Michael Meadows

The Department of Environmental & Geographical Science aims to further knowledge, understanding and management of interactions between humans and their social, biological, and physical life-support systems.

The research undertaken is often interdisciplinary and covers a wide range of areas which include: vulnerability and adaption to climate change, urban food security, cultural geography, environmental change, access and benefit sharing, governance of natural resources, environmental assessment, land reform, transfrontier conservation, biodiversity, energy politics, atmospheric modelling, climate variability, sustainable development, paleoenvironments, physical geography, landscape ecology, agroecology, and urban development.

Research Programmes & Projects

African Urban Food Security Urban Network (AFSUN)

Project focus areas: Southern Africa (South Africa, Zimbabwe, Zambia, Malawi, Botswana, Mozambique, Namibia, Swaziland, Lesotho)
Funder(s): Canadian International Development Agency (CIDA)
Contact person: Prof Jonathan Crush (jcrush@balsillieschool.ca)/ Jane Battersby-Lennard (jane.battersby.lennard@gmail.com)

AFSUN was founded in 2008 to address the crisis of food insecurity in Africa's rapidly-growing towns and cities. AFSUN aims to improve the knowledge base of the dimensions and causes of urban food insecurity in Africa and to develop and advocate for international, national and local policies to enhance food and nutrition security. AFSUN also conducts graduate and in-service training programmes to build the capacity of African governments and NGOs to respond to the challenge of rapid urbanization and feeding Africa's hungry cities.

Project partners: Queens University (Canada), African Center for Cities (UCT), University of KwaZulu-Natal (UKZN), Wits, University of Botswana, National University of Lesotho, University of Malawi, Eduardo Mondlane University, University of Namibia, University of Swaziland, University of Zambia

Status: 2008-2014 **For more information**: www.afsun.org

HYRAX

Project focus areas: Southern Africa **Funder(s):** European Research Council (ERC) Starting Grant

Contact person: Professor Michael Meadows

The goal of HYRAX is to revolutionise our understanding of environmental change in southern Africa, developing sites, proxies and methods that will lead to the procurement, analysis and integration of palaeoenvironmental datasets spanning the last 50,000 years.

The aim of HYRAX is to develop a novel and extremely promising palaeoenvironmental archive from southern Africa: the rock hyrax (Procavia capensis) midden. These stratified accumulations of urine and faecal pellets contain reliable, high resolution records of long-term climate and vegetation change in southern Africa spanning the last 50,000 years. As a new palaeoenvironmental archive, rock hyrax middens offer the first opportunity to obtain reliable high-resolution stable isotope and pollen records that can provide detailed information regarding past climate and vegetation change in the region

Project partners: Centre National de Recherche Scientifique (CNRS) (France) and University of Leicester (UK)

Status: **For more information**: http://www.hyrax.univ-montp2.fr/index.html

Regional Archives for Integrated Investigations (RAIN)

Project focus areas: Southern Africa **Funder(s):** Bundesministerium fur Bildung und Forschung (BMBF) through FONA Research for Sustainable Development
Contact person: Michael Meadows

The RAiN project deals with interdisciplinary investigations of climate evolution and its dynamic in southern Africa during the Late Quaternary. Only a comprehensive understanding of system relationships allows reliable predictions of current and future climate change and as associated of the affected ecosystems. With the innovative approach of simultaneous studies of terrigenous and marine climate archives RAIN tries to make a significant contribution in this regard.

Project partners: Center for Marine Environmental Sciences (Marum), University of Bremen, Friedrich-Schiller-University of Jena, the South African Council for Geoscience, University of KwaZulu-Natal (UKZN) and University of Witswatersrand

Status: The first duration of the project is 3 years, from July 2013 to June 2016

For more information: https://www.marum.de/en/R_A_i_N.html

Community-level socio-ecological vulnerability assessment in the Benguela Current Large Marine Ecosystem (BCLME)
Project focus areas: The Benguela Current Large Marine Ecosystem region
Funder: Food and Agriculture Organisation of the United Nations (FAO)
Contact person: Associate Professor Merle Sowman (Merle.Sowman@uct.ac.za)

In this FAO project the focus is on developing and applying community level vulnerability assessments, with a particular focus on climate change, in selected coastal fishing communities within the Benguela Current Large Marine Ecosystem region (in Namibia, Angola and South Africa).

Project partners: FAO **Status:** 2014 – April 2015 **For more information**: -

CLIMWAYS – Climate change and urban water governance: pathways to social transformation
Project focus areas: Cape Town and Durban
Funder: South Africa – Norway Research Co-operation on Climate Change, the Environment and Clean Energy (SANCOOP)
Contact person: Gina Ziervogel (gina@csag.uct.ac.za)

The CLIMWAYS project compares climate adaptation and water governance in the cities of Durban and Cape Town, analysing the institutional constraints and opportunities for social transformation.

More specifically, the study focuses on two issues and scales; the local and the multi-level dimensions of urban climate governance - with reference to how local societies and city authorities interact and respond in policy and everyday practice to the impacts of climate change and extreme weather as it interfaces with water resources management. Policy sectors of concern to the empirical case studies are climate change, flood risks, storm water management, water supply, sewerage, and environmental management.

Project partners: The Norwegian Institute for Urban and Regional Research, University of Oslo, the University of KwaZulu-Natal (UKZN) (South African lead), Umphilo waManzi , Environmental Monitoring Group and the City of Cape Town
Status: 4 year project which started in 2014

For more information: http://www.nibr.no/en/news/project-news/new-project-urban-water-governance.aspx

DO4 Models: Dust Observation
Project focus areas: Makgadikgadi (Botswana) and Skeleton Coast and Etosha (Namibia)
Funder(s): The Natural Environment Research Council (NERC) - UK
Contact person: Dr Frank Eckardt (frank.eckardt@uct.ac.za)

The **overall aim** of this research is to collect the first dust source-area process data tailored to climate model grid-box resolution from targeted remote sensing and fieldwork in order to develop a new generation of model dust emission schemes. In particular, the research relates to the core science themes of: The Climate System, especially the goal of developing an *improved predictive capability*; and Earth System Science, examining the linkages between the component parts of the system

Project partners: University of Oxford, University of Sheffield, Imperial College London, University of Namibia, Gobabeb Research & Training Centre and the Climate Systems Analysis Group (CSAG – UCT)

Timeframes: 2010-2015 **For more information**: http://www.geog.ox.ac.uk/research/climate/projects/do4models/

Franschhoek Water Innovation Centre
Project focus areas: n/a **Funder(s):** Western Cape Government **Contact person:** Dr Kevin Winter (kevin.winter@uct.ac.za)

The project involves the conversion of the WWTWs at Franschhoek into a 'living laboratory' which will use and demonstrate technologies including bioremediation to treat stormwater initially, and waste water. It is envisaged that the Centre will become a public education and training facility for water innovation and a resource recovery centre that will conserve water, extract value from discarded water, and reduce the carbon footprint of conventional treatment.

Project partners: AmanziBom Consulting company, with the Western Cape Government as the client (project is implemented jointly by the EGS Department and the Department of Civil Engineering)

Timeframes: Phase 1: 2 year concept and planning; Phase 2: operational phase **For more information**: www.wsud.co.za

Liesbeek Life Plan

Project focus areas: The Liesbeek River catchment and the Two Rivers Park (Observatory) **Funder(s):** Friends of Liesbeek **Contact person:** Dr Kevin Winter

This project deals with the design and feasibility of sustainable urban drainage systems and measures to adapt to changing climatic and urban densification conditions in the catchment. The development of the project is a collaborative exercise within a community of practice and aims to build an understanding of urban river systems through data collection and analysis.

Project partners: Friends of the Liesbeek, UCT Urban Water Management, City of Cape Town and stakeholders (project is implemented jointly by the EGS Department and the Department of Civil Engineering)

Timeframes: 2 years (2014 to 2016) **For more information**: www.wsud.co.za

Education Programmes

MPhil Degree in Environment, Society and Sustainability

Focus areas: n/a **Contact person:** -

The general aims of the Environmental, Society and Sustainability Masters programme are to produce graduates who have: a broad understanding of major environmental issues in Africa and around the world, as well as theoretical ideas underpinning sustainable development; and, the ability to effectively analyse and manage environmental and developmental issues, with emphasis on the southern African situation.

For more information: http://www.egs.uct.ac.za/mphil.html

Courses/ short courses

Sustainability and the Environment (EGS3021F)

Focus areas: n/a **Contact person:** -

The course aims to develop an understanding of key concepts and principles in the fields of sustainability, integrated environmental management and disaster risk science. It also comprises an applied component where students are introduced to various methods and tools for analysing environmental problems and integrating risk reduction as well as sustainability principles into planning and decision-making processes.

For more information: http://www.egs.uct.ac.za/undergrad.html

African Climate & Development Initiative (ACDI)

Type: Research initiative

Department/s: Environmental & Geographical Science Department

Faculty/s*:* Faculty of Science

Website: http://www.acdi.uct.ac.za/

Director: Professor Mark New (mark.new@uct.ac.za)

Main contact points: Dr Lorena Pasquini (lorena.pasquini@gmail.com)

The vision of the ACDI is to help create a developing world that has transitioned to a sustainable growth trajectory and has the capacity to mitigate and adapt to climate change and its related issues, through supporting the effective management of these challenges on the African continent and beyond.

The ACDI is UCT's active response to the climate change and development challenge. It was set up in 2011 by the University of Cape Town's (UCT) Vice-Chancellor Max Price as one of four strategic initiatives, each contributing to UCT's mission to tackle key issues in the social and natural worlds. Uniquely, the ACDI merges climate change issues with development issues, bringing together UCT's breadth and depth of research and teaching in these areas, which previously were conducted largely in isolation within a variety of departments and research centres.

As a cross-cutting, interdisciplinary initiative the African Climate and Development Initiative is working across numerous fields and faculties to consolidate and coordinate the climate change research that is being done at UCT. The ACDI focuses on 4 categories of climate change research: Mitigation; Vulnerability, Impacts and Adaptation; Climate Science; and Sustainable Development.

Research Programmes & Projects

Developing a SARUA Master's Curriculum and Courseware in Climate Change and Sustainable Development
Project focus areas: southern Africa **Funder:** CDKN **Contact person:** Leigh Cobban (leigh.cobban@uct.ac.za)
The University of Cape Town is currently leading a consortium of southern African universities to develop a curriculum in climate change at the Masters level, following a call from the Southern African Regional Universities Association (SARUA) for a Curriculum Innovation Network. SARUA is a Vice-Chancellor-level membership organization that represents the leadership of universities in the SADC region. The SARUA Curriculum Innovation Network follows a climate change capacity regional needs analysis and mapping study undertaken by SARUA from 2012 – 2014. This mapping study identified capacity gaps and needs in the SADC region related to climate change and development.

The project will draw from the team's collective expertise in climate change higher education to develop new, innovative curriculum and courseware. The consortia's expertise comprises pedagogical research and curriculum development experience, as well as climate change research expertise covering numerous important areas of specialism (including agriculture, ecosystems, DRR, adaptation, vulnerability, climatology). The methodology for developing a curriculum includes an analysis of policy requirements and a situation analysis, including consultation with possible future employers of graduates, from different sectors (public, private and academic). The work includes integrating measures to ensure that the curriculum can be customised and made relevant to different contexts (through elective streams, modules oriented around pathways for specialisation, and guidelines for using and developing appropriate case studies). The final curriculum will be flexible for inclusion in different universities and country contexts, and will have a strong interdisciplinary and integrated systems framing.

Project partners: the University of Namibia, the University of Mauritius, Rhodes University (South Africa), Eduardo Mondlane University (Mozambique), Sokoine University of Agriculture (Tanzania), and the Open University of Tanzania
Status: This project will run for the next 18 months, with the remainder of 2015 focused on the development of the curriculum (including core and elective modules) and drafting of courseware. **For more information**: http://www.sarua.org/

Berg River Climate Knowledge Network

Project focus areas: Bergrivier Municipality, West Coast District Municipality, the Western Cape
Funder: Carnegie Foundation
Contact person: Mark New /Kirsty Nortje (kirsty.nortje@uct.ac.za)

The ACDI's Berg River Climate Knowledge Network (CKN) brings together a network of academics, practitioners and civil society members, to facilitate knowledge sharing, relationship building and applied interdisciplinary research. The various current activity threads of the groups (including PhD and Masters student research scholarships, reading groups, supervision of various students working within the West Coast District, seminars and engagement with local communities on pressing needs) are vehicles for both sharing and co-producing knowledge.

Project partners: Multiple academic departments and partners from the region **Status:** Ongoing
For more information: http://www.acdi.uct.ac.za/research/berg-river-climate-knowledge-network

ASSAR: Adaptation at Scale in Semi-Arid Regions
Project focus areas: Semi-arid areas across Africa and Asia
Funder: Canada's International Development Research Centre (IDRC) and UK Department of International Development (DfID) **Contact person:** Dian Spear (dian.spear@uct.ac.za)

The ASSAR project aims to improve understanding of climate change in semi-arid areas across Africa and Asia, preparing the communities and governments for the potential impacts of climate change.

The ASSAR research aims to: understand how climate change might interact with other factors to affect the poor and vulnerable in semi-arid areas; develop a better understanding of what works and doesn't in building adaptive responses to climate change; identify the scientific, technical, social and political-economic barriers and enablers for effective adaptation, from local to national scales.

Project partners: Oxfam, START, University of Botswana, University of Namibia, University of East Anglia, IIHS Bangalore
Status: 5 year project, from 2014 to 2018
For more information: http://acdi.uct.ac.za/news/assar-adaptation-scale-semi-arid-regions

FLOW – Fostering Local Wellbeing
Project focus areas: Bergrivier municipality, Western Cape and Kokstad, KZN
Funder: The South African National Treasury **Contact person:** Gina Ziervogel (gina@csag.uct.ac.za)

The FLOW project aims to improve and support local wellbeing and self determination, with specific focus on the following challenges: poverty, inequality and dependency; youth employment and lack of skills; environmental challenges (eg. Climate change, resource depletion, pollution and others); and lack of money to do projects and start businesses. The project supports youth entrepreneurship through the FLOW ambassadors and is supporting the launch of a community currency, with the support of the Bergrivier municipality.

Project partners: Meshfield **Status:** September 2014 – August 2015
¨**For more information**: http://flowafrica.org/

SmartAgri
Project focus areas: The Western Cape **Funder(s):** The Western Cape Department of Agriculture (DOA) and the Western Cape Department of Environmental Affairs and Development Planning (DEADP) **Contact person:** Dr Stephanie Midgley (stephanie.midgley@gmail.com); Nadine Methner <nmethner@gmail.com>
The Smart Agriculture for Climate Resilience (SmartAgri) project is a collaborative project between the DOA and the DEADP, and the University of Cape Town's African Climate and Development Initiative (ACDI), and is aimed at creating sustainable climate smart responses for increased resilience in agriculture. The project will result in a provincial climate change response framework and implementation plan for the agricultural sector.

Project partners: DOA and DEADP **Status:** 4 year project, from 2014-2016
For more information: http://www.acdi.uct.ac.za/research/smartagri

Sustainable Economic Development in Water Constrained Catchments
Project focus areas: Saldanha Bay and Berg River Catchment
Funder(s): Water Research Commission (WRC) and Green Cape **Contact person:** Mark New (mark.new@uct.ac.za)

This project is a partnership between the ACDI and Green Cape, a Sector Development Agency established by the Western Cape Provincial Government and The City of Cape Town. It is is co-funded by the Water Research Commission and Green Cape. Water is increasingly becoming a potential constraint on socio-economic development over much of South Africa. Many river catchments, including the Berg River in the Western Cape Province are already fully exploited, and further socio-economic development will either require accessing non-traditional water sources such as desalination or water re-use, and/or trade-offs between demands on existing sources. However, water resources and economic development plans are generally each treated independently in the planning of the other, often entrenched by the independent planning protocols such as Integrated Development Plans, Water Services Development Plans, and Master Plans. The aim of this

project is therefore to develop and test a set of tools and methods that better allow for integration of water planning into development planning, and vice versa. The project will use Saldanha Bay, which draws water from the Berg River, as a case study. Saldanha is a hot-spot for development planning because of its status as an Industrial Development Zone (IDZ), and the potential for increased demand for water as a function of economic development within and around the IDZ.

Project partners: Green Cape **Status:** April 2015- March 2018

Green Skills: Building capacity for a sustainable future

Project focus areas: South Africa **Funder:** Green Fund **Contact person:** Leigh Cobban (leigh.cobban@uct.ac.za)

The Green Skills is a project of the National Environmental Skills Planning Forum and the Green Fund. The Green Skills project works to facilitate a more proactive approach to green skills planning in South Africa, focusing on a system-based approach to capacity building.

The Green Economy is a key driver for green skills development. This transformative economy is often seen as having the potential to create large numbers of green jobs, but these have not been quantified and there has been little associated skills planning. Key components of the project include a scoping study of green skills research and planning methodologies and approaches; training materials and training programme; a toolkit for organisational development that helps to unlock, plan and budget for green jobs & greening of jobs along the value chain of an organisation or sector.

Project partners: Led by Rhodes University with UCT, University of the Western Cape (UWC), Wits University, Department of Environmental Affairs (DEA), Wildlife and Environment Society of South Africa (WESSA), the World Wildlife Fund (WWF), GreenMatter, South African National Biodiversity Institute (SANBI) and others under the National Environmental Skills Planning Forum

Status: 3 year project, from 2015 to 2018 **For more information**: Site under development

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Monitoring and Tracking Climate Resilience

Project focus areas: South Africa **Funder(s):** GIZ

Contact person: Kirsty Nortje (kirsty.nortje@uct.ac.za) or Leigh Cobban (leigh.cobban@uct.ac.za)

Led by Mark New with support from ACDI research assistants in collaboration with the Department of Development Affairs, funded by Deutsche Gesellschaft fur Internationale Zusammenarbeig (GIZ). A number of contributing experts and authors worked to build understanding on how South Africa is transitioning to a more climate resilient society, and the process might be tracked and measured. This work was received well the National Climate Change Response Dialogue hosted by the DEADP in Johannesburg in December 2014.

Project partners: DEADP **Status:** June- Dec 2014 **For more information**:

Scientific Capacity Development (SCD) study: Analysis of barriers, opportunities and good practice in Africa

Project focus areas: Africa

Funder: Climate Development Knowledge Network (CDKN) (Future Climate for Africa (FCFA) Applied Research Fund)

Contact person: Leigh Cobban (leigh.cobban@uct.ac.za)

ACDI is leading a study in scientific capacity development (SCD) in Africa, with support from CSAG, START and INTASAVE. The SCD study is financially supported by CDKN, on behalf of the Future Climate for Africa (FCFA) research program. FCFA is a 5-year program to enhance scientific understanding and prediction of extreme weather and climate in sub-Saharan Africa.

A central component of FCFA involves the development of scientific capacity in Africa, and the SCD study will help to inform FCFA's scientific capacity development work, including recommendations based on a portfolio of potential SCD activities and approaches for FCFA. Other key outputs include a literature review with detailed case studies, database of SCD activities, and an evaluation framework for SCD activities.

Project partners: START, INTASAVE, Climate Systems Analsysis Group (CSAG), Rhodes University's Environmental Learning & Research Centre **Status**: 7 months, from December 2014 to July 2015

For more information on FCFA: http://futureclimateafrica.org/

Regionally-extensive droughts and climate change in Southern Africa: mechanisms, model reliability and projections

Project focus areas: Southern Africa **Funder(s):** Water Research Commission

Contact person: Babatunde Abiodun (Babatunde.Abiodun@uct.ac.za)

A three year project, led by Dr Babatunde Abiodun in CSAG/EGS, that explores the nature of widespread droughts in Southern Africa and their likely frequency and extent in the future. Research will be undertaken in Gauteng and the Western Cape. The project partly funds three graduate students in EGS, and also involves Prof Mark New (ACDI) and Dr Mathieu Rouault (Oceanography).

Project partners: South African Weather Service (Research Department), Council for Scientific and Industrial Research (CSIR) (Climate Studies, Modelling and Environmental Health Department)
Status: 01/04/2014- 31/05/2017 **For more information**:

NIE Scenarios Project

Project focus areas: South Africa **Funder(s):** NIE SANBI via Indigo
Contact person: Mark New (mark.new@uct.ac.za)

Indigo Development & Change contracted the ACDI to conduct the climate modelling aspect of the Long-Term Adaptation Scenarios Flagship Research Programme (LTAS) proposal. SANBI is the NIE for the LTAS project. The aim of the ACDI's involvement was to analyse the downscaled climate model results for the areas of Mopani and Namakwa, South Africa, at the district municipality scale.

Project partners: Indigo Development and Change **Status:** **For more information**:

CCAFS Near-term Climate Project

Project focus areas: South Africa , Zimbabwe, Malawi, Tanzania **Funder(s):** CGIAR
Contact person: Mark New (mark.new@uct.ac.za), Peter Johnston (peter@csag.uct.ac.za)

The project aims to understand the potential of new climate modelling efforts to provide useful information on climate change for the food and agriculture sector on timescales of the next few decades and at the same time to evaluate the ways in which in which food producers are vulnerable to near term climate change. The project involves case studies in South Africa, Zimbabwe, Malawi and Tanzania, as well as climate modelling analysis over the entire African continent.

Project partners: **Status:** 2012-2015 **For more information**:

IDRC IHACC (Indigenous Health and Climate Change)

Project focus areas: Peru **Funder(s):** McGill University/IHACC. **Contact person:** Mark New (mark.new@uct.ac.za)

The ACDI, in collaboration with McGill University, Montréal, Canada, is working on a project in Peru under the auspices of the Indigenous Health Adaptation to Climate Change (IHACC). The aim of the project is to model the precipitation climate of the Ucayali River catchment – upstream of the town of Panaillo, Ucayali Region, Coronel Portillo Province, Peru – in order to inform adaptation strategies relating to the specific on-site vulnerability to flooding of the river-side towns. This includes analysis of historical hydrology and rainfall as well as projection of the precipitation climate for various periods and under differing scenarios. The ACDI aspect of this project – a report – was completed by the end of March 2015. The ACDI's Christopher Brodrick (research assistant) conducted this research, under the guidance of Professor Mark New.

Project partners: McGill University, Canada **Status:** 2012-2015 **For more information**:

Food, Energy, Water, Land-Use & Biodiversity (FEWLB) Nexus

Project focus areas: Berg River Catchment
Funder(s): The British High Commission and the Cape Higher Education Consortium (CHEC)
Contact person: Dr Stephanie Midgley (stephanie.midgley@gmail.com)

The FEWLB Nexus project looks to inform decision making and project development to foster sustainable resource use and development within the Berg River catchment area. It is a 3 phased project that looks to inform decision making and project development to foster sustainable resource use and development within the Berg River Catchment area.

Project partners: DEADP and Berg River stakeholders **Status:** 01/06/2013 - 30/06/2014
For more information: http://www.fewlbnexus.uct.ac.za/

China and South –South Scoping Assessment for Learning and Development (CASSALD)

Project focus areas: Ten countries across three regions including Africa (Angola, Ethiopia, Kenya, South Africa, Rwanda); Asia (Bangladesh, Nepal, Indonesia) and the Caribbean (Grenada, Jamaica)
Funder(s): UK Department of International Development (DFID) China, the Swiss Agency for Development Cooperation, DFID Research and the UK Department for Energy and Climate Change (DECC)
Contact person: Mark New (mark.new@uct.ac.za)

CASSALD is a project which forms part of a larger initiative, Adapting to Climate Change in China (ACCC). The ACCC is an innovative policy research initiative focusing on linking climate change research with policy making and development.

The overarching aim of Phase 1 of the China and South-South Scoping Assessment for Learning and Development initiative is to identify key opportunities and avenues for South-South learning and climate compatible development and how to best channel resources to share China and developing countries' experiences of integrating climate adaptation into the development process. The ACDI has contributed to the South African case study.

Project partners: Intasave **Status:** 2012 to 2013
For more information: http://www.acdi.uct.ac.za/research/cassald-china-and-south-south-scoping-assessment-learning-and-development

Saldanha Bay Municipality Scenario Building: a road to sustainable growth and development?

Project focus areas: Saldanha Bay **Funder(s):** The British High Commission **Contact person:** Dr Lorena Pasquini

The project aimed to bring together stakeholders from a spectrum of social, economic, environmental and political backgrounds that are involved in economic development in the Saldanha Bay (SB) area for a scenario building process. The view was to facilitate a process of knowledge-sharing and collaboration between the stakeholders in order to begin to develop an integrated, common vision for sustainable economic development in the area.

Project partners: Reos **Status:** Nov 2012 - June 2013
For more information: http://www.acdi.uct.ac.za/research/saldanha-bay-municipality-scenario-building-road-sustainable-growth-and-development

Global Islands' Vulnerability Research, Adaptation, Policy and Development Project (GIVRAPD)

Project focus areas: Global islands **Funder(s):** CDKN **Contact person:** Sarah Corry. sarah.corry@intasave-caribsave.org

The project is designed to utilize a common community-based vulnerability assessment (CBVA) framework to integrate scientific and local knowledge from comparative 'learning sites'. The aim is to understand the multi-scale socioeconomic, governance and environmental conditions that shape vulnerability and capacity to adapt to climate change within and between small and medium sized coastal communities. The ACDI is one of the partners working on the GIVRAPD project. They are providing research assistants to undertake the CBVA's as well as contributing to the climate science aspect of the project and the downscaling of climate models for each case study site.

Project partners: CARIBSAVE (lead partner), University of Waterloo, University of Oxford, Global Climate Adaptation Partnership, University of Mauritius, CaribRM, Munich Climate Insurance Initiative, St Mary's University and the Governments of St Lucia, Jamaica, Mauritius, Seychelles and Trinidad and Tobago

Status: 2 year project, June 2012 - 31 May 2014 **For more information**: http://givrapd.org/about/

Education Programmes

Masters in Climate Change and Development

Focus areas: Africa **Contact person:** Dr Marie-Ange Baudoin (marie-ange.baudoin@uct.ac.za)

This full time one-year taught Master's course provides interdisciplinary training in climate change and sustainable development, with a focus on the issues of relevance to African development.

For more information: http://www.acdi.uct.ac.za/study/msc

Climate Systems Analysis Group (CSAG)

Type: Research Group

Department/s: Environmental and Geographical Science Department

Faculty/s: Faculty of Science

Website: http://www.csag.uct.ac.za/

Head of the Unit: Bruce Hewitson (hewitsen@csag.uct.ac.za)

Main contact points: Research: Chris Jack (cjack@csag.uct.ac.za /Climate Services: Anna Steynor (asteynor@csag.uct.ac.za)

CSAG aims to address the climate change knowledge needs of developing nations, delivering tailored information, building capacity within the continent and engaging with users around adaptation, policy and impact. Their work includes generating regional climate information (climate modelling), and dissemination of decision-relevant information. While CSAG is a research unit, their Climate Services Team provides some consultancy services, including climate information, impact analysis, vulnerability assessments and bespoke training on how to interpret and use climate information.

Research Programmes & Projects

Seasonal Forecasts - Global Forecasting Centre for South Africa

Project focus areas: Southern Africa **Funder(s):** Unfunded **Contact person:** Dr Chris Lennard (lennard@csag.uct.ac.za)

CSAG produces a seasonal forecast for Southern Africa.

Project partners: - **Status:** Ongoing, continuous

For more information: http://www.gfcsa.net/

Co-ordinated Regional Downscaling Experiment (CORDEX)

Project focus areas: Africa **Funders:** World Climate Research Programme (WCRP) **Contact person:** Dr Chris Lennard

The task of this programme is to organize an internationally coordinated framework to produce an improved generation of regional climate change projection information world-wide for input into impact and adaptation studies within the AR5 timeline and beyond. CSAG has been extensively involved in CORDEX from its original conception through to the present. In particular, CSAG has been the lead institution for the CORDEX Africa activities including capacity building workshops, publications "write shops", and community network development.

Project partners: Large number of contributing groups across the world **Status:** Ongoing, continuous

For more info: http://wcrp-cordex.ipsl.jussieu.fr/

The CORDEX Africa Analysis Campaign

Project focus areas: Africa **Funders:** WCRP **Contact person:** Chris Lennard

CSAG sources funding for and co-ordinates CORDEX-Africa activities. The CORDEX Africa Analysis campaign is designed around the following ethos:

A – Analysis; Developing methods and tools to analyse atmospheric processes over Africa and how these may change into the future

F – Foci; Addressing key meteorological and impacts knowledge gaps

R - Regional messages; Presenting information for key regions in the continent

I – Integrated approach; Bringing together climate and vulnerability-impact-adaptation scientists to identify and address key climate vulnerabilities

C – Capacity development; Long-term collaboration between African scientists and key global institutions for career development

A – Application and Adaptation; Bridging the science-society divide through transforming climate data to actionable information

Project partners: Global Change System for Analysis Research and Training (START), Swedish Meteorological and Hydrological Institute **Status:** Ongoing, continuous **For more information**: -

Southern Africa Agricultural Model Intercomparison and Improvement Project (SAAMIIP-2)

Project focus areas: South Africa, Namibia and Botswana **Funder:** The Agricultural Model Inter-comparison and improvement Project (AgMIP) **Contact person:** Dr Olivier Crespo (olivier@csag.uct.ac.za)

Based on website with input from representative

SAAMIIP Phase 2 regional integrated assessment (RIA) will build on the work done in Phase 1. The main focus will be to update, improve and document previous inputs and outputs where possible for South African commercial maize farming systems, and the small scale farming systems in Namibia and Botswana. To complement the latter two regions two new small sale farming locations in South Africa will be added.

Project partners: Led by the Agricultural Research Council (ARC), in cooperation with Facilitation of Systemic Change Consulting, University of Venda, Botswana College of Agriculture, Polytechnic of Namibia and University of the Free State
Status: 2 year project, from May 2015-April 2017 **For more information**:-

Crop-livestock intensification in the face of climate change (CLIP-2)

Project focus areas: Zimbabwe, Malawi, Mozambique **Funders:** AgMIP **Contact person:** Dr Olivier Crespo

Building on results from CLIP-phase 1 this project aims at reducing poverty and enhancing resilience to climate change, building pathways for sustainable futures for smallholder crop-livestock systems in semi-arid southern Africa.

Project partners: Led by the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), together with the International Center for Research in Agroforestry (ICRAF), University of Zimbabwe, Lilongwe University of Agriculture and Natural Resources and Instituto de Investigacao Agraria de Mozambique

Status: 2 year project, from May 2015-April 2017 **For more information:** http://www.agmip.org/

Integrated use of seasonal forecast for community preparedness to climate variability

Project focus areas: Southern Africa **Funder:** Water Research Commission (WRC) **Contact person:** Dr Olivier Crespo

The aim of this project is to develop an operational and robust climate-crop-water integrated assessment tool for the production of medium scale agricultural forecasts (including water demand).

Project partners: University of Fort Hare, University of Venda, the Council for Scientific and Industrial Research (CSIR), the Centre for Water Resources Research (CWRR), the Agricultural Research Council and South African Weather Service (SAWS)
Status: 2 year project, from 2015 to 2017 **For more information**:-

Climate Change Adaptation Assessments, Thought Leadership, and Learning (ATLAS)

Project focus areas: International **Funder(s):** USAID, subcontracted through Chemonics **Contact person:** Anna Steynor (asteynor@csag.uct.ac.za)

The ATLAS project is aimed at improving the quality and effectiveness of USAID's and countries' development programs to reduce climate risks through: tested and harmonized approaches to assessment; thought leadership; and capacity building of USAID and its partners.

Project partners: - **Status:** 5 year project, from January 2015 to December 2019 **For more information**: -

Exploration of attribution for extreme agricultural events in Limpopo

Project focus areas: Limpopo River Basin **Funder:** Oxford funded from the Oppenheimer Fund **Contact person:** Dr Olivier Crespo

This piece of research works towards addressing the following objectives: develop a comprehensive understanding of climate-crop event attribution; define an attribution experimental design for the Limpopo River Basin, South Africa; undertaken the attribution analysis using ensemble weather model attribution datasets; report on case study outcome and lead a scientific paper in an international journal; add value to regional climate-crop on-going study in the area by interacting/developing an attribution component; launch/participate/improve research proposals for regional funding and the strengthening of attribution studies in southern Africa.

Project partners: Environmental Change Institute (Oxford) **Status:** 3 month project, from April to July 2015
For more information:-

IDRC Communities of Practice

Project focus areas: International **Funder(s):** Canada's International Development Research Centre (IDRC)
Contact person: Anna Steynor

This project aims to advance knowledge on processes for strengthening climate change analytical and communication skills among experts from the hydrological/impact modeling and policy communities, using participants from Climate Change and Water (CCW)-supported projects in Latin America, Africa and Asia as the target group

Project partners: START **Status:** 2 year project, from March 2014 to February 2016 **For more information**: -

Wind Atlas for South Africa (WASA) – Phase 1&2

Project focus areas: South Africa **Funder(s):** Danish Embassy and Global Environment Facility (GEF) **Contact person:** Dr Chris Lennard

The projects is divided into a number of work packages which include an observations campaign, high resolution as well as microscale modeling, extreme wind climate assessment, wind climate assessment techniques as well as data dissemination. The cumulative objective of these efforts is to generate a very high resolution wind atlas for South Africa to provide stakeholders with knowledge allowing them to make informed decisions. WASA phase 1 has produced the atlas for

the western and southern parts of South Africa and WASA Phase 2 will do the same for the eastern and central parts of the country.

Project partners: South African National Energy Development Institute (SANEDI), SAWS, CSIR, Danish Technological University
Status: Phase 1: 2010-2014, Phase 2: 2014-2018
For more information: http://www.wasaproject.info

Land use change: assessing the net climate forcing, and options for climate change mitigation and adaptation (LUC4C)

Project focus areas: n/a **Funder(s):** The European Union 7th Framework Programme for Research and Technological Development (EU-FP7) **Contact person:** Dr Chris Lennard

The interplay between land use and climate change is fundamental in understanding land-based climate mitigation options and how societies will adapt to climate change in the future. LUC4C aims to provide progress towards quantitative understanding of impacts and feedbacks in the coupled human-land-climate system, and the role people play.

Project partners: A large number of partners **Status:** 2014-2018 **For more information**: -

Water Harvesting Toolkit

Project focus areas: n/a **Funder(s):** WRC **Contact person:** Rodger Duffett (rodger@csag.uct.ac.za)

The CIP is a rich source of climate related information. This project aims to extend access to that information by providing an easily accessible toolkit to assess water harvesting capacity. The location, catchment and storage information are provided by the user for analysis against rainfall data using a simple hydrological model. The first instance of the toolkit is for rainwater harvesting off hard surfaces such as roofs. The second instance in development will be to extend that to primary catchment analysis for modelling small dam catchments.

Project partners: - **Status:** 2 year project, September 2014 to September 2016
For more information: http://cip.csag.uct.ac.za/webclient2/waterharvest/

UAV Sonde

Project focus areas: [geographic focus] **Funder(s):** National Research Foundation (NRF) Innovation Fund **Contact person:** Rodger Duffett

Unmanned aerial vehicles are a trending phenomenon! CSAG and Interment Africa have been at the forefront of this using the UAV as a platform for boundary layer atmospheric measurement. The project is working toward developing a boundary layer sounding system that could be used for collecting basic atmospheric data and in carrying diverse sensor packages for environmental monitoring.

Project partners: Interment Africa **Status:** 2011-ongoing
For more information: -

Future Climate for Africa (FCFA) Pilot Case studies

Project focus areas: Africa **Funder(s):** Climate & Development Knowledge Network (CDKN)
Contact person: Anna Steynor

The purpose of this project and workshop was to inform the wider development of the Future Climate for Africa (FCFA) programme. For CSAG, it was an opportunity to further explore an approach to place-based decision-making using climate change information. The learning from this project's activities was then used to inform the thinking on the use of long-term climate information in an African context, through the development of the FCFA programme.

Project partners: START and Stockholm Environment Institute (SEI) **Status:** 6 month project, from May 2014 to Oct 2014
For more information: -

Fynbos Fire

Project focus areas: Fynbos Biome **Funder(s):** Global Environment Fund (GEF) through the Fynbos Fire Project **Contact person:** Rodger Duffett

The Fynbos Fire Project has a number of aspects each related to the assessment and management of fire within the Fynbos Biome. The project is working with a range of stakeholders in the various regions that form part of the biome. CSAG and Intermet Africa have partnered to provide automatic weather stations installed at strategic locations around the Fynbos Biome. CSAG will curate data from these weather stations that will form an invaluable resource for research in the Biome. In addition to fire management and risk assessment a key outcome of the project is ongoing research into fire regimes and potential linkages to climate change.

Project partners: Intermet Africa **Status:** Funded from April 2013 to April 2015, with an extension to install additional stations till December 2015
For more information: http://fynbosfire.org.za/ / http://www.wmon.co.za

Downscaled Climate Modelling for local authorities (and water basins) in Southern Africa

Project focus areas: Southern African Development Community (SADC) **Funder(s):** Local Governments for Sustainability (ICLEI) **Contact person:** Anna Steynor

As part of the five year European Commission funded 'Sustainable Urban Resilient (SURe) Water for Africa: Developing Local Climate Solutions' project, CSAG was commissioned to provide reports on six Implementing Local Authorities (ILAs) within SADC. The reports outlined current vulnerabilities together with present, past and projected future climate for each of the ILAs.

Project partners: - Status: 9 month project, from Oct 2013 to June 2014 **For more information**: -

Climate Science input into Municipal Climate Adaptation Plans: Phase 1&2

Project focus areas: Western Cape **Funder(s):** Western Cape Government **Contact person:** Anna Steynor

In Phase 1 CSAG was contracted by the Western Cape Government to provide climate analysis for three Western Cape Municipalities.

In Phase 2 CSAG undertook a general review of climate information sources and their usefulness to the stakeholders across the province. The report included; a review of available sources of climate information, pros and cons of the various sources, the most relevant application of these sources to different decision contexts and shortfalls and disclaimers associated with the various sources.

Project partners: - **Status:** Phase 1: March 2012 to March 2013, Phase 2: March 2013 to March 2014

For more information: -

Southern Africa Agricultural Model Intercomparison and Improvement Project (SAAMIIP-1)

Project focus areas: Southern Africa **Funder:** AgMIP **Contact person:** Dr Olivier Crespo

CSAG contributed to this project whereby an expert team of climate, crop, economic, and IT research scientists in Southern Africa evaluated the impact of climate change on the production and prices of important crops. A simultaneous goal within the project was to build human and institutional capacity to explore and evaluate these impacts and associated field management adaptation strategies on food prices and production.

Project partners: Led by the ARC, together with University of the Free State, South African Sugar Research Institute, Human Sciences Research Council South Africa and Swaziland Meteorological Services **Status:** 2 year project, from May 2012 - February 2014 **For more information**:-

Crop-livestock intensification in the face of climate change (CLIP-1)

Project focus areas: Southern Africa **Funders:** The Agricultural Model Inter-comparison and improvement Project (AgMIP) **Contact person:** Dr Olivier Crespo

The overall aim of this project was to identify pathways to improve food security in southern Africa's mixed crop livestock systems and develop adaptive management strategies to reduce climate induced risks and to increase systems resilience.

Project partners: Led by ICRISAT

Status: 2 year project, May 2012-February 2014 **For more information:** http://www.agmip.org/

Household Vulnerability to Disasters: An Application of the Household Vulnerability Index (HVI)

Project focus areas: Eastern Cape and Limpopo **Funders:** IDRC

Contact person: Dr Olivier Crespo

The purpose of this project is to use the Household Vulnerability Index (HVI) to assess rural household vulnerability to climate change- disasters, in terms of food and water security; so as to provide the basis for strategic interventions as well as recommending a potential suite of fiscal and economic measures to be used to improve the resilience of communities to climate change for targeted beneficiaries. The study focuses on the Eastern Cape and Limpopo provinces: two provinces that have been singled out as more vulnerable to disasters.

Project partners: The Financial and Fiscal Commission (FFC) and the Food, Agriculture and Natural Resource Policy Analysis Network (FANPRAN) **Status:** 5 month project, from October 2013 to February 2014

For more information: -

Healthy Futures

Project focus areas: Eastern Africa **Funders:** EU FP7 **Contact person:** Lisa Coop (lcoop@csag.uct.ac.za)

The project aims to build a disease risk mapping system for three water-related high-impact VBDs (malaria, Rift Valley fever (RVF) and schistosomiasis) in Africa, accounting for environmental/climatic trends to predict future risk. The project comprises a comprehensive, inter-disciplinary consortium of health, environment, socio-economic and climate experts in addition to governmental health departments.

Project partners: Trinity College Dublin (lead), together with 16 partners **Status:**

For more info: http://www.healthyfutures.eu/index.php?option=com_k2&view=item&layout=item&id=78&Itemid=97

Malawi Department for Climate Change and Meteorological Services (DCCMS) Capacity Building Project

Project focus areas: Malawi **Funder(s):** The World Bank **Contact person:** Anna Steynor

CSAG engaged in this year-long project with the Malawi Department for Climate Change and Meteorological Services (DCCMS). The primary objective of CSAG's involvement in this project was to develop and support training and capacity development within DCCMS with the goal of enhancing DCCMS's production and delivery of climate information to end

users. To meet this objective, CSAG worked with key personnel in DCCMS to address key issues related to existing infrastructure, skills, methods and tools.

Project partners: Malawi Department for Climate Change and Meteorological Services (DCCMS)

Status: 1 year project, 2012 – 2013 **For more information**: -

Linking stakeholders with integrated climate change data

Project focus areas: n/a **Funder(s):** CDKN **Contact person:** Anna Steynor

This project focused on two priorities; the integration of information sources in a heterogeneous and globally distributed context, and the tailoring of data into relevant information products communicated in a framework that facilitates stakeholder flexible exploration for sector specific knowledge needs.

Project partners: UK Climate Impacts Programme (UKCIP) and NASA Jet Propulsion Laboratory (JPL)

Status: 1 year project, from March 2012 to March 2013 **For more information**: -

Berg River Municipal Workshops as part of the Western Cape Government Municipal adaptation support programme

Project focus areas: Berg River Municipality **Funder(s):** Western Cape Government **Contact person:** Anna Steynor

In collaboration with the Western Cape Government and CSIR, CSAG ran a series of three workshops in the Berg River Municipality. The focus of the workshops was on integrating climate information into municipal adaptation plans.

Project partners: CSIR **Status:** 7 months project, from August 2012 to February 2013 **For more information**: -

Climate Change Vulnerability Modelling, Indices Development and Downscaling Refinement in Malawi

Project focus areas: Malawi **Funder(s):** USAID, subcontracted by Tetra-Tech ARD **Contact person:** Anna Steynor

CSAG provided an assessment of climate vulnerability, climate modelling and downscaling support for the Malawi vulnerability assessment. CSAG also hosted staff from the Department of Climate Change and Meteorological Services (Malawi) in Cape Town for a capacity building activity.

Project partners: - **Status:** 8 month project in the period 2012-2013 **For more information**: -

Strengthening Evidence-Based Climate Change Adaptation Policies (SECCAP) Project

Project focus areas: Lesotho, Malawi, Swaziland **Funders:** The International Development Research Centre (IDRC)
Contact person: Dr Olivier Crespo

Through focus on three SADC countries, Lesotho, Malawi and Swaziland, this project aimed to contribute to evidence-based decision making for policy makers and development practitioners through a systematic research process integrating climate, crop production and livelihoods data, and by carrying out cost benefit analysis on the identified adaptation options.

Project partners: FANPRAN (lead), Development Data, National University of Lesotho, University of Malawi, World Vision International, the International Food Policy Research Institute (IFPRI) and University of Swaziland

Status: 3 year project, from April 2011 to March 2014 **For more info:** http://www.fanrpan.org/projects/seccap/about/

Improving Seasonal Forecast Information for Managing On-farm Decisions

Project focus areas: n/a **Funders:** START
Contact person: Dr Olivier Crespo

This project examined how seasonal forecast development and delivery can be enhanced through testing downscaled climate forecasts for improving information from seasonal forecasts; tested the use of an optimization procedure to guide tactical decision making; and highlighted where improvements in communicating seasonal forecast information may be achieved.

Project partners: - **Status:** 1 year project, from July 2011 to June 2012

For more info: -

Agriculture transforming to adapt to climate change: Peanut industry expansion in the Northern Territoryas a blueprint

Project focus areas: New and old peanut production regions **Funders:** Department of Agriculture, Fisheries and Forestries (Australian Government) **Contact person:** Dr Olivier Crespo

This project monitored the biophysical and social aspects of the peanut industry's transformation process in both the new and old peanut regions to identify the main influences on, and magnitude of the impacts of transformation.

Project partners: Commonwealth Science and Industrial Research Organisation (CSIRO)

Status: 3 year project, from 2009 to 2012

For more info: -

Adaptive interventions in agriculture to reduce vulnerability of different farming systems to climate change in South Africa

Project focus areas: South Africa **Funder:** WRC

Contact person: Peter Johnston (johnston@csag.uct.ac.za)

This project aims to investigate the impact of projected climate change on agriculture; assess the vulnerability of crops, rangelands and farming households and enterprises; and identify and suggest appropriate adaptive techniques and practices in selected catchments and farming areas.

Project partners: Optimal Agricultural Business Systems (OABS) and University of KwaZulu-Natal (UKZN)
Status: 6 year project, 2010-2016 **For more information**:-

Visualising climate information

Project focus areas: n/a **Funders:** Unfunded **Contact person:** Dr Joseph Daron (joseph.daron@metoffice.gov.uk)

In this project researchers at CSAG, in collaboration with colleagues at the University of Leeds in the UK, worked together to develop an empirical research base to inform the visualisation of climate information in Africa. The research was aimed at guiding the development of climate services across the continent and feed into the development of the Climate Information Platform, hosted by CSAG.

Project partners: University of Leads **Status:** Paper with results are currently under review
For more info: http://www.csag.uct.ac.za/2014/03/26/visualising-climate-information-survey-results/

Projected changes in extreme rainfall over South Africa

Project focus areas: South Africa **Funder(s):** WRC **Contact person:** Dr Chris Lennard

This project examines projected changes in extreme rainfall in the medium (2040-2060) and long term (2070-2099), and the synoptic drivers of this change.

Project partners: - **Status:** 2 year project, 2013-2015 **For more information**: -

Historical extreme rainfall changes over South Africa

Project focus areas: South Africa **Funder(s):** WRC **Contact person:** Dr Chris Lennard

Several studies have shown an increase in the intensity of extreme rainfall over many regions of South Africa as well as spatial heterogeneity in these changes, especially in the Eastern Cape, southern Free State and parts of Kwazulu-Natal. This study investigated changes in the characteristics of extreme rainfall by establishing relationships between existing station data and the daily synoptic states.

Project partners: - **Status:** 2 year project, 2010-2012

For more information: -

ClimAfrica - *Climate change predictions in Sub-Saharan Africa: impacts and adaptations*

Project focus areas: Sub-Saharan Africa **Funders:** EU FP7 **Contact person:** Chris Lennard

ClimAfrica's main objective is to better understand and predict climate change in SSA for the next 10-20 years, analysing the expected impacts on ecosystems and population and developing 16- IGAD Centre for Climate Prediction and adaptation strategies tailored to the African context. The role of CSAG in this project is to provide downscaled seasonal and decadal forecast data

Project partners: Coordinated by Euro-Mediterranean Centre for Climate Change, together with 18 institutions
Status: 4 year project, 2011-2015
For more info: http://www.climafrica.net/index_en.jsp

Limits to predictability

Project focus areas: - **Funders:** WRC **Contact person:** Dr Chris Jack (cjack@csag.uct.ac.za)

This project explores the limits to predictability of the climate system with a particular focus on seasonal forecasting in southern Africa. The intent of the project is to describe the interplay between determinism and chaos or stochasticism in the climate system at different spatial and temporal scales.

Project partners: - **Status:** **For more info: -**

Climate Information Portal (CIP) Development and Capacity Development

Project focus areas: n/a **Funder(s):** The United Nations Institute for Training and Research (UNITAR)
Contact person: Dr Chris Jack

This project was aimed at developing CSAG's Climate Information Portal (CIP) into an operational and user friendly platform that meets the needs of diverse clients and beneficiaries when undertaking regional and local climate change analysis.

Project partners: - **Status:** October 2011-April 2013 **For more information**: -

Education Programmes

Atmospheric Science Honours

Focus areas: n/a **Contact person:** Kate Sutherland (kate@csag.uct.ac.za)

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For more information: http://www.egs.uct.ac.za/honours.html

Courses/ short courses

Synoptic Climatology (EGS3012S)

Focus areas: n/a **Contact details:** -

The course focuses on atmospheric energy balance; winds and circulations; clouds and cloud formation; thermodynamics; rainfall and weather systems in the tropics and midlatitudes; general circulation of the atmosphere; South African weather and climate; droughts and floods.

For more information: http://www.egs.uct.ac.za/undergrad.html

CSAG Winter School

Focus areas: n/a **Contact details:** winterschool@csag.uct.ac.za

The CSAG Winter School is an intensive course aimed at mid-career professionals engaged in decision and policy development which may involve issues related to climate change and adaptation.

For more information: http://www.csag.uct.ac.za/winterschool/

CSAG also offers ad hoc training courses

Marine Resource Assessment and Management group (MARAM)

Type: Research group

Department/s: Department of Mathematics and Applied Mathematics

Faculty/s*:* Faculty of Science

Website: http://www.mth.uct.ac.za/maram/

Lead: Professor Emeritus Doug Butterworth (doug.butterworth@uct.ac.za)

Main contact points: Di Loureiro (di.lapidoloureiro@uct.ac.za)

The **MARAM Group** is concerned with quantitative studies related to scientific recommendations for conservation measures governing the utilisation of South African and some other of the world's renewable marine resources.

The focus of the Group's work is the assessment and management of renewable marine resources. 'Assessment' relates to the evaluation of the present size (in particular in relation to pre-exploitation levels) and the productivity of a resource, while 'management' pertains to the translation of this information into scientific recommendations on appropriate limitations for harvest levels. Most of the methods used at present to lead to such recommendations for South Africa's major commercial fisheries have been developed by the Group.

Group members also participate in the Scientific Committees of a number of international fishery commissions and related organisations (nine in recent years), and have also worked recently with government agencies in nine countries and with fishing industry organisations in seven. Associated with this, the Group has wide links with fisheries research groups in other countries.

Research Programmes & Projects

Sustainable fisheries – estimating fish stocks and providing advice for catch levels

Project focus areas: South African fisheries

Funder(s): Mainly the Cape Town-based Fisheries Branch of the South African Department of Agriculture, Forestry and Fisheries **Contact person:** Professor Doug Butterworth

The MARAM Group provides annual advice on sustainable fishery management procedures and catch limits for a number of fish species, including hake, horse-mackerel, kingklip, anchovy, sardine and round herring, as well as for rock lobster. The advice is based on research that combines information obtained from commercial catches together with research surveys and the indices of abundance which they provide; mathematical and statistical assessment techniques are then applied that estimate future abundance trends depending on the management approach applied.

Project partners: - Status: Continuous, updated every year based on new information

For more information: http://www.mth.uct.ac.za/maram/research/sa.php (for focus on international fisheries focus see http://www.mth.uct.ac.za/maram/research/international.php)

Fisheries management under climate and environmental uncertainty

Project focus areas: Fisheries world wide **Funder(s):** - **Contact person:** Professor Doug Butterworth

MARAM contributed to this research, which resulted in a publication in the ICES Journal of Marine Science. The research considered how environmental variation, including climate change, is best taken into account in quantitative approaches to achieve fishery management goals.

Project partners: School of Aquatic and Fishery Sciences and Joint Institute for the Study of the Atmosphere and Ocean at the University of Washington (USA), Commonwealth Science and Industrial Research Organisation (CSIRO) (Australia), Alaska Fisheries Science Centre (USA), CEFAS Lowestoft Laboratory and Northwest Fisheries Science Center (USA)

Status: Published in 2014 **For more information**: http://icesjms.oxfordjournals.org/content/71/8/2208.full.pdf+html

The projects of current Masters and PhD students with MARAM provide a further indication of their research focus:

PhD project: Modelling cannibalism and inter-species predation in Cape hake (*Merluccius* spp.)

Candidate: Andrea Ross-Gillespie

The project aims to extend the models used in the current South African hake assessments to include cannibalism and inter-species predation amongst the two hake species, in order to better inform decision-making on the management of the hake fishery at a national level and to contribute to the newly emerging field of fisheries multispecies modelling.

MSc project: Update of the Krill-Predator Dynamics of the Antarctic Ecosystem

Candidate: Naseera Moosa

The project aims to extend the 2006 Mori-Butterworth model of the krill-predator dynamics of the Antarctic ecosystem by taking account of updated data on abundances, possibly including additional predators to whales and seals, and considering the possible impact of environmental change. The aim is a better understanding of Antarctic ecosystem dynamics.

The Rangeland Ecology Group

Type: Loose affiliation of two researchers

Department/s: Department of Mathematics & Applied Mathematics

Faculty/s*:* Faculty of Science

Website: None

Lead: n/a

Main contact points: Dr Henri Lauri (henri.laurie@uct.ac.za)

The Rangeland Ecology Group is a loose affiliation of two researchers, Professor David Richardson and Dr Henri Lauri. David Richardson moved from animal science to modelling upon retirement, and has consistently worked to publish papers on models of all aspects of animal performance on rangeland. Henri Laurie is an applied mathematician working in ecological modelling.

Research Programmes & Projects

Intermittent high-intensity grazing (Informal title)

Project focus areas: Savanna ecosystems

Funder(s): None (University Research Committee (URC) grants provide a very small amount)

Contact person: Henri Laurie (henri.laurie@uct.ac.za)

A model for the interaction of herbivores and vegetation, where the vegetation cover and density dynamics and the animal density interacts, in a seasonally varying environment and where the animal density is manipulated via rotation among the grazed areas.

Project partners: None

Status: No clear completion date

For more information: -

Based on input from representative

Department of Molecular and Cell Biology

Type: Department

Department/s: -

Faculty/s*:* Faculty of Science

Website: http://www.mcb.uct.ac.za/

Head of Department: Associate Professor Vernon Coyne (vernon.coyne@uct.ac.za)

Main contact points: Professor Jill Farrant (Jill.Farrant@uct.ac.za)

The Department of Molecular and Cell Biology has a number research streams, one of which is plant desiccation research. Desiccation relates to extreme drying, and the problem of desiccation in plants is being tackled by a combination of biochemical, molecular genetics, physiological and cellular biological approaches. Resurrection plants, used in this research, are unique in being able to tolerate extreme water loss.

Research Programmes & Projects

Improving tolerance to water deficit stress

Project focus areas: n/a

Funder(s): Department of Science and Technology (DST), National Research Foundation (NRF) and UCT are current funders, while various grants, including the NRF, University Research Committee (URC) and Oppenheimer Memorial Trust have funded the work which this project builds on **Contact person:** Professor Jill Farrant

It is predicted that increasing droughts due to climate change is likely to cause desertification in South Africa and many areas of the world over the next 35 years. To safeguard food production, it will be essential to improve drought tolerance in crops.

The major research questions to be addressed in this programme involve understanding the mechanisms associated with drought tolerance in vegetative tissues of resurrection plants and orthodox seeds, identified in part by their absence in select desiccation sensitive systems (crops and recalcitrant seeds), which we ultimately aim to transform for improved tolerance to water deficit stress.

The project builds on work that has been taking place over the past 21 years. Research conducted to date has involved comparison of various drought tolerant plants and seeds with matched tissues of select desiccation sensitive systems, which has allowed identification of key stresses associated with various degrees of water loss, and the development of physiological and biochemical markers associated with critical water contents for subsequent molecular studies. Such investigations have suggested that specific genetic information required for drought tolerance may be present in both vegetative tissues of desiccation sensitive crops (not unforeseen since they produce drought tolerant seeds) and in desiccation sensitive seeds.

Project partners: A number of South African and international Universities

Status: 5 year programme, expected to start in 2015 **For more information**: -

The Marine Research Institute (Ma-Re Institute)

Type: Multidisciplinary research institute

Department/s: The Department of Oceanography

Faculty/s*:* Faculty of Science

Website: http://ma-re.uct.ac.za/

Director: Associate Professor Coleen Moloney (Coleen.Moloney@uct.ac.za)

Main contact points: Emlyn Balarin (emlyn.balarin@uct.ac.za)

The vision of the Ma-Re Institute is to establish UCT as an internationally recognized hub of excellence, and a premier higher education institution for multi-disciplinary marine research, teaching and training in Africa and the southern hemisphere. The Ma-Re Institute is open to all marine-related research groups and individuals at UCT, studying the ocean and 'salty waters' of the coastal zone, as well as all issues influencing these areas (e.g. socio-economic, legal, historical etc), with a particular focus on implementing a co-ordinated multi-disciplinary research approach.

Key research areas at the Ma-Re Institute include: Atmosphere & Climate; Coastal Zone Management; Ecosystem Approach to Fisheries; Historical Studies; Law and Policy; Marine Biodiversity; Marine Biogeochemistry; Marine Biotechnology; Marine Engineering; Marine Geosciences; Resource Economics; Oceanography; and Social Anthropology.

The Department of Oceanography

Type: Department

Department/s: -

Faculty/s*:* Faculty of Science

Website: http://www.sea.uct.ac.za/

Head of Department: Professor Chris Reason (chris.reason@uct.ac.za)

Main contact points: Professor Chris Reason

The Department of Oceanography aims to advance our knowledge of all facets of the oceans around Africa and in the Southern Hemisphere, the impact of the oceans on regional climate change and variability, and to use this knowledge for the benefit of people everywhere. Emphasis is on the physical environment in the oceans and atmosphere and their interactions. The Department has Research groupings in sea-going observations, satellite marine remote sensing, coastal oceanography, numerical modelling, the science underpinning operational oceanography, marine and coastal meteorology, severe weather, and climate change and variability.

Research Programmes & Projects

SCOR Working Group 147: Towardsd comparability of global oceanic nutrient data (COMPONUT)

Project focus areas: Global

Funder(s): The International Council for Science (ICSU), Special Committee on *Oceanic* Research (SCOR)

Contact person: Dr. Howard Waldron (Howard.waldron@uct.ac.za) and Dr R. Roman

SCOR WG 147 International standards and methods for analysis of plant nutrients.

Project partners: SCOR **Timeframes:** 5 years **For more information**: http://www.scor-int.org/SCOR_WGs_WG147.htm

Southern Ocean Carbon and Climate Observatory

Project focus areas: Southern Ocean (GoodHope Transect) **Funder(s):** National Research Foundation (NRF)

Contact person: Dr Howard Waldron

Nitrogen Dynamics and carbon sequestration.

Project partners: Council for Scientific and Industrial research (CSIR), University of Stellenbosch

Timeframes: 5 years **For more information**: http://socco.org.za

South Atlantic Meridional Overturning Circulation

Funder(s): NRF's South African National Antarctic Programme (SANAP)

Contact person: Associate Professor Isabelle Ansorge (isabelle.ansorge@uct.ac.za)

Monitoring the overturning circulation in the South Atlantic.

Project partners: Brazil, Argentina, French Research Institute for Exploitation of the Sea (IFREMER), University Pierre and Marie CURIE (UPMC) Paris, Centre national de la recherche scientifique (CNRS)

Timeframes: **For more information**:

UMFULA

Project focus areas: Central and Southern Africa **Funder(s):** UK NERC **Contact person:** Professor Chris Reason

Climate variability and change, reducing uncertainty risk.

Project partners: Oxford University, University of Sussex, LSE, University of Zambia, South African Weather Service (SAWS), Mozambique Meteorological Agency, Mozambique Meteorological Office

Timeframes: 3 years **For more information**: -

TRAIN-SOPP

Project focus areas: Southern Ocean and southern Africa

Funder(s): NRF's South African National Antarctic Programme (SANAP) **Contact person:** Associate Professor Marcello Vichi

Modelling Southern Ocean biogeochemical cycling and climate change, impacts on southern African climate.

Project partners: CSIR **Timeframes:** 3 years **For more information**: -

The projects of PhD students with the Department of Oceanography provide a further indication of the Department's research focus:

- "Mesoscale Convective Complexes over southern Africa" (graduated June 2012)
- "Synoptic-scale rainfall patterns over southern Africa: scale-interactions with large-scale modes of variability" (graduated December 2012)
- "Modelling wind-driven inter-ocean exchange in the greater Agulhas using the Regional Ocean Modelling System" (graduated June 2014)
- "Rainfall variability over southern Africa" (graduated December 2014)

Education Programmes

Ocean & Atmosphere Science Honours

Focus areas: - **Contact person:** Isabelle Ansorge (isabelle.ansorge@uct.ac.za)

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For more information:
https://www.uct.ac.za/downloads/uct.ac.za/apply/handbooks/Handbook%2011%20Science2015.pdf

Ocean & Climate Dynamics Masters

Focus areas: - **Contact person:** Professor Chris Reason

This Master's course is designed for students who wish to gain advanced training in the ocean component of the climate system and how it interacts with the atmosphere, cryosphere and the land surface.

For more information:
https://www.uct.ac.za/downloads/uct.ac.za/apply/handbooks/Handbook%2011%20Science2015.pdf

Courses/ short courses

Ocean and Atmosphere Dynamics (SEA3004F)

Focus areas: n/a **Contact person:** Assoc. Professor M Vichi

This third year course will begin to specialise in advanced material related to physical oceanography, atmospheric science and climate. These topics will include a quantitative approach to ocean/atmosphere dynamics, theories of circulation and the development of ocean and atmospheric weather systems, coupled ocean/atmosphere processes, interactions and feedbacks with the carbon cycle in the earth system and climate change.

For more information:
https://www.uct.ac.za/downloads/uct.ac.za/apply/handbooks/Handbook%2011%20Science2015.pdf

The Nansen-Tutu Centre for Marine Environmental Research (NTC)

Type: Research centre

Department/s: Department of Oceanography

Faculty/s*:* Faculty of Science

Website: http://ma-re.uct.ac.za/nansen-tutu-centre-home/

Directors: Assoc. Prof. Marecello Vichi (Co-director, UCT representative), Dr Björn Backeberg (Co-director, NERSC representative), Dr Mathieu Rouault (Research director, UCT)

Main contact points: Dr Björn Backeberg (bjorn.backeberg@uct.ac.za)

The NansenTutu Centre (NTC) is a nonprofit research centre hosted at the Marine Research Institute and the Department of Oceanography at the University of Cape Town (UCT). The administrative and legal responsibilities reside with the University of Cape Town. It is a joint venture agreement between the signatory partners from South Africa, Norway and the United States. From South Africa including the Marine Research Institute (MaRe)/Department of Oceanography, University of Cape Town, the Applied Centre for Climate and Earth System Studies (ACCESS), the Council for Scientific and Industrial Research (CSIR) – Earth Observation research group, the South African Environmental Observation Network (SAEON), and the International Centre for Education, Marine and Atmospheric Sciences over Africa (ICEMASA). From Norway including the Nansen Environmental and Remote Sensing Center (NERSC) and the Nansen Scientific Society of Bergen and from the USA the Geosciences Department, at the Princeton University.

The vision of the NansenTutu Centre for Marine Environmental Research is to serve Africa through advancing knowledge of the marine environment and climate system in the spirit of Nobel Peace Laureates Fridtjof Nansen and Desmond Tutu.

The priority research activities at the Centre are:

- Ocean modeling and prediction
- Oceanatmosphere, climate and regional impact High resolution satellite remote sensing of the regional shelf seas
- Regional sea level variability and global change

Capacity building and education

Research Programmes & Projects

Ocean modelling and data assimilation

Project focus areas: Southern Africa **Funder(s):** The National Research Foundation (NRF)

Contact person: Dr Björn Backeberg

A number of student dissertations, Masters and PhDs, focused around ocean modelling and data assimilation are funded through two NRF programmes (Competitive Support for Unrated Researchers and the Research Career Advancement Fellowship). The aim of these programmes is to develop southern African capabilities in ocean modelling and data assimilation to support ocean environmental and climate research (by providing accurate regional simulations and reanalyses data) and operational oceanography (by providing a regional ocean prediction system). The aim for the ocean forecasting and reanalysis system in the long run is to contribute toward better understanding and assessing potential changes in the functioning of the ocean currents around southern Africa due to seasonal-to-decadal variability and climate change.

Project partners: NERSC, Bergen, Norway **Status:** 2014-2019 **For more information**: -

The role of the Southern Ocean carbon cycle under climate change

Project focus areas: The Southern Ocean

Funder(s): SEVENTH FRAMEWORK PROGRAMME Marie Curie Actions

People
International Research Staff Exchange Scheme **Contact person:** Dr Björn Backeberg and Prof Chris Reason

Project SOCCLI - "The role of the Southern Ocean carbon cycle under climate change" aims at realizing a high-level staff exchange and networking activity in the field of climate research, and in particular ocean carbon cycle research, between key research groups of South Africa (Council for Scientific and Industrial Research (CSIR), NTC-UCT) and Europe (Norway: University in Bergen, NERSC; France: CNRS-IPSL). The topic to be jointly investigated is the Southern Ocean's role in global carbon cycling. Through the exchange programme we will foster already existing cooperation between the partner institutions and establish new links through also involving early stage researchers. The Southern Ocean has been shown to play a key role in controlling the atmospheric carbon dioxide concentration both in the pre-industrial and the high CO2 state of the Earth system. The staff exchange will provide a very efficient opportunity to promote joint publications and to exploit the complementary expertise optimally. The project is embedded in and linked with important European collaborative projects and large international research projects. We will also carry out outreach events with policy makers both in Europe and South Africa which will provide the respective communities with essential material for informed decisions on greenhouse gas emission reductions and mitigation of climate change.

Project partners: University of Bergen (Norway), Centre National de la Recherche Scientifique - Institut Pierre Simon Laplace (Paris, France), Nansen Environmental and Remote Sensing Center (Bergen, Norway), Nansen-Tutu Centre, Department of Oceanography, University of Cape Town (South Africa), Council for Scientific and Industrial Research (Cape Town, South Africa).

Status: 2012-2016 **For more information**: -

Seasonal to decadal Changes Affecting Marine Productivity: an Interdisciplinary investigation

Project focus areas: Southern Africa

Funder(s): The NRF and The South Africa-Norway Research Co-operation (SANCOOP)

Contact person: Prof Coleen Moloney and Prof Johnny Johannessen

The project aims to use available data and a variety of analysis and statistical tools to identify seasonal to decadal patterns of variability in the marine ecosystems off South Africa and how these change in time and space. It further aims to use atmospheric, physical and biological models to complement these observations, testing hypothesised causes of change and the ways in which processes impacted at one scale might propagate to other scales. The main focus of the project is on processes that occur on time scales of less than one year, which includes, for example, seasonal changes and changes associated with coastal upwelling events, transient eddies and filaments. These short-term processes influence primary and secondary production, and changes in the timing, frequency and intensity of these events over the medium- to long-term can cause shifts in the structure and functioning of the marine ecosystem. The project aims to predict the likely implications of such change for biodiversity and marine living resources.

Project partners: University of Cape Town, the Nansen Environmental and Remote Sensing Centre in Bergen, the University of Bergen and the University of Oslo

Status: 2014-2016 **For more information**: -

The Role of the Ocean on Climate

Project focus areas: Southern Africa **Funder(s):** The Water Research Commission (WRC) **Contact person:** Dr Mathieu Rouault (mathieu.rouault@uct.ac.za)

The project investigate mechanisms linking ENSO to Southern African rainfall and focus on reason why there is no linear relationship between strength of El Nino and spatial extension and intensity of droughts in Southern Africa. Impact of ENSO on temperature, streamflows and the occurrence of floods is also investigated. The project, while keeping the investigation of ENSO open, also focus on the role of the Agulhas Current, Tropical South East Atlantic, and Indian Ocean on Southern African rainfall. The project will also document and understand mechanisms leading to cooling or warming of the coastal region of Southern Africa since the 80's. This include the Tropical South-east Atlantic, the Benguela upwelling system, the Agulhas Current and the Mozambique Channel. Decadal variability of climate is investigated. Adequacy of model used to do seasonal forecast, floods forecasting or used to establish global warming scenario for Southern Africa is verified with regards with identified mechanisms linking ocean to climate variability in Southern Africa. In that respects model development and technology transfer from north to South will be an important part of the project. At last capacity building of Southern African scientists with respects to data analysis of large dataset and model development is a a priority of the project and is achieved with long stay visit of Master and PHD students, postdoctoral fellow and scientists in South Africa and Europe. European student and scientists will benefit from local knowledge and data access and will be integrated in local teams and project.

Project partners: University of Dijon, France, University of Bergen, Norway, ACCESS, Nansen Environmental and Remote Sensing Centre, Norway. Coventry University UK **Status:** 3 years starting in April 2015

For more information:

Enhancing prediction of Tropical Atlantic climate and its impacts

Project focus areas: Tropical Atlantic Africa

Funder(s): EU FP7

Contact person: Dr Mathieu Rouault

Enhancing prediction of Tropical Atlantic climate and its impacts – is a climate change project, and 3 associate partners directly involved in the sustainable management of the three Eastern boundary large marine ecosystems of the Tropical Atlantic.

Project partners: 28 partners across 18 countries in Europe and Africa **Status:** 4 years starting November 2013

For more information: http://preface.b.uib.no/:

South Atlantic Meriodional Overturning Circulation

Project focus areas:

Funder(s): NRF's South African National Antarctic Programme (SANAP)

Contact person:

Project partners:

Status:

For more information:

Courses/ short courses

The Nansen Tutu Centre Summer School on Ocean, Climate and Marine Ecosystems: A focus on the Agulhas Current, the Benguela upwelling system and the Tropical Atlantic

Focus areas: n/a **Contact person:** Dr Mathieu Rouault

The Nansen Tutu Center school on Ocean, Climate and Marine Ecosystem, which took place in December 2014, focused on Agulhas Current, the Benguela upwelling system and the Tropical Atlantic, and it dealt with field observations, remote sensing and modelling. 30 students from Europe, Africa and Indian Ocean Islands attended lectures given by African and European scientists. The Summer School was the first of its kind, but if funding can be arranged the Center would like to make it an annual event.

For more information: http://mathieurouault6.wix.com/nansentutusummer#!lecturers/cfvg

International Centre for Education, Marine and Atmospheric Sciences over Africa (ICEMASA)

Type: Research Centre

Department/s: Department of Oceanography

Faculty/s*:* Faculty of Science

Website: http://www.icemasa.org/

Director:

Main contact points:

ICEMASA is a joint venture between several laboratories in Republic of South Africa and France, focusing on Marine Sciences (marine ecosystems, resources management, physical oceanography, ocean-atmosphere exchanges, biogeochemistry) over the Southern Africa coasts and the Southern Ocean through a multidisciplinary approach.

ICEMASA is devoted to three complementary goals: a research component**;** an education component**; and** an operational component**.**

Based on website only

Statistics in Ecology, the Environment and Conservation (SEEC)

Type: Inter-departmental grouping

Department/s: Department of Statistical Sciences

Faculty/s*:* Faculty of Science

Website: http://seec.uct.ac.za/

Lead: Associate Professor Res Altwegg (res.altwegg@gmail.com)

Main contact points: Associate Professor Res Altwegg

The statistical sciences develop quantitative tools for evaluating hypotheses in the light of data and therefore assume a critical role within science. This is especially true for the biological and environmental sciences, which study complex systems with large amounts of multi-layered data and are faced with decision making problems that directly affect human livelihoods and well-being. The SEEC group has skills that range from quantitative ecology to theoretical statistics.

The group's goals are: to be the leading group in statistical ecology and environmental analytics within South Africa; to provide a hub connecting statisticians and biological / environmental scientists to ensure that the most important environmental questions are addressed with cutting edge statistical methods; to develop methods that link data analysis and modelling into the conservation planning and management process Scientific knowledge progresses by confronting hypotheses with data.

Research Programmes & Projects

Climate change effects on biodiversity and ecosystems
Project focus areas: Southern Africa
Funders: Afrcan Climate and Development Initiative (ACDI), the National Research Foundation (NRF) and the Applied Centre for Climate & Earth Systems Science (ACCESS)
Contact person: Res Altwegg

The programme focuses on understanding impacts of climate change on biodiversity and ecosystem services, as well as quantifying weather changes in southern Africa and their attribution to climate change. As part of the biodiversity and ecosystem research, we use Southern African Bird Atlas data to examine shifts in relation to different drivers. Using available demographic information (survival, recruitment and population size), we are able to examine the mechanisms by which birds respond to climate variation in more detail. The group also studies phenology shifts to understand how a changing climate affects the timing of the annual life cycle of organisms. Under the quantification of weather changes research, the programme is documenting how the climate has changed in the recent past, because it is critically important for understanding current biotic responses to climate change. Using state-space models, we are analysing weather trends in detail, and planning to develop these models into tools for attributing weather changes to (anthropogenic) climate change.

Project partners: A number of national and international partners

Status: Ongoing, the programme combines a number of parallel projects with different start and end days

For more info: http://seec.uct.ac.za/
The project titles of current Masters and PhD students within SEEC provide a further indication of their research focus:

- Effectiveness of protected areas under climate change
- Climatic drivers of bird demography
- Environmental drivers of albatross populations
- Management of climate-change threatened high-altitude grasslands
- Phenology shifts in barn swallows (registered in Biological Sciences)
- Species distribution models (registered in Biological Sciences)

- Climatic drivers of mountain toad demography

Courses/ short courses

Bayesian integrated population modelling Workshop

Focus areas: n/a **Contact person:** -

SEEC is offering a five day workshop on Bayesian integrated population modelling, in October 2015. This particular course is a once-off, but SEEC runs at least one or two workshops per year on specific topics within the realm of ecological statistics.

For more information: http://seec.uct.ac.za/workshops.php

6.3.3 Stellenbosch University

Agriscience

Department of Conservation Ecology & Entomology (Plant Ecology)

The Department of Conservation Ecology and Entomology is a forward-thinking, dynamic department with a distinct agricultural and forestry orientation which is reflected in its vision, mission and strategic objectives, namely to be a world centre of excellence for teaching, research and technology. It brings together a considerable body of teaching and research in the rapidly growing and important field of the conservation of utilised landscapes and their surrounds. In principle, the aim is to sustain agricultural and forestry production without compromising the natural viability of the agricultural land mosaic. Under this umbrella of conservation in the agricultural and forestry contexts, the expertise ranges from integrated pest management, conservation of natural communities, management of living resources, and conservation policy formulation to technology transfer.

Faculty: Agriscience

Type: Research Unit; Teaching and Learning

Website: http://www.sun.ac.za/english/faculty/agri/departments1/conservation-ecology

Head of the Unit: Karen Esler (kje@sun.ac.za)

Main Contact Points: C Louw (collouw@sun.ac.za)

Annual Budget:

Nationally/ Internationally Funded:

Research Projects (4)

Invasion Ecology

Focus is on woody alien seed banks and seedling ecology; seed banks and repair after clearing in riparian habitats and Fynbos & Karoo; stakeholder perception and management of invasive alien plants on private land. (Ongoing research)

Partners: Centre for Invasion Biology, WfW,Collaborators: Prof Dave Richardson, Dr Mirijam Gaertner; Dr Heidi Prozesky & range of MSc & PhD students

Funder: Centre for Invasion Biology, DST-NRF Centre of Excellence

Focus Areas:

Restoring Natural Capital

South Africa has a proud history of restoring natural capital. We undertook a meta-analysis of the ecological, hydrological, and economic impacts of restoration across a range of contrasting sites and contexts. The aim was to determine the tangible contributions to restoration. The study involved working on existing restoration sites and monitoring and evaluating the ecological, hydrological and socio-economic impacts restoration may have had at those different sites. It used a carefully selected set of ecological, hydrological and socio-economic parameters at 8 different restoration sites to test the hypothesis "RNC improves water flow and water quality, land productivity, in some instances sequesters more carbon, and, in general, improves both the socio-economic value of the land in and the surroundings of the restoration site as well as the agricultural potential of the land". (Ongoing research)

Partners: Centre for Invasion Biology, WfW,Collaborators: Prof James Blignaut (Project Leader), Dr Martin de Wit, Prof Sue Milton, Dr Dave le Maitre. **Collaborators**: Prof James Blignaut (Project Leader), Dr Martin de Wit, Prof Sue Milton, Dr Dave le Maitre.

Funder: Water Research Commission (K5/1803).

Focus Areas:

Restoring Riparian Function

Riparian zones are some of the most threatened ecosystems on earth, the result of a multitude of disturbances acting singly or in concert to change structure and function. In South Africa riparian degradation due to invasion by woody alien invasive species has received much attention due to the declines in water supply and threats on native biodiversity. Large landscape-scale restoration programmes such as Working for Water have set out to restore riparian structure in fynbos riparian zones, however, it is more complex to measure whether ecosystem function has also been restored, or indeed whether and how the ecosystem services associated with riparian zones have changed with invasion and clearing of alien species. In addition, one has to ask whether all woody alien species are the same. Acacia spp. invading fynbos riparian zones are putative nitrogen fixers, and are known to change ecosystem functioning elsewhere, yet the consequences of elevated nitrogen and modified microbial diversity has not been adequately quantified. On the other hand, some Eucalyptus spp. may be allelopathic, which may have consequences for soil functioning and plant species diversity in restored riparian zones. Restoration trajectories may be modified by other disturbances such as fire, lowering of surface runoff and agricultural activities. Specifically, we are exploring what ecosystem function means for riparian zones, links to ecosystems services, how these parameters change with invasion of woody alien invasive plants and the consequences of clearing for riparian functioning and water resource management, especially given potential synergistic effects of alien invasives, fire, agricultural modifications and global climate change. (Ongoing research)

Partners: Dr Shayne Jacobs (Project Leader); Dr Andrei Rozanov, Prof Donald Cowan, Dr Karin Jacobs, Dr Brian Mantlana.

Funder: Water Research Commission (K5/1927)

Focus Areas:

Transdisciplinary Research

Active, founding member of the Centre for Transdisciplinarity, Sustainability Assessment, Modelling and Analysis, known as the TSAMA HUB. This Centre is an academic structure of Stellenbosch

University (SU) established to facilitate and coordinate a number of existing PhD qualifications of the University, research projects, and sustainable community building activities as well as policy work under the overarching notions of transdisciplinarity, complexity and sustainability. Have co-supervised 2 PhDs under this centre, working on stakeholder perceptions of ecosystem services; & perceptions of meaningful nature experiences. (Ongoing research)

Partners: Prof Belinda Reyers; Dr Heidi Prozesky; Prof Leslie le Grange; Dr Andrew Knight, PhD students

Funder: S.U., C.I.B & C.S.I.R

Focus Areas:

Department of Forest and Wood Science

The department is tasked specifically with the enrichment of forest and wood science through basic and applied research, teaching at undergraduate and postgraduate levels, and community outreach. Committed contact with the country's forest and processing industries has been maintained and strengthened through the past 80 years.

Faculty: Agriscience

Type: Research Unit; Teaching and Learning

Website: http://www.sun.ac.za/english/faculty/agri/forestry

Head of the Unit: Pierre Ackerman (packer@sun.ac.za)

Main Contact Points: Ursula Petersen (uap@sun.ac.za); Ben du Toit (ben@sun.ac.za)

Annual Budget:

Nationally/ Internationally Funded: nationally and internationally funded

Research Projects (30)

Green Landscapes

Adaptation of land use portfolios for optimal eco-system service provision. Completed 2014

Partners: Stellenbosch: Soil Science, ConsEnt, Agric. Econ., Agronomy, Animal Sci., Sustain. Inst., NMMU

Funder: DST/NRF

Focus Areas: Africa

CatchMan

Adapting the Letaba catchment for optimal ecosystem service provision under climate change.

Partners: ARC-ISWC, Soil science, Limpopo University

Funder: DAFF/DST

Focus Areas: Africa

AgroSolar Systems

Integrated Agro-Forestry-Energy land use systems for climate change adaptation along the West coast of South Africa.

Partners: CEBRA/Germany, DLC/Germany, BTU Cottbus/Germany, INERC (industrial)

Funder: DAFF/DST

Focus Areas: Africa

Effect of climate change on wood quality

Testing climatic influences on wood quality.

Partners: CBU/Zambia

Funder: NRF

Focus Areas: Africa

Pine prescribed burning

Risk, sustainability with prescribed burning under pine stands on a climate gradient.

Partners: NMMU

Funder: DAFF, KLF, SAFCOL

Focus Areas: Africa

Climate fit forests

Solutions for adapted forest management strategies under the threat of climate change - learning from a climate gradient from Germany over Italy to South Africa. Completed 2014

Partners: Padova University/Italy, TU München/Germany, HAFL Bern/ Switzerland

Funder: EU Marie Curie, IRSES

Focus Areas: Germany; South Africa; Italy

A spatial simulation framework to assess the impact of climate change on forest tree growth

Developing novel forest modelling approaches by coupling hydrological landscape models with stand process models.

Partners: ICFR, soil science (SU)

Funder: ACCESS

Focus Areas: Africa

FORSIM

Developing novel Hybrid growth models to adapt forestry planning to climate change

Partners: TUM/Germany, ConsEnt (SU

Funder: DST/NRF, BMBF

Focus Areas: Africa

Drought stress in indigenous forests

Completed research

Partners: SANParks, TUM/Germany, Sand Diego University/USA, CTHB

Funder: CTHB, Pretoria

Focus Areas: South Africa

The role of bark as a fire protection of selected indigenous and exotic trees

Fires will most likely be more frequent in a changing climate. Analysis of the vulnerability of trees is essential. Completed 2014

Partners: CTHB

Funder: CTHB

Focus Areas: Africa

Dryland tree regeneration and development

Effect of disturbance and Carbohydrate storage on development of Pterocarpus angolensis. Completed 2014

Partners: Namibia Forest Service

Funder: Namibia Forest Service

Focus Areas: Africa

Emerging Farmer Agroforestry in dry regions

Improved productivity for emerging farmer agroforestry enterprises

Partners: NCT, University of Venda

Funder: DAFF

Focus Areas: South Africa

Drought tolerant eucalypts to alleviate poverty in South Africa

Testing drought tolerant Eucalypts and developing management options to alleviate poverty in South Africa. Completed 2014

Partners: Innventia/Sweden, LNU/ Sweden

Funder: SIDA/Sweden

Focus Areas: Africa

Properties of burnt wood

Determination of chemical, physical and mechanical properties of wood from burnt trees to decide on potential end-use.

Partners: Sappi

Funder: NRF, DAFF

Focus Areas: South Africa

Green building: A life-cycle assessment of timber building systems compared to conventional building systems in South Africa

The project will look at the following three topics; Sustainability and wood constructions: A review of life-cycle assessment methods and rating systems from a South African perspective; A life cycle assessment study to investigate the current role of timber products in reducing the environmental impact of buildings in South Africa, and finally a life cycle assessment and costing study to investigate the potential environmental and economic impact of expanding timber use in the building and construction industry in South Africa.

Partners: none

Funder: Merensky

Focus Areas: South Africa

Development of enterprise guidelines for Natural Resource Management Value Added Industries

Understanding of the business dynamics of existing and failed NRM Value Added Industries. Development of VAI enterprise development guidelines

Partners: NRM/DEA

Funder: NRM/DEA

Focus Areas: South Africa

Evaluation of selected quaternary catchments to guide management of the use, rehabilitation and conservation of natural woodlands and forests

Provide a basic overview of how to approach sustainable management of the natural forest resources in the Ntabelanga catchments around Maclear in the Eastern Cape.

Partners: NRM/DEA

Funder: NRM/DEA

Focus Areas: South Africa

Development of a standard time study and productivity protocol for NRM operations

Time and work studies (which potentially include using alternative technologies and operating methods) can however help to improve the efficiency of NRM operations though the setting of attainable benchmarks for specific site and operation combinations

Partners: NRM/DEA

Funder: NRM/DEA

Focus Areas: South Africa

Eucalyptus pulpwood cut-to-length clear-felling productivity and cost optimisation using discrete Event Simulation techniques

Completed 2014

Partners: Mondi

Funder: NRF

Focus Areas:

Impact of mechanised debarking of Eucalyptus pulpwood on chip quality and quantity and timber harvesting costs

Completed 2014

Partners: Mondi

Funder: NRF

Focus Areas: South Africa

Impact of slope, tree size for both coppiced and planted regimes of Eucalyptus pulpwood cut-to-length clear-felling stands on productivity and cost for excavator based and custom built mechanised harvesters

Partners: Mondi

Funder: NRF

Focus Areas: South Africa

Fibre balances (losses) during pine saw timber clear-felling operations in South Africa.

This study takes into account cost of fibre production; quality of fibre produced and optimised volume determination. Completed 2014

Partners: SA Forestry Industry

Funder: none

Focus Areas: South Africa

Loaded and unladen travel speeds of articulated skidder timber extraction systems in pine saw timber regimes in South Africa taking into account slope, species, tree size, travel distances and geographic location.

An additional outcome was the determination of a Southern African applicable terrain factor (wander ratio) for skidder extraction systems. Completed 2014

Partners: SA Forestry Industry

Funder: none

Focus Areas: South Africa

Establishing travel speeds (loaded and unladen) of pine saw timber secondary timber transport in South Africa taking road class, road condition into account

Partners: SA Forestry Industry

Funder: none

Focus Areas: South Africa

Development of an internationally benchmarked Time Study Protocol for South Africa forest industry in order to make South African forest operations internationally competitive.

Completed 2014

Partners: SA Forestry Industry

Funder: NRF, DAFF

Focus Areas: South Africa

Supply chain optimisation of South African pine saw-timber harvesting and transport operation

Completed

Partners: SA Forestry Industry

Funder: None

Focus Areas: South Africa

Development of an internationally benchmarked Forest Operations Machine and Systems Costing protocol for South Africa forest industry in order to make South African forest operations internationally competitive

Completed

Partners: SA Forestry Industry

Funder: NRF

Focus Areas: South Africa

Application of Discrete event Simulation Operations Research techniques in the optimisation of productivity and production costs of multi-stem tree-length Eucalyptus pulpwood clear felling operations in the Zululand coastal region

Completed

Partners: International Forestry Industry

Funder: EU

Focus Areas: South Africa

State of the art of the use of forest residue for bioenergy in Southern Africa

Completed

Partners: SA Forestry Industry

Funder: SA Forestry Industry

Focus Areas: South Africa

The effect of irregular stand structures on growth, wood quality and its mitigation in operational harvest planning of Pinus patula stands

Row thinning combined with selective thinning carries the risk of irregular stand structure with gaps in the canopy. This affects tree characteristics and wood properties. Similarly increasing the spacing between the rows removed reduces the amount of non-selective harvesting, gaps in the canopy and increases harvesting productivity. Completed

Partners: Merensky

Funder: NRF, Merensky

Focus Areas: South Africa

Department of Soil Science (Soil Chemistry)

Soil is the extremely thin but precious skin covering our planet that sustains all terrestrial life forms. Soil Science focuses on the importance of soils as a very slowly renewable natural resource. It involves the study of the properties and processes that occur in soils, as well as, the sustainable use and management of soils. Soil Science is an indispensable field of study for sustainable food production into the future.

Faculty: Science

Type: Research Unit; Teaching and Learning

Website: http://www.sun.ac.za/english/faculty/agri/soil-science/about-us/history-mission

Head of the Unit: Eduard Hoffman (ehoffman@sun.ac.za)

Main Contact Points: Alisa Hardie (aghardie@sun.ac.za)

Annual Budget:

Nationally/ Internationally Funded:

Research projects (9)

Effects of long-term tillage and crop-rotation practises on soil carbon stocks and soil quality in Swartland, Western Cape, South Africa

The aim of this project is to investigate the long-term effects of tillage (conventional till, minimum-till, no-till) and crop-rotation practices on soil C and N stocks, overall soil quality, soil C functional pools (labile and stabile pools) at the Western Cape Department of Agriculture's long term field trials at Langgewens Experimental Farm, near Malmesbury in the Swartland region.

Partners: Department of Soil Science, Stellenbosch University; Elsenburg, Western Cape Department of Agriculture (Dr J. Strauss and Dr J Labuschagne)

Funder:

Focus Areas: Western Cape

Effect of composted biochar on soil quality and Carbon sequestration

The aim of this project is to investigate the effect of composted biochar on soil quality and nutrient availability, as well as, the stability (longevity) of the composted biochar in soils. Our previous research has shown that adding biochar directly to soils results in several negative effects, such as nitrogen immobilisation and over-liming; hence we have decided to look at composting of biochar with green residues in order to reduce these negative impacts. This project is part of a larger research programme in the NRF-funded Centre of Excellence in Food Security jointly hosted at University of Western Cape, Stellenbosch University and University of Pretoria which began in 2014. Our section of the research programme aims to investigate novel technologies for improving soil and water quality for small and large-scale agricultural producers. Our research projects are looking at the use of biochar for removing organic and microbial pollutants from waste-contaminated river/dam water to make it suitable for vegetable production. My project will look at composting

spent biochar filters together with green residues in order to sterilize pathogens and make the filters suitable for use as a soil amendment.

Partners: The soil and water projects involve collaboration between the Departments of Soil Science, Food Science and Agronomy at the University of Stellenbosch and Microbiology at the University of Pretoria.

Funder: NRF Centre of Excellence in Food Security funding initiative

Focus Areas: South Africa

Sustainable soil fertility management of rooibos tea (Aspalathus linearis)

The aim of this project is to develop an environmentally friendly and sustainable, organic soil fertility management programme for commercial rooibos tea producers. This project also aims to determine critical soil and rooibos phosphorous (P) levels to avoid causing P toxicity in this fynbos species. This PhD project is a follow-up of the MSc project that investigated the long-term effect of commercial rooibos production on soil health.

Partners: Department of Soil Science, Stellenbosch University; Rooibos Ltd, Clanwilliam

Funder:

Focus Areas: Western Cape

Effect of physicochemical properties of biochars on C and N mineralisation, and mineral N availability in sandy soil

The aim of this project was to understand the how the physical and chemical properties of various types of biochar affect C and N mineralisation, and mineral N availability in sandy soil. This was a follow-up project on the Biochar amendment of Cape Flats sandy soil project.

Partners: Department of Soil Science, Stellenbosch University

Funder: NRF and University funded

Focus Areas: South Africa

Effect of inorganic fertilizers on the decomposition dynamics of composts and crop litters in sandy soil

The aim of this project was to understand the effect of adding different chemical fertilizers on the decomposition dynamics (CO_2 production; DOC production; enzyme activities; total organic matter loss) of composts and crop litters in sandy soil. Interestingly, it was found that certain fertilizers promoted humification and suppressed CO_2 production from composts. Completed in 2014.

Partners: Department of Soil Science, Stellenbosch University

Funder: NRF and University funded

Focus Areas: South Africa

Effects of long-term no-till crop-rotation practises on soil carbon functional pools and quality in the Overberg, Western Cape, South Africa

The aim of this project was to investigate the long-term effects no-till crop-rotation and pasture practices on soil C and N stocks, overall soil quality, soil C functional pools (labile and stabile pools)

at the Western Cape Department of Agriculture's long term field trials at Tygerhoek Experimental Farm, near Riviersonderend in the Overberg region. Completed in 2013

Partners: Department of Soil Science, Stellenbosch University; Elsenburg, Western Cape Department of Agriculture (Dr J. Strauss)

Funder: NRF

Focus Areas: Western Cape

Investigation of soil quality (health) in commercial production of rooibos tea (Aspalathus linearis) in the Western Cape, South Africa

The aim of this study was to investigation the long-term effect of commercial rooibos production on soil health (soil chemical, physical and microbiological properties) in the Clanwiliam region. The soil properties of commercial rooibos plantations of different ages (ranging between 2-60 years) were compared to natural fynbos stands in the same area. The tea yields and quality of the different plantations were also assessed. It was found that the biggest changes in soil quality were in soil C, N and P levels, and soil base status. The biggest problem that contributed to poor tea yields and quality was high P levels. This led to lower mycorrhizae colonization of roots and increased susceptibility to pathogens and necrosis. Completed in 2013

Partners: Department of Soil Science, Stellenbosch University; Rooibos Research Council

Funder:

Focus Areas: South Africa

Biochar amendment of Cape Flats sandy soil: Effect on soil quality (chemical, physical and microbiological properties) and plant growth

This was a transdisciplinary research project consisting of 4 MSc projects that investigated different aspects of the effect of the effect of locally produced pinewood biochar on soil chemical, physical and microbial properties, as well as, crop production and decomposition of biochar in local Cape Flats sandy soil. Completed in 2012

Partners: Departments of Soil Science, Botany and Microbiology, Stellenbosch University

Funder:

Focus Areas: Western Cape

Distribution and stability of soil carbon in spekboom thicket, Eastern Cape, South Africa

The aim of this project was to investigate the effect of spekboom plants versus other types of vegetation versus open (degraded) veld in the spekboom thicket on soil C stocks, soil C functional pools and soil chemistry. Completed in 2012

Partners: Department of Soil Science, Stellenbosch University; Gamtoos Irrigation Board

Funder:

Focus Areas: Eastern Cape

Food Security Initiative (FSI)

Improve knowledge of the social, economic and political aspects of food & nutritional insecurity in Southern Africa. Promote the utilization of safe and nutritious food. Empower small scale farmers through appropriate new technologies. Reduce food losses in the farm to fork chain. Improve crop production and water use efficiency. Understand environmental and climatic changes and their implications for agricultural policy and practice.

Faculty: Agriscience (Sustainability Institute: Sustainable Agriculture Division)

Type: Research Unit and Community Services Initiative

Website: http://www0.sun.ac.za/fsiweb/index.htm

Head of the Unit: Jimmy Volmink (jvolmink@sun.ac.za)

Main Contact Points: Julia Harper (jrs@sun.ac.za)

Annual Budget:

Nationally/ Internationally Funded:

Research Projects (27)

Agricultural policy and food security

The core purpose of the research is to investigate key aspects of the relationship between agricultural policy and food security in the South and Southern African context. To this end, the initial focus will be on three aspects, namely a) climate change and food security; b) the role of agribusiness; and c) supply response.

Partners: Partnership funding with Market Matters, Inc. of Cornell University, University of Antwerp, Imperial College, University of London

Funder:

Focus Areas: Agricultural policy and food security (South and Southern Africa)

Soil science (Biochar)

The project is addressing the issue of sustainable agricultural production on sandy soils using biochar-an easily-accessible local material for amelioration of sands. It is targeting innovative methods of soil fertility management to improve food production and prevent ground and surface water pollution from agricultural sources.

Partners:

Funder: Funding will come from industrial partners that are active in the appropriate research areas.

Focus Areas: crop production efficiency

Community Nutrition Security Project (CNSP)

The goal of the CNSP are to understand the socio-economic conditions that contribute to persistent food and nutrition insecurity in rural and peri-urban communities and to design, implement and evaluate interventions that create conditions for sustainable community nutrition security. The

project will involve establishing a community nutrition research site in the Winelands (East) and Overberg districts in the Western Cape, in conjunction with Ukwanda, the University's Rural Health training and research platform, to enable ongoing research and action on nutrition security issues in these districts, and to inform nutrition security policy and programmes in other regions of South and Southern Africa.

Partners:

Funder: They source funding from local and international funding sources

Focus Areas: CNSP addresses issues related to local availability, access and utilization of food

Reducing Post-Harvest Losses of Fruit and Vegetables

To decrease food wastage by:

- Training of staff working in the cold chain and handling produce from the farm to markets and retail outlets
- Improving existing postharvest practices within the export and retail cold chain and thereby increase food supply, quality and nutritional value of products;
- To make fruit and vegetable production more accessible to areas without adequate cold storage facilities and allow for new business opportunities in rural areas lacking in these capital expensive resources;
- To qualitatively decrease the carbon foot print of exported products by lowering the dependence on energy used during cooling requirements.
- Determining consumer preference for apple appearance and taste, thus facilitating the targeted marketing of apple cultivars to different consumer groupings. Knowledge of consumer preferences with regards to apple appearance and taste may also increase the efficiency of local apple breeding programmes.
- Determining whether apples from different canopy positions differ in internal quality and whether this affects consumer preference for these fruit. Also establish how internal quality can be best quantified and try and develop equipment to determine these quality traits non-destructively.

Partners:

Funder: HortGrow (formerly DFPT) partially fund, with leverage additional funding via the THRIP programme of DTI

Focus Areas:

Minimize the wastage that occurs during the whole meat value chain. Food (meat) safety. And Increase the nutritional intake of those who are currently undernourished (specifically protein intake).

Evaluation of wastage has shown that in game meat and in the storage and freezing of meat and organs there are losses. Research is needed to see if this can be minimized. The quantification of the nutritional value of meat and meat products. Development of technologies to ensure that cheaper meat products are developed.

Partners:

Funder:

Focus Areas:

Reduce food 'lost' in the farm to fork chain in South Africa

To develop a resource map of food losses in South Africa and to recommend appropriate corrective measures to reduce the losses occurring at various links in the supply chain (on-farm, wholesale, retail and households). With the objectives of Quantify the amounts of fruit and vegetables lost (quantity loss/wastage). Quantify the amounts of fruit and vegetables downgraded (quality/value loss). Quantity the nutritional losses associated with quantity and quality losses along the food supply chain

Partners:

Funder: Had R400,000.00 in phase one source of funding not stated (funding agencies that are involved in food security, sustainable agriculture and integrated rural development to support the implementation of next phase)

Focus Areas: Postharvest Technology and Losses

Food security in West Coast fishing communities

The project brings an important sociological dimension to the FSI research programme, in that it will be exploring issues such as power, gender, inequality, social networks and identity in shaping livelihoods as well as access to and the distribution of food within vulnerable communities and households. The project on mariculture will also address possible alternative employment opportunities in the context of declining fish stocks. To advance understanding of the complex social dynamics relating to food security/ insecurity in selected communities caught up in significant processes of social change.

Partners:

Funder:

Focus Areas: Saldana Bay and Paternoster

Food Security, Agro-Ecological Science and Land Reform: A Stellenbosch Case Study

Evaluate existing food security work within a region of South Africa and develop the understanding of the food security challenges facing South and Southern Africa. Review food security strategies at both national and regional level and identify specific challenges to food security at the national and regional level. Design a model to obtain food security in Stellenbosch. Investigation of the existing production-beneficiation strategies of food production in the Stellenbosch region.

Partners: proposals were submitted in association with University of Cape Town's Urban Food Security Project (AFSUN)

Funder: complimentary funds from the Sustainability Institute

Focus Areas: Stellenbosch

EAU4FOOD

European Union and African Union cooperative research to increase Food production in irrigated farming systems in Africa. EAU4Food seeks to address the enormous challenges African agriculture is

facing today: despite numerous attempts, agricultural productivity has only slightly increased in recent years and, in general, cannot keep up with population growth. In the coming years irrigation will gain importance, but at the same time the availability of fresh water and the sustainable use of soil resources is under increasing pressure. Hence, new approaches are required to increase food production in irrigated areas in Africa, while ensuring healthy and resilient environments.

Partners:(co) Stichting Dienst Landbouwkundig Onderzoek Alterra Netherlands. Institut d'Economie Rurale du Mali IER Mali. West African Rice Development Association AfricaRice Benin1. Council for Scientific and Industrial Research CSIR RSA. Institut National de Recherches en Génie Rural Eaux et Forêts INRGREF Tunisia. Mekelle University MU Ethiopia. International Water Management Institute IWMI Ghana1. Centre de Cooperation International en Recherche Agronomique pour le Developpement, CIRAD France. Overseas Development Institute ODI UK. Lisode Lisode France. Consejo Supoerior de Investigaciones Cientificas CEBAS-CSIC Spain. University Eduardo Mondlane UEM-FAEF Mozambique. Stellenbosch University SU RSA. International Fertilizer Development Center IFDC Ghana

Funder:

Focus Areas: European Union and African Union

Community based Nutrition Security Project (CNSP)

The CNSP focused on identifying the underlying causes of nutrition insecurity at household and family level using the UNICEF malnutrition conceptual framework. The community in which they worked was Worcester, Western Cape.

Partners: Dept of Health, NOMU (Nutrion and Human Rights)

Funder:

Focus Areas: Worcester, Western Cape

Sharing Best Agroecological Practice for Resilient Production Systems in Dryland and Drought Conditions - EcoDry.

To identify and build a body of knowledge on innovative agroecological strategies to mitigate threats of natural and man-made nature for drylands and drought. To build a network of expertise on agroecological innovations through workshops, conferences and seminars. To provide opportunities for research on cutting-edge agroecological approaches in the natural and social sciences for postgraduate students.

Partners: Coventry University, Univeristy Extremadora (Spain), University of Yucatan (Mexico), National Centre for Research and Development – Badia Researcher Programme, Jordan.

Funder:

Focus Areas:

STING - Systematic Review of the effects of iodised salt and iodine supplements on growth. Researcher led.

Reduction of stunting during childhood is assuming greater importance in the post-MDG global health agenda. The multiple factors that contribute to stunting are only partially understood. Iodine deficiency (ID), still common in many countries, may influence growth but its role has not been

rigorously evaluated. WHO/UNICEF require an evidence base to make recommendations on this issue. If ID impairs growth, policy and programs aimed at reducing stunting should include an emphasis on provision of iodine. To perform a systematic review on the effects of iodised salt and iodine supplements on pre- and postnatal somatic growth. This will feed into the developing evidence base on prevention of stunting for global agencies as well as country programs aimed at reducing the global burden of disease.

Partners: ETH Zurich

Funder:

Focus Areas:

Effect of basal and top dressing soil amendments on yield of wild okra (Corchorus olitorius) in northern KwaZulu-Natal

To evaluate the yield performance of C.olitorius in response to a combination of different types of basal soil amendments and incremental rates of nitrogen top dressing fertiliser. Plant height, number of branches, marketable fresh yield and shoot dry mass responded significantly ($p<0.05$) to the applied soil amendments. Growing Corchorus without any form of fertiliser gave significantly the lowest yield. It was concluded that the application of basal soil amendments and the interaction of basal and top dressing result in increased marketable yield for C.olitorius.

Partners: UKZN and SU

Funder:

Focus Areas: South Africa

Social Learning for Sustainable Food Systems – Researcher led

The SLSFS is an innovation- , research-, and action-oriented strategic alliance between academia, business, civil society and government to enhance food security in Southern Africa. SLSFS seeks to facilitate innovation in regional food systems and establish an ongoing participatory learning process on innovation initiatives.

Partners: Southern Africa Food Lab

Funder:

Focus Areas: Southern Africa

Smart Agriculture for Climate Resilience (SmartAg) Project Launch

Developing a strategic locally relevant sectorial response to climate risks for agriculture in the Western Cape Province: the next step towards supporting climate smart decision making and long-term sustainability.

Partners: DAFF, SU, UCT, DEA & DP, City of Cape Town

Funder:

Focus Areas:

Western Cape Food Security Strategy

The purpose of this assignment is to develop a household food security strategy for the Western Cape. The strategy should, Provide a situational analysis of the challenges, and examine the underlying causes of the household hunger, food and nutrition insecurity; Identify short-, medium- and long-term strategic opportunities and interventions to address the challenges and causes; Identify provincial government food programmes and guide the strategic and effective coordination and implementation of those programmes, including opportunities for scaling them up; Embrace/be founded on the 'whole-of-society' approach by identifying strategic opportunities for better intergovernmental coordination and for public-private partnerships; Establish governance mechanisms to address specific challenges in the food system, and galvanise action and create working relationships between stakeholders involved.

Partners: SU, UWC, UCT, DAFF, DoTP

Funder:

Focus Areas:

Sustainable Agriculture South Africa, Researcher led

Develop a Masters and research programme with a focus on interdisciplinary on sustainable agriculture in South Africa.

Partners: WUR, Conservation South Africa

Funder:

Focus Areas:

BIOSOL | Biochar to reduce and eliminate persistent organic pollution from agricultural water and soil

The South African agricultural sector uses 60% of the available rain water and the industrial sector is responsible for approximately 3% of the water usage (DWAF, 2010). Of the total water available, 98% has been allocated to various users leaving very little water available to areas or sectors which are under high water stress (Anon, 2012b). Furthermore, the country currently faces vast infrastructure development problems in terms of water supply (SAICE, 2011). This influences the quality of the water, which is often not acceptable in many areas in South Africa (SAICE, 2011). Water has therefore been labelled as an invaluable resource and the careful management thereof cannot be over emphasised (SAICE, 2011). BIOSOL will use an inexpensive and readily available product of biochar as a means of filtering agricultural waste water in order for it to be re-used for production.

Partners: UP, UV and SU

Funder:

Focus Areas:

SOLIQA – Integrated approach of managing soil fertility to enhance crop nutrient contents in a sustainable way

One of the challenges of sustainable agricultural practices is the declining soil fertility that results from continuous planting on the same soil and the demand of plants on especially mineral elements which are often not sufficient for sustainable yields. In rural areas this is enhanced by the lack of

various resources like knowledge, skills, infrastructure, equipment etc. that limit yield, quality or sustainability. The SOLIQA team will combine their expertise to develop a model for different climatic zones which can be disseminated in the different regions.

Partners: ARC, SU, NMMU, Limpopo University

Funder:

Focus Areas:

Mass rearing of insects as feed and food, researcher led

Insects as food and feed emerge as a relevant issue in the twenty-first century due to the rising cost of animal protein, food and feed insecurity, environmental pressures, population growth and increasing demand for protein among the middle classes. Insect as feed not only supplies a natural and sustainable protein source but can also assist in solving the problem of organic waste disposal. Insects as a food source offer an opportunity to help solve protein deficiency problem of humans. Insects are easily available and consumed in various forms and are used as ingredients or supplements among several ethnic groups in Africa, Asia and South America. In Western countries, people view insect consumption with disgust and associate it with primitive behaviour, resulting in the neglect of Entomophily in agricultural research. There is therefore a need to understand which insects are most nutritious, most palatable and can be reared in mass.

Partners: SU, Limpopo University, UP, Federal Research Institute for Animal Health

Funder:

Focus Areas:

Unlocking the value of smallholder ruminant livestock for food security

Smallholder farmers in South Africa who produce livestock make very little contribution to the markets. Their desire is to be able to sell their ruminant and livestock meat to markets but they do not produce enough meat and the quality does not pass the standards required. This project will work with farmers in the three poorest provinces to develop rangeland and marketing strategies to increase production. Following this it will work with farmers and communities to identify opportunities to provide for markets so as to enable farmers to both increase production but to enable sales. This in turn increases the profitability of the system and increases the purchasing power of farmers.

Partners: SU, Limpopo, Fort Hare, ARC, NAMC

Funder:

Focus Areas:

Food System Governance, Food Security and Land Use in Southern Africa

Food Systems and the governance structures that manage them are highly complex and poorly understood in Southern Africa. From an initial scoping project undertaken with NRF/Belmont funds with the University of Cape Town (UCT), Stellenbosch, Pretoria, Oxford, Newcastle, Wageningen and Florida Universities, it became apparent that a more detailed study embedded within a consultative process with stakeholders across the food system is needed. The study would therefore not be an

exclusively academic, but is designed to lead to developing strategies and policies to improve the performance of the food system with regards to food security, land and availability issues.

Partners: SU, WUR, Oxford, Newcastle, Florida, UCT

Funder:

Focus Areas:

Strengthening Linkages between Social Protection and Agriculture

Social protection strategies, both short and long-term, have the potential to alleviate hunger and poverty and to ensure increased food security and dietary diversity among recipients. This project aims to describe some of these linkages and locate opportunities to strengthen the delivery and implementation of social protection systems.

Partners: The United Nations Food and Agriculture Organisation (FAO), and

Funder: the Ford Foundation (Funders)

Focus Areas: South Africa

South Africa's Food Future: A Transformative Scenarios (TSP) Process and Supporting Smallholders into Commercial Agriculture (SSA), these are multi-stakeholder processes

The Southern Africa Food Lab, in partnership with Reos Partners, decided to embark upon a transformative scenarios process (TSP) to critically examine the possible futures for South Africa's food system. The four scenarios focused on nutrition, political economy, production and climate change. This is a two prong project funded by the Ford Foundation which also included a component of work around supporting smallholders into commercial agriculture (SSA)

Partners: Reos Partners (facilitators),

Funder: the Ford Foundation (funders)

Focus Areas: South Africa

Supporting Smallholders into Commercial Agriculture and Strengthening Linkages with the Media

This project is focused on strengthening extension and advisory services for smallholder farmers in South Africa and engaging with farmers' voices to determine the barriers to entry to commercial markets and how these can be addressed through capacity building and partnerships with commercial supermarkets. There is also a strengthening the media component of the project which is focused on workshops with journalists in rural areas and increased engagement around the critical issue of smallholder farmers in South Africa.

Partners: Southern Africa Trust (funders), Spar, Phalaborwa Community Radio

Funder: the Southern Africa Trust (SAT)

Focus Areas: South Africa

Building Local Economies and Standards, researcher-driven

This project is focused on building local economies and improving standards of entry for smallholder farmers by providing mentoring and training for GlobalGap and other certifications that can enable

smallholder farmers' entry into commercial marketplaces. The project is funded by Treasury (FICA) with assistance from Flanders.

Partners: Lima Rural Development

Funder: FICA and Flanders (funders)

Focus Areas:

Organic Agriculture in South Africa

This project is focused on a systematic literature review examining current organic farming practices in South Africa and supporting organic farming practices among smallholder farmers.

Partners: the Sustainability Institute

Funder: GIZ (funders)

Focus Areas: South African

Hydrology, Remote Sensing, GIS

Study of the occurrence, distribution and movement of water over, through and under the land surface

Faculty: Science (Soil Science Department)

Type: Research Unit

Website: http://www.sun.ac.za/english/faculty/agri/soil-science/about-us/history-mission

Head of the Unit: Eduard Hoffman (ehoffman@sun.ac.za)

Main Contact Points: Willem P. de Clercq (wpcd@sun.ac.za)

Annual Budget:

Nationally/ Internationally Funded:

Research Projects (5)

ACCESS: continued long term monitoring of the hydrology of the Berg River catchment

The research focusses on defining a window period in time where we aim to understand the current state of the processes involved in the hydrology of the Berg River catchment. The research especially also look at the cyclicity of events, to understand why change occur over the short term, as climate change research are currently more conserned to understand current change.

Partners: UWC water Center, UKZN Water Institute, CSIR

Funder:

Focus Areas: South Africa

Southern African Science Service Centre for Climate Change and Adaptive Land Management (SASSCAL): SU manages the focus on water for SA

Aim to improve the capacities to provide sound science-based solutions for current problems and future risks in the region, in particular regarding climate change and the associated demands concerning land management practices of local players.

Partners: UWC water Center, UKZN Water Institute, CSIR

Funder:

Focus Areas: South Africa

PPP Giyani Limpopo

The central aim is to set up an innovation platform through which we will have a science based impact on the economic development that will take place over the next 10 years. The aimed development involves the renewal of an existing irrigation scheme, with a coordinated effort between public, private and donor's entities.

Partners: Alterra-Wageningen, Manombe Trust, ZZ2, LDA-Limpopo

Funder:

Focus Areas: Limpopo Province

SUWAM-Hessequa. Sustainable water management for resilience to climate change impact on society in South Africa

The objective is to enhance resilience to climate change impacts (CCI) on society. The chosen perspective is the water sector and impacts caused by changes in water related ecosystem services (ESS) and effects on man-made water cycle services (WCS). The specific goals are: 1. Map the current status and predicted CCI on water resources and related ESS with a focus on their impacts on society in Hessequa Municipality. 2. Assess the WCS of a selected settlement with a view to the identified CCI on water resources and related ESS, by social, economic and environmental sustainability analyses.

Partners: SINTEF, Norway

Funder:

Focus Areas: South Africa

Optimising soil fertility and plant nutrient status for increased Rooibos tea (Aspalathus linearis) quality and sustainable production in the Northern Cape, South Africa

Aims are:

- To investigate the effect of repeated rooibos cultivation cycles on soil fertility and plant leaf nutrient levels and yields, in order to establish why yields decrease with repeated cultivation and to establish healthy plant foliar norms.
- To develop an optimal fertilizer regime based on the findings of objective 1 for enhancing rooibos yields without damaging the environment with excessive nutrients.
- Investigating the fertilizer requirements for increased leaf development.

Partners: None

Funder:

Focus Areas: Northern Cape

Mondi Ecological Network Programme

This very large, perennial research project involves the design and offset of land for biodiversity conservation and the maintenance of ecological processes while optimizing agroforestry production and freshwater conservation. It has three primary researchers, several post-docs, PhD and MSc students. It is funded by Mondi Forests.

Faculty: Agrisciences

Type: Research Unit

Website: http://www.sun.ac.za/english/faculty/agri/conservation-ecology/research/mondi-ecological-network-programme

Head of the Unit: Michael Samways **(**samways@sun.ac.za)

Main Contact Points: Michael Samways **(**samways@sun.ac.za) James Pryke (jpryke@sun.ac.za)

Annual Budget:

Nationally/ Internationally Funded: Nationally funded

Research Projects (2)

Future-proofing Food

A large research project aimed at developing methods of biodiversity conservation in the context of sustainable agricultural production and freshwater conservation. This includes the development of intuitive farming methods. It has three primary researchers, one post-doc, PhD and MSc students.

Partners: James Pryke, René Gaigher

Funder: It is funded by the NRF.

Focus Areas: South Africa

Green Matter Biosphere Reserve Project

This research project aims to determine the complementary value of the buffer and transition zones relative to the core of three biosphere reserves in the Western Cape. It also involves the development of biodiversity conservation leaders for the future. It has three primary researchers and three PhD students.

Partners: James Pryke, René Gaigher

Funder: It is funded by GreenMatter.

Focus Areas: South Africa

Standard Bank Centre for Agribusiness Development and Leadership

Stellenbosch University's Standard Bank Centre for AgriBusiness Development and Leadership, funded by Standard Bank of South Africa, started its operations in April 2010 as one of the initiatives under the University's HOPE Project. The Centre is focused on the development and implementation of transformation strategies through academic training, research and leadership development support, and strives to be a preferred knowledge partner of the agricultural industry (in SA and in the context of Africa). The Centre operates in the Department of Agricultural Economics in the Faculty of AgriSciences.

Faculty: Agriscience

Type: Research Unit; Community Development

Website: http://www.sun.ac.za/english/faculty/agri/standard-bank-centre

Head of the Unit: Johan van Rooyen

Main Contact Points: Carin Bruce (cbruce@sun.ac.za); E von Wechmar (ekvw@sun.ac.za)

Annual Budget:

Nationally/ Internationally Funded:

Research and Mentoring Projects (5)

Academic and Research Programme

The Centre participates in the teaching of postgraduate students in Agribusiness and Rural Development. Eleven students were supported in 2014 through bursaries mobilised from institutions such as AgriSeta, Santam Agri and the Western Cape Department of Agriculture. The Centre's research programme focuses on case studies in agricultural transformation, leadership, agribusiness competitiveness analysis and food security, and the linking of new farmers/smallholders to commercial agri-food value chains. To date, a number of "local "and African cases have been developed and are used for teaching purposes. Two students submitted their Master's theses successfully in 2014 – Asanda Jafta, who graduated in December 2014, and Simphiwe Tshoni, who will graduate in March 2015. Asanda's thesis focused on the analysis of competitiveness in the SA apple industry, while Simphiwe focused on a smallholder farming typology for the Stellenbosch district.

Partners: Agribusiness and Rural Development; Stellenbosch University

Funder: AgriSeta, Santam Agri and the Western Cape Department of Agriculture

Focus Areas: South Africa

Agribusiness and Mentorship Development

A short course programme developed in collaboration with Standard Bank and PwC is focused on middle management and offers training for agri-mentors. Training on agricultural transformation and land reform is currently being contracted. Discussions are currently being held with a number of agribusinesses and government departments on the presentation of this short course. The Africa

University in Lusaka is considering a "franchise agreement" with the Centre to present this programme collaboratively elsewhere in Africa. Similar arrangements currently are being considered by the African Agribusiness Schools Association, which is active in parts of Africa. A new short course programme to support business development, in collaboration with Standard Bank and PwC, is in its development phase. The programme currently is being "tested" internally in Standard Bank. The next step is the formal certification and marketing of this course by Stellenbosch University.

Partners: University in Lusaka; Stellenbosch University

Funder: Standard Bank and PwC

Focus Areas: Africa

Agri-Leadership Laboratory

The Agri-Leadership Laboratory programme focuses on "thought leadership development" in the agricultural environment through the staging of "Agri-Leadership Imbizos". Prominent agri-leaders and opinion makers are invited to discuss "hot topics" in agricultural transformation in a "laboratory setting", i.e. to stimulate "out-of-the-box" debate and dialogue with the aim to develop new thinking and solutions. Only consensus statements from Imbizos ("one-pagers") are published on the Centre's website.

Fifteen Imbizos have being conducted since 2010, focusing on important agricultural topics such as "land reform and agricultural development", "job creation in agriculture" and "towards unity in organised agriculture". A "Young Leadership Laboratory" featuring prominent speakers is also conducted in collaboration with Santam Agri, Standard Bank and Grain SA.

An Imbizo on the implementation of the land reform proposals in the National Development Plan (NDP) was conducted in Mpumalanga Province (March 2014), mobilising prominent agribusiness institutions and leading commercial farmers.

In September 2014, an Imbizo was held that focused on "Agricultural Training and Education", conducted in collaboration with the Academy of Sciences of South Africa (ASSA) and the National Research Foundation. A "record of discussions" will be submitted jointly to the National Planning Commission.

The third Imbizo in 2014 focused on "Land reform and the contribution commercial farmers can make to implement the proposals contained in the National Development Plan (NDP)". This meeting was conducted in collaboration with the In Transformation Initiative and the GIBBS Business School in Johannesburg. It was jointly organised at the request of Gwede Mantashe, the Secretary General of the governing party, to meet prominent commercial farmers on this matter. More than 70 agri-leaders, relevant ministers and top government officials met on 16 September 2014.

Imbizo-linked activities concerning the implementation of the NDP pilot land reform initiative were staged in district and municipality context, as these are the local points for such implementation. The Centre was also active in a meeting on agricultural transformation strategy held in Stellenbosch in December 2014 between prominent farming and industry leaders.

Partners: Academy of Sciences of South Africa (ASSA) and the National Research Foundation

Funder: Santam Agri; Standard Bank and Grain SA; NRF

Focus Areas: South Africa

The African Agriculture Leadership Programme (AALP)

The AALP is a partnership between the Centre, the African Fellowship Trust (AFT) and the Royal Agricultural University (RAU) in the United Kingdom, and was launched at South Africa House in London on 30 June 2011. The aim is to strengthen agricultural business leadership and talent development in the context of Africa. Dr Z Skweyiya, the SA High Commissioner in the UK, hosted the launch.

The programme involves a postgraduate core component at Stellenbosch University and the RAU, and internships and industry placements of selected fellows of the AFT with South African agribusiness firms, agencies and financial institutions. To date, 21 Fellows have participated in the AALP and discussions to continue with this initiative are currently in progress.

The year 2014 saw the final phase of the AALP and five fellows undertook their industrial placement period with a number of agribusiness development agencies in the Western Cape – KaapAgri, ASNAPP, AgriMega and the Department of Agriculture.

Partners: the Centre, the African Fellowship Trust (AFT) and the Royal Agricultural University (RAU) in the United Kingdom

Funder: Western Cape – KaapAgri, ASNAPP, AgriMega and the Department of Agriculture.

Focus Areas: Western Cape

International networking

The Centre set a clear goal to establish itself as a world-class establishment, straddling the academic and operational agribusiness environment and focusing on leadership in agribusiness transformation and development issues. Respected international institutions, such as the World Food and Agricultural Organization (FAO), and the universities of Ghent in the Netherlands, Harvard, Wageningen and Cornel, and the Regional Universities Forum for Capacity Building in Agriculture (RUFORUM), have collaborated on the drafting of research publications.

In 2014 the Centre acted as co-presenter and organiser of the 25th World Forum of the International Food and Agribusiness Management (IFAMA) Conference held in Cape Town in June. The theme was “Africa’s Age of Opportunity in Agribusiness”. The Centre also featured prominently in a book, launched at the IFAMA conference, on “African agribusiness on the move”. Two Centre-based student teams – one from Stellenbosch and one from Africa – participated in the Global Case Study competition, with sponsorship organised by the Centre. The Centre was also involved in a number of presentations and keynote papers.

Partners: World Food and Agricultural Organization (FAO), and the universities of Ghent in the Netherlands, Harvard, Wageningen and Cornel, and the Regional Universities Forum for Capacity Building in Agriculture (RUFORUM)

Funder: World Forum of the International Food and Agribusiness Management (IFAMA)

Focus Areas: African Union and European Union

Sustainable Agriculture in South Africa (SASA)

Faculty: Agriscience

Type: Research Unit; Community Development

Website: http://www.sun.ac.za/english/faculty/agri/standard-bank-centre

Head of the Unit: Johan van Rooyen

Main Contact Points: Carin Bruce (cbruce@sun.ac.za)

Annual Budget:

Nationally/ Internationally Funded:

Research Projects (4)

One boer met die natuur: towards sustainable production of rooibos and honeybush in the Cape Fynbos of South Africa

This research investigates options for sustainable biomass production of two economically significant Cape Fynbos legumes. The focus is especially on small-scale farmers and production systems that incorporate local and scientific ecological knowledge.

Partners: Prof. Karen Esler, Prof Joop Schaminee, Dr Gerrie van de Ven (Wageningen University)

Funder: Niche funding Netherlands

Focus Areas: South Africa

SASA Project

The aim of the programme is to develop and maintain a research agenda for sustainable agriculture in South Africa. One objective towards that aim is to develop a Master's programme in Sustainable Agriculture at Stellenbosch University to train students from different disciplinary backgrounds in ways that ensure their marketability in the demanding and dynamic agricultural sector.

Partners: Wageningen University

Funder: Niche funding Netherlands

Focus Areas: South Africa

Honeybush Knowledge Partnership

This is research driven initiative amongst small-scale land-users of the Overberg village at Genadendal. Research outcomes on honeybush related research is shared with local land-users at their request. We also use the opportunity to generate research questions suitable for honours and MSc students.

Partners: Local farmers of Genadendal and surrounds, Prof. Alex Valentine (Botany/Zoology); Dr Shayne Jacobs (Conservation Ecology and Entomology) and Dr Marcellous le Roux (Agronomy)

Funder: Stellenbosch University internal funding

Focus Areas: South Africa

Local Ecological Knowledge and Climate Change

The research is aimed at improved understanding of the concerns landusers have with regard climate change and its effects on wild and cultivated honeybush in the different regions where it is produced. We also focus on the ecological and biophysical traits of honeybush to drought stress and other likely effects of climate change.

Partners: Ms Birgit Jilisen, Rhoda Malgas, Debby Comley

Funder: Cape Higher Education Consortium

Focus Areas: South Africa

Arts and Social Sciences

Department Of Geography and Environmental Studies

Urban studies encourages students to learn about cities as historical, social, cultural, economic, and political phenomena within a spatial context aiming to find solutions to seemingly intractable problems. The focus is mainly on the spatial transformation of the South African city. Special attention is given to small town developmental challenges.

Faculty: Arts and Social Science

Type: Research Unit; Teaching and Learning

Website: http://www0.sun.ac.za/geography/blog/

Head of the Unit: Sanette Ferreira (slaf@sun.ac.za)

Main Contact Points: Andrea Lombard (lombae1@unisa.ac.za.)

Annual Budget: ± R275 000

Nationally/ Internationally Funded: Both national and international funding

Research Study (1)

Renewable energy infrastructure development in rural South Africa: An Evolutionary Analysis

This study aims to investigate the role that solar and wind energy infrastructure can play in the economic diversification and socio-economic transformation in selected rural regions of South Africa. To establish a solid base and understanding of the concepts and constructs related to evolutionary economic geography and associated theoretical underpinnings by reviewing the international scholarship on this topic. To review the South African renewable energy policy context. To examine the socio-economic transformation of solar and wind energy infrastructure establishment and operation in the Northern and Western Cape provinces of South Africa. To design a predictive rural regional development model for areas to consider when introducing renewable energy infrastructure.

Partners: University of South Africa (UNISA)

Funder: DAAD-NRF In-country Masters and Doctoral Scholarship Programme. R100 000 p.a. (3 years)

Focus Areas: Eastern Cape; Northern Cape; and Western Cape (South Africa)

Economic and Management Sciences

Centre for Business in Society (CBiS)

The Centre for Business in Society (CBiS) is a Centre of Excellence within USB-ED with the mandate to make the sustainable development agenda of the 21st century relevant for leadership, organisational and societal learning. In doing so, CBiS is a laboratory for co-creating `transformative solutions for a sustainably developed world.

Faculty: Economic and Management Sciences (University of Stellenbosch Business School)

Type: Research Unit; Teaching and Learning

Website: http://www.usb-ed.com/content/Pages/Business-In-Society.aspx

Head of the Unit: Arnold Smit (Arnold.Smit@usb-ed.com) +27 (0)21 918 4404

Main Contact Points: Rochall Daniels (Rochall.Daniels@usb-ed.com)

Annual Budget:

Nationally/ Internationally Funded:

Research Programmes (6)

Systemic Organisational Transformation

Provides participants with the theory and methodology for dealing with systemic organisational development and transformation.

Partners: Biomatrix-Web

Funder:

Focus Areas:

Systemic Societal Transformation

Provides participants with the theory and methodology for dissolving complex societal problems.

Partners: Biomatrix-Web

Funder:

Focus Areas:

Spiral Dynamics Integral

Reveals the hidden codes that shape human nature, create global diversities, and drive evolutionary change.

Partners:

Funder:

Focus Areas:

Sustainability for Managers

Open enrolment and customised programmes that equips managers to deal with the sustainable development challenges of companies.

Partners:

Funder:

Focus Areas:

Enabling Sustainability through Action Research (EStAR)

An on-going sustainable development action learning project with SMEs.

Partners: Santam and Ashridge Business School

Funder:

Focus Areas:

Accelerating Next Generation Leadership in South Africa

A survey on top leadership talent development needs in South African companies (report to be expected later in 2014).

Partners:

Funder:

Focus Areas:

Department of Logistics

In common parlance, logistics often refers to the smooth execution of a complex or problematic operation. In a business context, it refers to the process of transporting resources from their place of origin, supporting the processing of these resources, and delivering the finished products on the intended time at a designated place at acceptable cost for consumption or use. In view of the fact that logistics adds value through the most profitable application of available means, adequate logistics competency gives firms and practitioners a competitive advantage.

Faculty: Economic and Management Sciences

Type: Teaching and Learning; research

Website: http://www.sun.ac.za/english/faculty/economy/logistics

Head of the Unit: Hannelie Nel (jhnel@sun.ac.za)

Main Contact Points: Stephan Krygsman (skrygsman@sun.ac.za)

Annual Budget:

Nationally/ Internationally Funded: National and international funding

Research Driven Projects (9)

Provincial Land Transport Framework for the Provincial Government of the Western Cape

Prepare the Provincial Land Transport Framework for the Western Cape and provide guidelines on appropriate institutional arrangements for transport authorities. Project management an interaction with various stakeholders (+/- 60)

Partners: Provincial Government of the Western Cape, Department of Transport and Public Works

Funder: Project Value: R1.5 million

Focus Areas: Western Cape

Implementation, updating and maintenance of the Highway Development and Management (HDM) software, South Africa

Brief Description: Support the role out of HDM to consultants, development of case studies to assist consultants and Branch officials with training in the use of HDM, updating, calibrations and further development of HDM model to suit the consultant's needs, research and development of socio-economic information for use in the HDM model for the economic analysis and prioritisation of road projects within the Western Cape.

Partners: Western Cape Provincial Administration: Roads Infrastructure Branch

Funder: Project Value: R1 250 000

Focus Areas: Western Cape

C885 - HDM-IV Implementation and Management, South Africa

Overall, the goal of the project will be to build the necessary capacity in the use, application and interpretation of the HDM-IV.

Partners: Western Cape Provincial Administration: Roads Infrastructure Branch

Funder: Project Value: R400 000

Focus Areas: Western Cape

Learner Public Transport System, South Africa

Developing a Learner Public Transport System for Department of Education.

Partners: Department of Education, Provincial Government: Western Cape

Funder: Project Value: R700 000

Focus Areas: Western Cape

HDM-4 and RED support, South Africa

HDM-4 and RED support and customising of software for Economic Evaluation Planning.

Partners: Department of Transport and Public Works, Provincial Government, Western Cape

Funder: Project Value: R500 000

Focus Areas: Western Cape

Integrated Transport Plan for Central Karoo, Western Province, South Africa

Integrated Transport plan for Central Karoo

Partners: Integrated Transport plan for Central Karoo

Funder: Project Value: R500 000

Focus Areas: Central Karoo

Various projects for City of Cape Town and Western Cape Provincial Administration, Western Province, South Africa

Cape Metropolitan Transport Plan: Context Framework – Part 1. Preparing alternative land use scenarios for the Cape Town Transport model and providing input on future growth scenarios, Quantification of the MSDF

Partners: City of Cape Town &Western Cape Provincial Administration

Funder: Project Value: R1 million

Focus Areas: Western Cape

Proposed system for guiding travel intensive land use, Department of Transport, South Africa

A proposed system for guiding travel intensive land use to areas with high accessibility. Modelling of best locations for model interchanges and defining land uses in terms of the Dutch ABC land use policy.

Partners: CSIR

Funder: Project Value: R250 000

Focus Areas: South Africa

Identifying land suitable for low income housing, Western Province, South Africa

Identifying land suitable for low income housing in close proximity to employment opportunities. Identifying accessibility contours for public transport users, GIS analysis, stakeholder consultation and assessing the suitability of land for low income housing from an infrastructure perspective.

Partners: none

Funder: Project Value: R1 million

Focus Areas:

School of Public Leadership

The School of Public Leadership (SPL) at Stellenbosch University (SU) provides solutions through unique research, graduate, postgraduate and executive programmes adding public value for the public good within a global and African context. The SPL relates dynamically, intellectually and professionally to the three pillars of effective and ethical public leadership – good governance, environmental management and sustainable development .At the SPL rigorous research is the proven method of finding solutions to problems and all programmes offered by the SPL are research and evidence based. The SPL is constantly generating useful knowledge that is implemented in the governance space for the benefit of South African and global citizens.

Faculty: Economic and Management Sciences

Type: Research Unit; Teaching and Learning

Website:

Head of the Unit: Johan Burger (Johan.Burger@spl.sun.ac.za)

Main Contact Points: Kobus Müller (Kobus.Muller@spl.sun.ac.za)

Annual Budget:

Nationally/ Internationally Funded: Nationally and internationally funded

Research Projects (4)

Improving the governance and economics of protected areas, ecosystem services and poverty eradication through HEI-capacity-building and transdisciplinary research

A 5-year capacity building programme for HEI (Copperbelt University, South African Wildlife College) involving as primary output the delivery of 12 PhDs and a Master's programme by 2018

Partners: Copperbelt University, South African Wildlife College, Norwegian University of Life Sciences

Funder:

Focus Areas: African Union and European Union

An assessment of the functional fit between environmental regulation and agricultural management of riverscapes in a biodiversity hotspot: the Breede Water Management Area

A 5-year capacity building programme for HEI (Copperbelt University, South African Wildlife College) involving as primary output the delivery of 12 PhDs and a Master's programme by 2018

Partners: none

Funder:

Focus Areas: South Africa

A natural risk governance model for the agricultural sector in the Western Cape

A 5-year capacity building programme for HEI (Copperbelt University, South African Wildlife College) involving as primary output the delivery of 12 PhDs and a Master's programme by 2018

Partners: none

Funder:

Focus Areas: South Africa

Tax-based integrated environmental policy instruments to promote sustainable agricultural practice in South Africa

A 5-year capacity building programme for HEI (Copperbelt University, South African Wildlife College) involving as primary output the delivery of 12 PhDs and a Master's programme by 2018

Partners: none

Funder:

Focus Areas: South Africa

Sustainability Institute

The Sustainability Institute in co-operation with the University's School for Public Leadership focuses on ecological, community and mental development. Sustainability Institute provides a space for people to explore an approach to creating a more equitable society that lives in a way that sustains rather than destroys the eco-system within which all society is embedded.

Faculty: Economic and Management Science

Type: Research Unit; Teaching and Learning

Website: http://www.sustainabilityinstitute.net/

Head of the Unit: Mark Swilling (Mark.Swilling@spl.sun.ac.za)

Main Contact Points: Mark Swilling (Mark.Swilling@spl.sun.ac.za)

Beatrix Steenkamp (Beatrix.Steenkamp@spl.sun.ac.za)

Annual Budget:

Nationally/ Internationally Funded: Nationally and internationally funded

Research projects (19)

Untamed Urbanism

Book edited by Mark Swilling, Adriana Allen (London) and Andreas Lampis (Bogota). Chapters contributed by researchers around the world. Mainly written by social scientists interested in urban change dynamics within a context of global environmental change. Essential argument is that urban dynamics can be understood in terms of tension between tendencies of urban systems to be untamed versus the tendency by powerful groups to impose measures aimed at 'taming' the city.

Partners: Stellenbosch University, International Social Science Council, Development Planning Unit at University College London, and University of Bogota

Funder:

Focus Areas: World Cities

Greening the South African Economy

book edited by Mark Swilling, Josephine Musango and Jeremy Wakeford, that includes 25 chapters from South African researchers covering the greening of a broad range of economic sectors.

Partners: National Research Foundation

Funder: National Research Foundation

Focus Areas: South Africa

Sustainable community-based infrastructure solutions

Three Phd theses on various sustainable socio-technical solutions to the problem of sanitation services in informal settlements.

Partners: Lauren Tavener-Smith, University of the Western Cape

Funder: National Research Foundation

Focus Areas: Africa

Material flow analysis of the South African economy

PhD research on first ever attempt to analyse the South African economy from a resource consumption perspective, using material flow analysis methods. Makes it possible to analyse the relationship between GDP growth and resource use over time.

Partners: National Research Foundation

Funder: National Research Foundation

Focus Areas: South Africa

Greening intra-African trade relations

PhD research project using a case study of fair trade coffee produced in Burundi, the structure and nature of the agro-processing value chain is analysed from the perspective of the coffee grower.

Partners: National Research Foundation, Utrecht University

Funder: National Research Foundation

Focus Areas: Burundi

Ethiopia's developmental state and the sustainability of agricultural irrigation systems

Given the central role of the state in greening the economy, this PhD thesis uses developmental state theory to analyse the Ethiopian state and its role in promoting irrigation systems in ways that pay little attention to long-term financial and ecological implications of the current system.

Partners: African Union

Funder: African Union

Focus Areas: Ethiopia

Integrated urban water management in Accra, Ghana

This is a PhD research project that attempts to merge material flow analysis with Integrated Water Resource Management approach to develop a solution for Accra's water resource problems.

Partners: African Union

Funder: African Union

Focus Areas: Accra, Ghana

Just Transitions: Explorations of Sustainability in an Unfair World

This is a book project that explores the socio-technical and socio-institutional dynamics of transition to more sustainable modes of consumption and production.

Partners: National Research Foundation, Stellenbosch University

Funder: National Research Foundation

Focus Areas: Developing Countries

iShack: community-based energy provision

This project has pioneered an approach to providing energy services in informal settlements using solar energy systems.

Partners: Green Fund, Development Bank of Southern Africa, Stellenbosch University

Funder: SA Government's Green Fund: SA Government's Green Fund

Focus Areas: South Africa

Understanding change agents for sustainable food systems in South Africa (PhD)

PhD research as part of NRF-funded Global Change project called 'Social Learning for Sustainable Food Systems'. Aim of the project is to understand the leaders who are driving change in the food system with the aim of ensuring greater food security and/or reducing hunger and/or creating more jobs and/or reducing environmental impacts etc. The ultimate aim is to determine whether the types of people who catalyse and lead change in the food system are similar in any way, which would help us to determine whether future leaders of change could be developed and nurtured. It will also help us to understand the challenges these people are facing in making the changes happen, and how we can assist them in being more effective in their work as change agents.

Partners: Supervisors: Prof Milla McLachlan and Dr Scott Drimie (Health Sciences Faculty, Stellenbosch Unviersity)

Funder: NRF

Focus Areas: Africa

The Food-Water-Energy Nexus in Developing Countries

Externally funded by the UK government's Department for International Cooperation (DfID). Set up and driven by researcher, Dr Jeremy Wakeford, and the funding is being channelled through the Sustainability Institute's consulting branch, SI Projects. The aim of the project is to better understand the linkages between the water, food and energy systems in developing countries, to make recommendations for policymakers in terms of how to ensure they protect their natural resources while ensuring water, energy and food security for their citizens, into the future. A literature review will be used to develop a typology of different kinds of nexus types in different developing countries. Various indicators of the health of these different nexus types will be developed and compared across countries.

Partners: DfID, researchers from SI Projects (Sustainability Institute, Stellenbosch)

Funder: Sustainability Institute

Focus Areas: Africa and United Kingdom

The status of organic agriculture in South Africa and opportunities for smallholder farmers

Externally funded by the German government's GIZ. Set up and driven by the Southern Africa Food Lab, which is linked to Stellenbosch University's Health Sciences Faculty. The Sustainability Institute researchers were contracted to conduct a literature review on the current status of organic agriculture, which will be used as a baseline for the rest of the study, which will involve engaging smallholder farmers and other key roleplayers in dialogue about the future opportunities for smallholders in organic farming.

Partners: GIZ, Southern Africa Food Lab, researchers from SI Projects (Sustainability Institute, Stellenbosch)

Funder: GIZ

Focus Areas: Africa

African Urban Metabolism Research Network (AUMRN)

The AUMRN aims to bring together academics, researchers and multiple local partners in African cities for discussions regarding the resource consequences of African urbanization over the coming decades.

Partners: Massachusetts Institute of Technology and Stellenbosch University collaborative Research

Funder: Massachusetts Institute of Technology (MIT) and Stellenbosch University

Focus Area: African Cities

Africa cities typologies: in-depth analysis for South Africa cities resource consumption

Partners: Stellenbosch University and MIT

Funder: NRF

Focus Areas: Africa

Towards building an inclusive green informal economy in South Africa: A systems approach

PhD study of Suzanne Smit at Stellenbosch University, in Progress

Partners: none

Funder: TBC

Focus Areas: South Africa

Project: Participatory Integrated Assessment of Energy Systems to Promote Energy Access and Efficiency (PARTICIPIA)

Partners: http://participia.net/

Funder: ACP-EU Co-operation

Focus Areas: Africa

Dynamic model of the Western Cape economy: Focus on the agricultural value chain

Completed 2014

Partners: Sustainability Institute, Stellenbosch University, Green Cape

Funder: Green Cape

Focus Areas: Western Cape

Incorporating agro-processing, automotive, iron and steel manufacturing into South Africa Green Economy Model

Completed 2014

Partners: Stellenbosch University, Industrial Development Corporation

Funder: Industrial Development Corporation

Focus Areas: South Africa

South Africa Green Economy Modelling

Completed 2014

Partners: UNEP, DEA, Stellenbosch University, Sustainability Institute

Funder: UNEP

Focus Areas: South Africa

Sustainability Institute Projects

SI Projects was formed in 2011 as a business unit of the SI to offer clients access to sustainability expertise shaped by the insights of the Masters programme and the latest research conducted by its students and associates. Projects are managed by a core group assisted by individuals and institutions within the SI's network, offering expertise across a range of sustainability-related areas.

Faculty: Economic and Management Science under Sustainability Institute

Type: Research Projects Unit

Website: http://www.sustainabilityinstitute.net/siprojects

Head of the Unit: Mark Swilling (Mark.Swilling@spl.sun.ac.za)

Main Contact Points: Mark Swilling (Mark.Swilling@spl.sun.ac.za)

Blake Robinson (blake@sustainabilityinstitute.net)

Luke Metelerkamp Luke@sustainabilityinstitute.net

Annual Budget:

Nationally/ Internationally Funded: Nationally and Internationally Funded

Research Projects (11)

Researching Resource Futures for Urbanisation (REFURB)

This project looks at the resource requirements on projected urbanisation to 2050, and consists of three components: (1) An estimation of the amounts of various resources required to accommodate the urban resource growth anticipated in the next 35 years, (2) How the use of various alternative / sustainable technologies / systems could reduce this overall resource impact, and (3) What governance configurations are required to achieve an urban transition toward more sustainable resource use. Expected Outcomes: three reports

Partners: UNEP, Tsama Hub, CSIRO, PBL, IIHS, UCSB, DRIFT, MIT

Funder: UNEP's International Resource Panel

Focus Areas: Cities around the world

Green Economy Toolkit for the Sub-National Level in Africa

The toolkit aims to assist sub-national levels of government to translate national green economy strategies into local plans and action. It looks at key sectors of relevance to the African context, as well as more general planning principles and approaches. The interactive toolkit brings together existing tools and case studies into an easily navigable software platform that can be used by a broad array of stakeholders. Expected Outcomes: Interactive planning toolkit

Partners: UNEP, Stockholm Environment Institute, UNU-INRA

Funder: UNEP and GIZ

Focus Areas: Sub-national levels of government in African countries

Toolkit for Resource Efficient Cities

This is an ongoing collaboration with UNEP that started with a comprehensive review of the approaches to assessing urban metabolisms and green city indicator sets in 2013. This led to the development of a draft toolkit for urban practitioners in the developing world. In 2013 and 2014, this was further refined in collaboration with city representatives from Southeast Asia, Latin America and Africa, and UNEP's partner institutions. The next phase of work is likely to involve piloting the toolkit in cities around the world. http://www.unep.org/resourceefficiency/Policy/ResourceEfficientCities/Activities/GI-REC

Partners: UNEP, IIED, ICLEI

Funder: UNEP's Global Initiative for Resource Efficient Cities (GI-REC)

Focus Areas: Cities around the world

Mitigating Risks and Vulnerabilities in the Energy-Food Nexus in Developing Countries

This report looks at the risks and vulnerabilities that developing countries face with regard to the food-energy-water nexus, and how these can be mitigated via a transition to more sustainable energy and food systems. A particular focus will be on how vulnerable food systems could become more resilient to energy shocks by making more efficient use of energy and by substituting inputs (including energy) for non-renewable inputs.

Partners: DFID-UK

Funder: Department for International Development (DFID-UK)

Focus Areas: Developing Countries

Spatial Development Framework for Stellenbosch town

Following on from a project we undertook in 2012 to summarise the SDF for Stellenbosch Municipality, we were approached to develop a new SDF focused on the town of Stellenbosch in an innovative manner that would embed sustainability into the town's future plans. In 2013, we started work on a two-pronged process: (1) using decision-making software to capture insights from local experts to develop scenarios and priorities for the town, and (2) inviting the public to contribute their ideas for improving pockets of Stellenbosch via a website. The two streams will be brought together in the drafting of a new SDF for Stellenbosch town in the coming months. www.shapingstellenbosch.co.za

Partners: Stellenbosch Municipality, RAINN, Centre for Knowledge Dynamics and Decision Making (Stellenbosch University)

Funder: Stellenbosch Municipality

Focus Areas: Stellenbosch town

The State of African Cities 2014: Re-imagining Sustainable Urban Transitions

This report evaluated the key pressures facing cities in all the sub-regions in Africa, and emphasized the need to make development decisions that respond to both formal and informal systems of trade, housing, land management, service provision and so forth. It proposed that a 'green

urbanism' development trajectory that responded to the high levels of poverty and inequality in African cities, as well as the low levels of basic service delivery and infrastructure provisions, be adopted by local, national and regional development actors and agencies. It dealt with the full realm of liveability concerns in African cities, and emphasized the role of the youth as a key resource for transitioning to more sustainable urban living standards, productivity, employment, ecosystems management and governance regimes. http://unhabitat.org/the-state-of-african-cities-2014/ Completed 2014

Partners: ICLEI

Funder: UN-Habitat

Focus Areas: African cities

City-Level Decoupling: Urban resource flows and the governance of infrastructure transitions

This report applied the concept of decoupling to the urbanisation challenge, looking at the role cities could play in a transition toward sustainability by investing in infrastructure that supports decoupling. Theoretical arguments were complemented by 30 case studies from around the world that demonstrate the concept of decoupling at the city scale. The project ran over 2 years, and involved the coordination of over 30 authors from around the world. http://www.unep.org/resourcepanel/Publications/City-LevelDecoupling/tabid/106135/Default.aspx Completed 2014

Partners: UNEP, SURF (Salford University) and experts from around the world

Funder: UNEP's International Resource Panel

Focus Areas: Cities around the world

Oil Shock Mitigation Strategies for Developing Countries

This report analysed the key socioeconomic vulnerabilities to and likely impact of oil price and supply shocks on developing countries, and recommended a broad set of mitigation strategies and policies for ameliorating these impacts. The areas covered included the energy system, transport, agriculture, macro-economy and socioeconomic welfare. The report included detailed oil shock vulnerability assessment case studies on Malawi, Nigeria, South Africa and India. http://r4d.dfid.gov.uk/Output/193544/ Completed 2013

Partners: DFID-UK

Funder: Department for International Development (DFID-UK)

Focus Areas: Developing Countries

Green economy modelling report for South Africa: focus on the sectors of Natural Resource Management, Agriculture, Transport and Energy

This report assessed potential opportunities and options to promote green economy, with a focus on key economic sectors set out by the South Africa's National Development Plan – Vision 2030. A modelling exercise compared scenarios of investments directed to business-as-usual, with scenarios allocated to four critical sectors to a green economy in South Africa, namely: energy, agriculture, transport and natural resource management. The findings of the study showed that strengthening

natural resource management is fundamental for sustained economic development and societal well-being. Completed 2013

Partners: UNEP, DEA

Funder: The Department of Environmental Affairs and UNEP

Focus Areas: South Africa

Green Living Guide

As part of a multi-year project with Nedbank aimed at introducing sustainability principles into their homeloans business, we developed a guide for sustainable living aimed at middle to high income South African homeowners. The guides provide a range of interventions from behavioural changes to more expensive investments in new technologies that help homeowners to save resources and money. The guides were launched at the 2013 Green Building Conference, branded as a collaboration between Nedbank, the Sustainability Institute and the GBCSA. http://www.nedbankgroup.co.za/green-living-guide.asp Completed 2013

Partners: Nedbank

Funder: Nedbank

Focus Areas: South Africa

Urban Patterns for a Green Economy Quick Guides

UN-Habitat approached us to assemble a series of short booklets to educate city decision makers on the latest concepts in urban sustainability, in order to encourage them to contribute toward greener economies. The booklets focused on urban infrastructure, density, ecosystem services and urban competitiveness, and included case studies from around the world to inspire innovative approaches. http://unhabitat.org/series/urban-patterns-for-a-green-economy/ Completed 2012

Partners: UN-Habitat, MCA Planning and experts from around the world

Funder: UN-Habitat

Focus Areas: Cities around the world

Projects for Western Cape Department of Agriculture (7)

Testing Loan Finance to Peri-urban Land Reform

Eric Swarts is an organic farmer and land reform beneficiary who has been farming 10ha of municipal commonage in Stellenbosch for the last 15 years. The research seeks to test two research hypotheses developed by Eric Swarts in collaboration with Transdiciplinary Researcher Vanessa von de Heyde. These are as follows:

- That facilitating strategic access to credit to land reform beneficiaries farming organically on small tracts of peri-urban land can dramatically improve the incomes of these farmers in 6 months, thus enabling them to self-finance much larger investments into their farming enterprises.

- That small tracts of well positioned peri-urban land can be developed into engines of growth for profitable and sustainable land reform with significant job creation potential

Partners: The Sustainability Institute, Stellenbosch University, Eric Swarts, Spier, Open Society Foundation

Funder: Spier; Various Donations

Focus Areas: Stellenbosch

GIZ/FoodLab Status of Smallholder Organics in South Africa

Literature review to provide the basis of a much longer study into supporting smallholders into organic agriculture. Aims to answer the following questions:

- What is the current status of organic agriculture in South Africa? What have been the major limitations and drivers of this over the past decade (changes in lifestyle, role of consumer ethics, middle class market, etc.)?
- What is the size of the organic market in South Africa? (What data is there on this? The retailers would have certain data, but it is questionable whether they would share competitive information.)
- What has been the growth curve in this market? The general perception is that organic sales peaked a number of years ago and has since decreased. What evidence exists to support this perception, or other growth trends?
- What are the key products currently produced organically in South Africa, including exports?
- What organic products do smallholder farmers in South Africa grow?
- What are the smallholder organic success stories?
- What can we learn from the literature on the future for smallholder organic farming in South Africa?

Partners: The Sustainability Institute, Stellenbosch University, Southern African Food Lab, GIZ, NNMU.

Funder: Southern African Food Lab

Focus Areas: Western Cape

DFID Global Food/Water/Energy Nexus Research Report

Global case study and literature review relating the food/water/energy nexus. In particular understanding how dynamics around the cost and provision of energy affects food availability.

Partners: DIFID, The Sustainability Institute

Funder: DIFID, The Sustainability Institute

Focus Areas: Various locations

Coproducing knowledge on food systems for development in Africa

Partnership between 6 universities across Africa, aiming to build a transdisciplinary approach to solving challenges across the following five thematic areas; (i) Institutions, governance and social

structures; (ii) Land Rights Issues; (iii) Nutrition, Health and Dietary Change; (iv) Farming and Food Production Systems; (v) Ecosystems and Resource Use

Partners: Stellenbosch University, Mekelle University, University of Ghana, University of Nigeria, University of Dar es Salaam, WITS University, Open Society Foundation.

Funder: Open Society Foundation

Focus Areas: Africa; other developing countries

Understanding change agents for sustainable food systems in South Africa

PhD research looking into the role which specific change agents play in modifying the food system.

Partners: Stellenbosch University

Funder: Various funders

Focus Areas: South Africa

Discord and transition: Leveraging crisis as a catalyst for change in peri-urban food systems in Southern Africa

This PhD research (supported by MPhil students) takes a participatory action research approach to supporting the growth and development of the existing Stellenbosch Agroecology Academy into a scalable, policy relevant example of peri-urban land reform, youth skills development and food system transformation. The core research question: What opportunities does rapid urbanisation present for unemployed youth along the urban fringe to increase their agency within, as well as contribution to, resilient local food systems in the face of climate change?

Investigated through the following four sub- themes:

- Agro-ecosystems - Can peri-urban investments into supporting ecological capital (specifically soil and water resources) be tested as a means of increasing the climate resilience and livelihood potential of peri-urban agro-ecosystems?
- Enterprise models - Investigating more equitable models of beneficiation from the food value chain along the growing urban fringe. Does developing alternative value chains for peri-urban producers (which operate outside of the big 5 retailers) present a viable opportunity to broaden the ownership base and increase employment with the Western Cape's food system?
- Youth employment - Investigating the potential of explicitly peri-urban modes of intensive agricultural production as a means of promoting green jobs and food security in the context of land reform. Can the growth of the urban fringe be used as a means of supporting the emergence of a new class of agrarian micro-entrepreneurs?
- Capacity development - What capacity/capability barriers need to be overcome in order to enable the emergence of successful small scale urban and peri-urban agri/food-enterprises?

Partners: Stellenbosch University, University College London

Funder: Various funders

Focus Areas: South Africa

Ernst & Young Food Systems Research Series – exploring private sector engagement in African food systems

5 paper research series undertaken over two years exploring issues relating to the South African food system from a private sector perspective. Completed 2014

Partners: Stellenbosch University, The Sustainability Institute, Ernest & Young

Funder: Stellenbosch University, The Sustainability Institute, Ernest & Young

Focus Areas: Africa

Engineering

Centre for Renewable and Sustainable Energy Studies (CRES)

CRSES acts as a central point of entry into Stellenbosch University for the general field of renewable energy, and strives to develop renewable and sustainable energy in order to facilitate economic growth in the area of renewable energy.

Faculty: Engineering

Type: Research Unit

Website: *http://www.crses.sun.ac.za/home*

Head of the Unit: Corli Leonard (corli@sun.ac.za)

Main Contact Points: Alan Brent (acb@sun.ac.za*)* & Carla Nell (carlanel@sun.ac.za)

Annual Budget:

Nationally/ Internationally Funded:

Research projects portfolio (38)

Letsatsi Solar PV - Resource and Yield prediction

The aim of this project was to provide Exxaro Resources with a solar resource report and PV yield report for their proposed 11 MW PV plant near Vryburg in the Northern Cape province of South Africa. Completed 2012

Partners: University of Pretoria; University of KwaZulu-Natal; University of Cape Town

Funder: Exxaro

Focus Areas: South Africa

Continuation Lephalale Measurements

Stellenbosch University through the Centre for Renewable and Sustainable Energy Studies (CRSES) is currently managing a solar measurement station for Exxaro in Lephalale. This station has been managed from middle February 2010 to the end of February 2011. The aim of this project is to continue this service for another year (March 2011 – February 2012). Completed 2012

Partners: Eskom; JSM-Power; Adventure Power; University of Cape Town

Funder: Exxaro

Focus Areas: South Africa

On Site Solar Insolation Measurement – Danielskuil and Kimberley

On Site Solar Insolation Measurement for the purpose of installing a large PV and/or CSP plant at Daniëlskuil (Groenwater site) and Kimberley (Platfontein). DNI, GHI, OTI and Diffuse will be measured. Stellenbosch University through the Centre for Renewable and Sustainable Energy Studies (CRSES) has the required expertise and access to data-bases to execute such irradiation measurement and assessment projects. The aim of this project is to measure solar irradiation at two sites specified by the client and to correlate the data with the corresponding satellite data as well as with historic satellite data. Therefore, the client needs to have already performed a pre-feasibility study to identify a specific site where the solar resource needs to be characterised. Other weather data (wind, temperature, humidity, rainfall, etc.) will also be measured and can be used by CSP and/or PV project developers to design their plant. Completed 2012

Partners: Afri Devo Eskom, University of Cape Town.

Funder: Afri Devo

Focus Areas: Northern Cape

Solar and Wind Potential Study of South Africa (Grid Study)

The Strategic Grid Planning Manager at Eskom Grid Planning contacted the Centre for Renewable and Sustainable Energy Studies (CRSES) to conduct a study on solar and wind energy. The findings of this study will assist decision makers' grid planning strategies with focus on the integration of renewable energy forms. Stellenbosch University through the Centre for Renewable and Sustainable Energy Studies (CRSES) has the required expertise to conduct such a study. Furthermore, the CRSES has access to relevant solar data-bases and previous expertise with GIS to execute the solar component of the study. CRSES is less confident with wind energy, therefore a competent third party will assist with this section of the study. This partner will have access to the necessary accurate wind maps and data. Completed 2012

Partners: ESKOM

Funder: ESKOM

Focus Areas: Southern Africa

On Site Solar Measurement – Noupoort CPV site: Installation of equipment and site visits

Focuses on solar cell and module testing and characterisation; system evaluation and monitoring; concentrator PV cell characterisation and module design; outdoor testing; and building integrated PV design and embedded generation. Completed 2012

Partners: Terra Solar Energy Pty (Ltd)

Funder: Terra Solar Energy Pty (Ltd)

Focus Areas: Northern Cape

Pre-feasibility Study of a Concentrating Solar Power (CSP) Plant at Distell

A pre-feasibility analysis to construct and operate a concentrating solar power (CSP) plant, for electricity generation and/or process heat provision purposes, at one of the Distell sites in the Western Cape Province. Completed 2012

Partners: Distell Group (Ltd)

Funder: Distell Group (Ltd)

Focus Areas: South Africa

Maintenance of Solar Measurement Stations in the Northern Cape

Aveng Engineering & Projects Company has recently installed two solar measurement stations in the Northern Cape. These stations use Kipp&Zonen solar trackers and solar sensors (pyrheliometer and pyranometers). The tracker and instruments require regular maintenance and cleaning. Stellenbosch University, through the Centre for Renewable and Sustainable Energy Studies, has the required expertise and experience in installing and maintaining such stations. At this stage the Centre monitored and maintained 8 such stations. CRSES was tasked to maintain these stations and to download the data for 12 months. Completed 2012

Partners: Vexicom (Pty) Ltd

Funder: Vexicom (Pty) Ltd

Focus Areas: Northern Cape

Lesotho Solar Measurement Installation and Personnel Training – UNDP

A recent tender was released by the UNDP on the acquisition and installation of three solar measurement stations in Lesotho and training of two Lesotho Meteorological Services (LMS) personnel in Maseru. A proposal was submitted by Campbell Scientific Africa (CSAfrica) where the hardware and some training will be provided by CSAfrica and the larger training and installation component be completed by CRSES. Completed 2012

Partners: CS Africa

Funder: CS Africa

Focus Areas: Lesotho

Supply and Delivery of Solar Resource Maps at the Department of Economic Development and Tourism

Stellenbosch University and the University of KwaZulu-Natal undertook a project to provide solar energy data and maps to the KwaZulu-Natal Department of Economic Development and Tourism, comprising of the following:

- Customised high-resolution, satellite-derived, digital solar radiometric datasets covering the Province of KwaZulu-Natal in geo-referenced ESRI ArcGIS format.
- Full-colour satellite-derived poster maps in digital printing file format covering the Province of KwaZulu-Natal. Completed 2012

Partners: KZN Economic Development

Funder: KZN Economic Development

Focus Areas: KwaZulu-Natal

SOLTRAIN I: Southern African Solar Thermal Training and Demonstration Initiative

SOLTRAIN (Southern African Solar Thermal Training and Demonstration Initiative) is funded by the Austrian Development Agency and one of the main activities is focussed awareness campaigns of

solar thermal applications for specific stakeholders and to highlight the impacts of energy savings and secure supply. With solar thermal energy we refer to all technologies that convert solar energy into useful thermal energy. This includes solar water heating and cooling for residential, commercial and industrial applications using non-concentrating and concentrating solar collectors. Completed 2012

Partners: AEE Intec – Institute for Sustainable Technologies

Funder: AEE Intec – Institute for Sustainable Technologies

Focus Areas: Southern Africa

PV Rooftop Study – Hessequa

Review of the current technical, regulatory and financial frameworks governing (or constraining) the rooftop PV market in South Africa, and benchmark it against international best practices. The study was also to investigate different technical, financial and social-economic scenarios to stimulate the rooftop PV market in South Africa and provide recommendations on how to implement the most promising of these in a typical midsize municipality. Completed 2013

Partners: GreenCape Initiative

Funder: GreenCape Initiative

Focus Areas: South Africa

Grid Planning Phase 3 – WASA data (CRSES2012/07)

Acquiring the WASA data in the appropriate GIS format, refinement of environmental and developmental criteria used in the GIS methodology and generation of results. Currently the WASA wind data is in a digital format that is accessible via an online interface. The first step will be to translate or acquire the WASA map in shapefile format. After the WASA map has been obtained the refinement of the GIS criteria will be conducted. This involves including criteria as determined by the regional strategic environmental assessment conducted by the Western Cape government. The criteria to be included will only depend on available digitized maps. Specific areas of layer refinement include more up-to-date representation of housing in rural areas (farm houses etc.) and location of private-game reserves. Completed 2013

Partners: ESKOM

Funder: ESKOM

Focus Areas: Western Cape

Broadbased RE Potential of South Africa (CRSES2012/12)

Acquiring the underlying data used to determine the various different renewable resource capacities in the appropriate GIS format, application of environmental and developmental criteria used; and generation of results as GIS layers. Completed 2013

Partners: ESKOM

Funder: ESKOM

Focus Areas: South Africa

Solar Study: Effect of Clouds on Solar Plants (CRSES2012/14)

To quantify the impact of clouds on PV power production from PV installations for preparation / defining of appropriate operational strategies and management of solar power fluctuations. All types of weather and season are analysed and most extreme cases are selected. The data can be used for optimum site selection in terms of maximising the output and minimising the impact on the grid. The focus of the study is to enhance understanding of the impact of cloud cover and movement and its typical patterns. The study will provide key support information for minimizing negative effects of PV on grid stability / load. The study will provide preparatory information for grid analysis and for implementation of forecast tools. Completed 2013

Partners: ESKOM

Funder: ESKOM

Focus Areas: South Africa

Installation and Measurements at Solar Station in Upington

The aim of this project is to measure solar irradiation at a site specified by the client for at least 12 months. Other weather data (wind, temperature, humidity, rainfall, etc.) will also be measured. A satellite derived data time series will be updated with ground measured solar data obtained from Eskom. Later the on-site measured solar data will further be used to update the satellite data. Completed 2013

Partners: Sasol New Energy

Funder: Sasol New Energy

Focus Areas: Northern Cape

DNI measuring equipment procurement, installation, commissioning and reporting

The aim of the study is to establish the solar radiation in terms of DNI at various locations of interest to Sasol. The data will be used to design possible solar fields which will in turn generate energy to be used in various ways. These solar fields are highly capital intensive and their optimal design will have a deciding influence on the feasibility of any solar related project. It is therefore crucial that the base case for the design, namely the solar resource, be determined accurately. Completed 2013

Partners: SASOL New Energy

Funder: SASOL New Energy

Focus Areas: South Africa

Rwanda Renewable Energy Strategy

The United Nations Environmental Programme (UNEP) intends to undertake a Green Economy Sector Study on Energy in Rwanda. The study aims to support the Vision 2020 that the government developed, which aims to transform Rwanda's economy in promoting economic development, providing policy reduction strategies, and promoting green growth and climate resilience. Completed 2013

Partners: UNEP

Funder: UNEP

Focus Areas: Rwanda

Solar and wind energy for rural water supply projects in Ethiopia

Ethiopia has an abundance of solar and wind energy resource that is currently not being exploited. The country also has a significant need to pump water, which is done either by hand or by fossil fuel powered pumps. In order to address these challenges experts needed to be trained to be competent in utilising the available natural resources of available energy to pump water. This project consisted of the training of a group of 26 Ethiopian delegates on specifically pumping water using solar and wind energy. Completed 2013

Partners: Ethiopian Ministry of Water and Energy

Funder: Ethiopian Ministry of Water and Energy

Focus Areas: Ethiopia

OWS Scaling / Testing Device

Natural Energy Systems has approached CRSES in order to help quantify the device testing and scaling parameters which are needed for the development of their novel OWC concept. The specific emphasis on this invention is the unique turbine which has been developed by Natural Energy Systems. The focus of the work done by CRSES is to establish a set of test parameters which will lead to results with integrity whilst making use of the established model test rig that is currently in existence. Completed 2013

Partners: Natural Energy Systems

Funder: Natural Energy Systems

Focus Areas: South Africa

REVIEW OF OCEAN ENERGY RESOURCE DATA

In this project a review of the available ocean energy resource data available in South Africa was conducted, some of the past resource assessments were summarised and two case studies were completed in order to pave the way to a better understanding of the available ocean energy resource along the South African coast. Completed 2013

Partners: TIA / SANEDI

Funder: TIA / SANEDI

Focus Areas: South Africa

Eskom RE Analyst

A joint venture between the Centre for Renewable and Sustainable Energy Studies at Stellenbosch University and 3E Renewable Energy Services for the appointment of a consultant as a Resource Analyst Manager to conduct resource measurement and analysis to assess site potential in support of Eskom's Renewables Business Unit strategies. The Resource Analyst Manager (in this case Solar (Stellenbosch University) and Wind (3E)) was required to provide analytical support to the Renewables Business Unit with regards to wind and solar resource assessment, energy capture derivation, site conditions, and wind farm optimization. The study was required to aid robust project development and assessment of suitability and economic viability of sites. Completed 2013

Partners: Eskom Holdings (Pty) Ltd

Funder: Eskom Holdings (Pty) Ltd

Focus Areas: South Africa

SOLTRAIN II: Southern African Solar Thermal Training and Demonstration Initiative

SOLTRAIN (Southern African Solar Thermal Training and Demonstration Initiative) is funded by the Austrian Development Agency and one of the main activities is focussed awareness campaigns of solar thermal applications for specific stakeholders and to highlight the impacts of energy savings and secure supply. With solar thermal energy we refer to all technologies that convert solar energy into useful thermal energy. This includes solar water heating and cooling for residential, commercial and industrial applications using non-concentrating and concentrating solar collectors. Ongoing (2012-2016)

Partners: AEE Intec – Institute for Sustainable Technologies

Funder: AEE Intec – Institute for Sustainable Technologies

Focus Areas: Southern Africa

South African-German Energy Programme - Installation and Monitoring of DNI Solar Stations and Updating of the South African DNI Solar Map

This project proposes the installation of six high accuracy DNI stations with data that will be placed in the public domain. The purpose of the project is to:

- Place six sets of high accuracy solar measured data in the public domain. High accuracy solar data forms the basis of a range of activities relating and eventually resulting into solar developments.
- Update the current SolarGIS DNI map after one year of measurements of the proposed six stations as well as other data that is in the public domain obtainable from Universities and other organisations.
- To summarise all the work that was done on this project in a detailed report. The report will explain the results and methodologies followed in updating the solar map. The report will also summarise all measured data. Completed 2014

Partners: German International Cooperation (GIZ)

Funder: German International Cooperation (GIZ)

Focus Areas: South Africa & German

ETHEKWINI – GREEN POWER TARIFF PROPOSAL

By conducting the Green Power Tariff Feasibility Study, CRSES assisted the Energy Office at eThekwini Municipality to:

- Understand international and national experience in implementing green tariffs
- Design a Green Tariff structure that would be appropriate for implementation in eThekwini Municipality

- Understand likely levels of market demand for the tariff. Completed 2014

Partners: eThekwini Municipality

Funder: eThekwini Municipality

Focus Areas: KwaZulu Natal

Mapping of Current Renewable Energy EIA Applications

The Centre for Renewable and Sustainable Energy Studies (CRSES) conducted a digitizing project on GIS platform. The digitizing entails collecting or obtaining the spatial location and project summary details of approximately 650 EIA applicants specific to large scale renewable energy projects. The project was extended to capture, verify and spatially represent additional information provided by developers in response to the release of Version 1 of the RE EIA Application Map as well as back capture renewable energy applications since December 2012, for a period of six months from the signing of a contract. Completed 2014

Partners: CSIR

Funder: CSIR

Focus Areas: South Africa

National Strategic Environmental Assessment (SEA) identification for the rollout of Wind and Solar PV Energy in South Africa

The Centre for Renewable and Sustainable Energy conducted GIS based sensitivity mapping as part of the National Wind and Solar PV SEA projects. The objective of the SEAs are for Renewable Energy Development Zones (REDZs) to be identified and submitted for Cabinet approval for the rollout of wind in the Northern Cape, Eastern Cape and Western Cape provinces, and solar PV energy in the Northern Cape, Eastern Cape, Western Cape and Free State provinces. The REDZs will allow for wind and solar PV energy projects and the associated grid infrastructure to be developed in these areas without requiring additional environmental authorization, subject to certain conditions or guidelines. In identifying the REDZs the SEAs will give consideration to a number of aspects including the resource potential as well as environmental and social sensitivities of certain study areas. Completed 2014

Partners: CSIR

Funder: CSIR

Focus Areas: South Africa

V & A Waterfront Renewable Energy Advisory

CRSES will perform an on-site prefeasibility study on the installation of a large (>500 kWp) photovoltaic (PV) project. The project's aim is to offset current electrical energy usage from the grid and increase the renewable energy sources as per the client's sustainability mandate. For the PV system a tender process will be followed to procure a turnkey solution for the client and CRSES will

lead the development and specification of related tender documentation as technical advisor to the client. Completed 2014

Partners: V & A Waterfront Holdings (Pty) Ltd

Funder: V & A Waterfront Holdings (Pty) Ltd

Focus Areas: Western Cape

STAGE-STE EU-FP7 (Scientific and Technological Alliance for Guaranteeing the European Excellence in Concentrating Solar Thermal Energy)

The project is divided into three sub-tasks namely:

- Task A: Development of an indigenous low cost version of a direct steam Linear Fresnel (This collector will be designed at SU, literature study, comparison of current designs, find a low cost version for this design).
- Task B: Implementing and testing a methodology for dynamic solar field testing which was developed by FHG. One or two Fresnel collectors should be measured in SA to verify this methodology.
- Task C: Joint workshops and short-term exchange (workshop in either Europe and/or SA to discuss the results and create procedures for the future). Completed 2014

Partners: EU

Funder: EU

Focus Areas: European Union and Africa

Technical Advice on Large (1MW) PV Installation

CRSES was appointed as technical advisor to complete a prefeasibility study leading up to the development of a tender specification document that will be used in a formal tender process to procure a turnkey 1 MW, or less, PV project. Services rendered included:

- Consolidation of historical electrical energy usage data (time series format). Data was obtained and analysed.
- On-site investigation into available/existing infrastructure related to the development of 1 MW PV. Identify various PV project areas with recommendations.
- Asses the available solar resource for the greater estate as well as smaller project areas (rooftops, vacant land areas etc.).
- Investigate and catalogue secondary renewable resources on the estate deemed important to future development.
- Develop technical specification and tender process related to a large scale (500 kW) roof integrated PV system for a turnkey installation. The technical specifications formed part of the tender documentation and was used in a tender process for procurement purposes. Bid submissions are currently under review.
- Compile an analysis of the tenders received in a report. Completed 2014

Partners: Lourensford Wine Estate

Funder: Lourensford Wine Estate

Focus Areas: Western Cape

GUIDELINES FOR ENERGY MANAGEMENT IN WINERIES

To develop an Energy Management Guideline that can be used as part of, or incorporated into, the IPW practices of wineries/cellars. The resulting guideline will be applicable to any size cellar but the focus will be on smaller cellars that cannot necessarily afford a full energy audit or energy efficiency consultations. This guideline will firstly aid in the decision making process and will also highlight the potential savings on energy efficiency measures to aid in the justification of assigning resources to this crucial part of a cellar's operations. Completed 2014

Partners: Winetech

Funder: Winetech

Focus Areas: South Africa

Conducting RESEARCH on the GREEN ECONOMY IN KWAZULU-NATAL (Contract 1)

The KwaZulu-Natal Provincial Government approached the Centre for Renewable and Sustainable Energy Studies (CRSES) to conduct research on the Green Economy in KwaZulu-Natal. The project was divided into three sub-projects: KwaZulu-Natal Renewable Energy Development Potential GIS Study; KwaZulu-Natal Sustainable Energy Investment Policy (SEIP); and KwaZulu-Natal Waste Energy Policy (WEP). Completed 2014

Partners: KZN Government

Funder: KZN Government

Focus Areas: KZN

Conducting RESEARCH on the GREEN ECONOMY IN KWAZULU-NATAL (Contract 2)

After the successful completion of the first KZN Government funded project, the contract has been extended to keep on conducting research on the Green Economy in KwaZulu-Natal. This project was again divided into two sub-projects: KwaZulu-Natal Renewable Energy Development Potential GIS Study; KwaZulu-Natal Sustainable Energy Investment Policy (SEIP); and KwaZulu-Natal Waste Energy Policy (WEP). Ongoing

Partners: KZN Government

Funder: KZN Government

Focus Areas: KZN

Desktop study on technologies to convert biomass to energy and electricity

A survey using readily available information from international sources to identify technologies and processes used to convert biomass into energy and electricity. Gaia Carbon Sciences provided assistance and inputs. CRSES focused on technologies and processes using:

- Pyrolysis of biomass to energy and the generation of electricity with biochar as a by-product.
- Gasification of biomass and the generation of energy and electricity.

- The use of biomass and oilseeds for the manufacture of bio-diesel.

CRSES focused on technologies and processes which are already commercialized or very close to commercialization. The proprietors and operators of these technologies and processes and in particular those with a possible interest in establishing ventures in Southern and Eastern Africa have also been identified. Completed 2014

Partners: Gaia Carbon Sciences

Funder: Gaia Carbon Sciences

Focus Areas: Southern and Eastern Africa

Renewable Energy Advisor

CRSES performed an on-site prefeasibility study on the installation of a large (>50 kWp) photovoltaic (PV) project and investigated the potential of solar process heat integration. The project was to offset current electrical energy usage and increase the client's sustainability mandate. The services required by the client entailed consolidating all existing electrical data and determining the historical electrical energy usage, preferably in time-series format. Existing infrastructure primarily for rooftop PV development was investigated and included assessing available project space and determining the solar resource. Completed 2014

Partners: Pepkor

Funder: Pepkor

Focus Areas: South Africa

Singita Lebombo Tender Review

CRSES performed an independent review of tender documentation relating to a solar based energy system at their Lebombo lodge in the Kruger National Park. The client required an independent consultant with special expertise in the hybrid energy and renewable energy fields to assist in reviewing and assessing the two bids received, with the purpose of arriving at a "Preferred Bidder" with whom the client may confidently enter into a Power Purchase Agreement (PPA). Completed 2014

Partners: Singita Lebombo Lodge

Funder: Singita Lebombo Lodge

Focus Areas: Mpumalanga

Biofules: From Viability to Pilot Projects

Multi-criteria assessment of bio-ethanol, biodiesel and biogas productions from wastes and crops. Simulation and assessment of advanced processes for co-production of ethanol and high-protein animal feed from triticale grain. Completed 2014

Partners: GreenCape Initiative

Funder: GreenCape

Focus Areas: South Africa

Mangaung Municipality Water Project – Renewable Energy Advisory

The Mangaung Metropolitan Municipality approached the Centre for Renewable and Sustainable Energy Studies to perform a prefeasibility study on the use of renewable energy to provide electricity for a new pumped water supply project. The water supply project will connect the Gariep dam to the client's water reticulation system in the central Free State, with the main electricity demand for pump stations located near the Gariep dam in the southern Free State. CRSES assessed the site at the specified location of the pump stations identified by the client for their potential to generate electricity from wind and solar energy. The aim of the study was to offset the electrical energy usage and demand of the pump stations from the Eskom supply and reduce future energy costs associated with the operation of the water supply system. Completed 2014

Partners: BiGen

Funder: BiGen

Focus Areas: Mpumalanga

Aurecon Solar Assisted Central Receiver Concept Design and Optimisation

The project was limited to a concept design, analysis and optimization of the central receiver collector system in a solar augmentation/boosting project. The primary design activities that were addressed are:

- Conceptual design and optimization of 1 or more heliostat fields to fit into the parcel of land. The result is a conceptual heliostat field arrangement optimized for an objective function related to the economic performance of the system but primarily based on the optical analysis.
- Determination of the peak annual receiver power for the concept.
- Conceptual design and documentation of the tower height, receiver size and boiler requirements.
- Basic cost analysis for capital ($/kW) and operation ($/kWh). There calculations will be based on the reference costs for heliostats (Sandia power tower roadmap 2011), a single TMY data set and a prescribed set of assumptions for the time value of money. Completed 2014

Partners: Aurecon

Funder: Aurecon

Focus Areas: South Africa

Department of Information Technology

Developing new ways of working and a different work culture is now more important than ever as we find ourselves in the Information Age. As the focus shifts to the application of information and communication technologies (ICT) within Stellenbosch University's strategy, the IT Division has to be able to meet higher expectations. The new building can be viewed as a tool, amongst others, to help meet these expectations. The nature of knowledge work in the Information Age, in which the IT Division engages, is increasingly team-oriented, social, requiring intensive communication, interactions, knowledge sharing, continuous learning and consultation. The ability to collaborate, breaking out of siloed thinking, effective networking and flexibility become valued capabilities. Finally, the work environment must be healthy, encourage creativity and collaboration and must be a place where people want to work and spend time. A working environment that is welcoming, open and does not reinforce hierarchies and promotes flexibility and communication will contribute to the transition to a next-generation IT Division.

Faculty: Engineering

Type: Operation and Management

Website: http://blogs.sun.ac.za/it/category/green-it-2/

Head of the Unit: Albert Meyer (IT) (ajuyn@sun.ac.za)

Main Contact Points: Ralph Pina (ralph@sun.ac.za)

Annual Budget:

Nationally/ Internationally Funded: nationally and internationally funded

Research Projects

Procurement of energy-efficient computers for the institution

SU goes out on tender every 2 years for the supply of laptops/PCs for university staff. Components of the tender criteria are Energy Star and EPEAT ratings. (Ongoing Research)

***Partners**: Computer vendors*

***Funder**: Stellenbosch University*

***Focus Areas**: African Universities*

New IT Building

The new IT Building is under construction for occupancy 1 Sept 2015. As clients the IT Division has insisted on various sustainability features in the design and these have been incorporated. The features can be considered according to the Green Building Council of South Africa's Green Star Office rating tool categories. Energy efficiency and renewable energy: Solar photovoltaic energy generation on the roof (15kWp); optimal northern orientation and window sizing; shading elements; vertical garden on the northern aspect to minimise heating and cooling; usage of river water for cooling; low energy lighting and smart lighting. Indoor environment quality (IEQ): Natural lighting; ventilation; minimisation of noise. Transport: Bicycle store and facilities for cyclists; optimal parking spaces. Innovation: The vertical garden; the use of river and rainwater for air-conditioning plant cooling. (Current Research)

Main Contact person information

Main Contact person information

Law

The Development and Rule of Law Programme [DROP]

DROP is aimed at researching "sustainable development law and policy" focusing on reconciling the tensions between environmental sustainability, economic development, and human welfare with a holistic view of current legal, political, economic, social and cultural developments. It integrates public international law (i.e. international economic, social, and environmental law), regional and national law and policy with the goal of enhancing the rule of law around the world and reducing poverty in developing nations.

Faculty: Law

Type: Research Unit

Website: http://drop.sun.ac.za/

Head of the Unit: Oliver C. Ruppel (ruppel@sun.ac.za)

Main Contact Points: Oliver C. Ruppel (ruppel@sun.ac.za)

Annual Budget:

Nationally/ Internationally Funded: Nationally and internationally funded

Research Projects (10)

Wasser und Land - Brennpunkte innerhalb der Entwicklungsgemeinschaft des südlichen Afrika (SADC)

Investigating access to land and water rights for justice and sustainability in SADC (Completed 2012)

Partners: Rottendorf Project, Munich School of Philosophy, SJ

Funder:

Focus Areas: SADC regions

Knowledge lives in the lake. Case studies in environmental and customary law from southern Africa. Namibia Scientific Society

Research on the interplay of environmental and customary law for the protection of biodiversity in southern Africa

Partners: United Nations Environment Programme (UNEP)

Funder:

Focus Areas: Windhoek

Research on Climate Change: International Law and Global Governance: Legal Responses and Global Responsibility

One of the first academic attempts to systematically address both international climate change law and global climate change governance. International climate change law is not only a new and emerging legal discipline. In fact, climate change permeates public and private law, national and international law in many ways creating intersections of law in its diverse procedural and substantive fields. The project deals with international law and the multiple regulatory regimes reflecting fragmentation in the absence of a universal climate change regime. International climate change law, global climate governance and diplomacy are interrelated and extremely complex: The project explores these areas from a variety of doctrinal, transdisciplinary and thematic perspectives. In doing so the project inter alia reflects on international climate change law as a new international law discipline; climate change and human rights; climate change, international trade and investment law; the law of the sea and sea-level rise; judicial review and international climate change litigation; and multiple crosscutting issues such as mitigation regulation, natural resource management and climate-engineering. (Completed 2013)

Partners: Konrad Adenauer Foundation

Funder:

Focus Areas: South Africa and other countries

Research on Policy, Diplomacy and Governance in a Changing Environment

The project reflects on the United Nations Convention on Climate Change (UNFCCC) and the most pressing impacts of climate change on international diplomacy and global governance. This is highlighted from various transdisciplinary and geopolitical perspectives with a special focus on the challenge of strengthening national and international climate change policy, sustainable development and increasing equity around the world, which goes beyond the capacity of national governments. Various international climate change cooperation and protection efforts are analysed, also in the context of global security; climate-induced migration movements; adaptation and the loss and damage debate. (Completed 2013)

Partners: Konrad Adenauer Foundation

Funder:

Focus Areas: Africa and other developing countries

Research on Environmental Law and Policy in Namibia: Towards Making Africa the Tree of Life

A sustainable environment is essential to protect people from the short, medium and long term ravages of nature; man-made threats in nature; and the deterioration of the natural environment. Namibia faces a range of difficult environmental challenges including land degradation; water scarcity and pollution; deforestation; biodiversity loss; and climate change. Addressing these challenges requires, above all, unequivocal determination on the part of policy-makers. The law, as a subsequent step to policy and decision-making processes on the one hand and as a basis for enforcement and implementation on the other, is an important discipline in terms of environmental protection and is an essential tool to address environmental problems threatening our country, region and planet. Given the multi-disciplinary nature of environmental issues and the involvement of different government institutions, policy makers and stakeholders, the afore-mentioned environmental challenges are covered by a variety of statutes and policies. These are critically investigated in this project in order to make recommendations for improvement. The project is a pilot project and shall be continued in various other African countries.

Partners: Hanns Seidel Foundation, GIZ

Funder:

Focus Areas: Africa

Research on the FUTURE OKAVANGO

The Okavango basin with its variety of savannah woodlands and wetland ecosystems linked by the central lifeline of the Okavango River is a global hot-spot of accelerating change and land use conflicts. The river has its source in the rainy highlands of Angola and terminates in the Okavango Delta, the world's largest inland delta and the largest freshwater swamp south of the equator. The TFO project will analyse ecosystem functions and services within this trans-boundary basin of high international visibility and high potential transferability of results to other tropical and sub-tropical region.

Partners: German Federal Ministry of Education and Research and others

Funder:

Focus Areas: Africa SDAC regions

AR5 - Research on the scientific state of Climate Change Vulnerability in Africa

It assess scientific, technical and socio-economic information concerning climate change, its potential effects and options for adaptation and mitigation – with a special focus on African vulnerabilities. (Completed 2014)

Partners: United Nations Intergovernmental Panel on Climate Change (IPCC)

Funder:

Focus Areas: Africa

Research on Development and Rule of Law (DROP)

The DROP Programme intends to synthesize global knowledge relevant to the legal empowerment agenda, promote the legal empowerment agenda at national, regional and global level, assist emerging economies (i.e. BRICS) development, serves as a global networking platform and cross-fertilizes global and local experiences. It conducts research, develops and provides policy recommendations and tools that will guide policymakers in the implementation of reforms.

It has a legal and socio-political focus on the major challenges and opportunities around

- Natural resources, aquatic, oceanic and atmospheric justice
- Poverty and transformation
- Rights protection through formal and informal structures
- Regional courts and access to justice
- Green growth and sustainable economic development
- Global security, peace and international cooperation
- Climate change, transition and diplomacy

Partners: Various international organisations, Universities around the world, political foundations and others. With its exceptional national and international reputation and its partnering institutional network worldwide, Stellenbosch University, provides an excellent networking platform for DROP to enfold its full capacity.

Funder:

Focus Areas: BRICS Countries

Research on "Regulatory Aspects and Legal Environment Related to Sugar Cane Ethanol production in South Africa and Mozambique, compared to Brazil. A Comparative Analysis and Indication of a Possible Legal Ideal Model for the Development of Economic Activities Related to the Production of Ethanol from Sugarcane, in Mozambique and South Africa."

From a southern African perspective countries are yet to develop or are in the process of developing appropriate biofuel policies. In this context the joint project will not only be vital to learn from pest practices elsewhere in the world (i.e. Brazil) but to develop legal and regulatory frameworks that are conducive to the production of biofuels for the benefit of the people.

Partners: University of Sao Paulo; various national, regional and international partners

Funder:

Focus Areas: South Africa; Mozambique; and Brazil

Research Regulation and Policy for Energy Security and Sustainable Development in Subsahara Africa

In this project the Development and Rule of Law Programme (DROP) researches all regulatory aspect relating to energy security, sustainable development law and policy, focusing on reconciling the tensions between environmental sustainability, economic development, and human welfare, with a holistic view of current legal, political, economic, social, and cultural developments. With its "law-for-development, investment-for-the-poor, and policy-for-society approach", DROP intends to utilise knowledge transfer for energy security by deepening existing and establishing new partnerships with policy makers, governments, diplomatic corps, commerce, industry and academic institutions – particularly on the African continent.

Partners: Konrad Adenauer Foundation

Funder:

Focus Areas: Africa

Medicine and Health Science

Environmental Health

Faculty:

Type:

Website:

Head of the Unit:

Main Contact Points:

Annual Budget:

Nationally/ Internationally Funded:

Science

Centre for Studies in Complexity at Stellenbosch University

The Centre for Studies in Complexity (CSC) is an interdisciplinary research and training centre of Stellenbosch University that studies complex phenomena and draws together researchers and practitioners interested in complexity. The CSC provides the institutional framework and infrastructure for engaging with complexity systematically and in depth. Core activities of the Centre include the development and dissemination of knowledge. Through its outputs the Centre contributes to a wide array of disciplines and serve to integrate these disciplines on a theoretical level.

Faculty: Science and Social Science

Type: Research Unit

Website: http://blogs.sun.ac.za/complexity/

Head of the Unit: Rika Preiser (rika@sun.ac.za)

Main Contact Points: Oonsie Biggs (oonsie@sun.ac.za) or Rika Preiser (rika@sun.ac.za)

Annual Budget:

Nationally/ Internationally Funded: Internationally funded

Administered Projects (3)

Generating and disseminating scientific-, policy-, and regionally-relevant knowledge of social-ecological dynamics and transformations to enable stewardship toward sustainable development.

The project has 2 major components 1) to support the first international conference of PECS (Program on Ecosystem Change and Society, a Future Earth project) in South Africa in Nov 2015; 2) To support stakeholder dialogues to gather regional views on the "Good Anthropocene" linked to a Future Earth Fast Track Initiative project.

Partners: PECS, Stockholm Resilience Centre (SRC)

Funder: Swedbio Resilience and Development Program (ResDev), Sweden (2,200,000 SEK)

Focus Areas:

Bright Spots: Seeds of the Good Anthropocene

To gather views on the "Good Anthropocene" from around the world, based on a survey of "seeds" – initiatives that already exist that could contribute to addressing some key dimension of what might create a Good Anthropocene.

Partners: PECS, Diversitas, Future Earth, SRC, McGill University

Funder: Diversitas, but SAPECS and Dr Biggs; Future Earth Fast Track Initiative (75,000 USD)

Focus Areas:

Assessing resilience to regime shifts: The case of bush encroachment

To quantitatively assess resilience to regime shifts and the economic value of resilience to such shifts, using the example of bush encroachment.

Partners: Bob Scholes, Wits University

Funder: Green Matter Fellowship (500,000 ZAR)

Focus Areas:

Projects administered through Stockholm Resilience Centre, Sweden (3)

Ecosystem Services in the Anthropocene: Anticipating and managing regime shifts. 549,500 CHF Branco Weiss Society in Science Fellowship, managed by ETH Zurich, Switzerland. 1 September 2010 - 30 November 2015 (PI).

Regime Shifts in the Anthropocene: Assessing risks and building resilience. 4,792,000 SEK Junior Researcher Grant funded by The Swedish Research Council Vetenskapsrådet, Sweden. 1 January 2015 - 31 December 2018 (PI).

Ecosystem service based strategies to alleviate poverty in southern Africa: The importance of cross-scale synergies and cultural services in addressing multiple dimensions of human well-being. 3,900,000 SEK Development Research Grant funded by The Swedish Research Council Vetenskapsrådet, Sweden. 1 January 2015 – 31 December 2017 (co-PI). [Funds 2 South African PhD students working in the Eastern Cape, has also funded one Masters Student at Rhodes University]

DST-NRF Centre of Excellence for Invasion Biology (CIB)

The C.I.B is an inter-institutional Centre of Excellence established in 2004 within the DST-NRF Centres of Excellence Programme. Its members undertake research on the biodiversity consequences of biological invasions, largely through post-graduate student training. The principal aims of the Centre's work are to reduce the rates and impacts of biological invasions by furthering scientific understanding and predictive capability, and by developing research capacity.

Faculty: Science

Type: Research Unit

Website: http://academic.sun.ac.za/cib/index.asp

Head of the Unit: Dave Richardson (rich@sun.ac.za)

Main Contact Points: Sarah Davies (sdavies@sun.ac.za); Mathilda van der Vyver (cib@sun.ac.za)

Annual Budget:

Nationally/ Internationally Funded:

Research projects (11)

Long-term change in Insect Assemblages

Involves the investigation of invertebrate diversity along several major spatial transects in different areas of South Africa

Partners: Formicidae Barcode of Life Project

Funder:

Focus Areas: Cederberg, Soutpansberg Mountains

Long-term Changes to the Prince Edward Islands Ecosystem

Involves repeated measurement of sites, which were investigated many years ago, providing multiple data points in a lengthy time series

Partners: Percy Fitzpatrick Institute of African Orthology (UCT)

Funder:

Focus Areas: sub-Antarctic islands, Marion and Prince Edwards Islands

Biodiversity Foundations

The research field focuses on, theoretical ecology; behavioural ecology; biogeography and the ecology of diversity and its distributions; physiological ecology; systematics; conservation and biogeography.

Partners:

Funder:

Focus Areas:

Biodiversity Dynamics through Space and Time

The theoretical and empirical studies of distributions and spread dynamics; the role of mutualism in invasions; keystone species and ecosystem engineers; species distribution modelling (SDM); invasion biogeography.

Partners:

Funder:

Focus Areas:

Molecular Ecology and genetics of Invasions

The barcoding as a tool for elucidating native and alien components of biodiversity; molecular ecology of established and emerging invasive species.

Partners:

Funder:

Focus Areas:

Global Environmental Change, Biological Invasions, Ecosystem Services and Sustainability

The Biodiversity indicators & trends at global and regional scales; Ecosystem services; the ecology of ecosystem degradation and biodiversity loss; Aquatic and riparian ecosystems – special challenges for management; Environmental change in the Antarctic and sub-Antarctic islands.

Partners:

Funder:

Focus Areas:

Detection, Deterioration, Restoration and Re-introduction

Inventorying and mapping of invasive species; Assessing impacts of invasive species; Restoration ecology; Novel ecosystems and new approaches to management in the face of rapid global change.

Partners:

Funder:

Focus Areas:

Risk assessment, Indicators and Policy

Protocols for risk assessment for introduced reptiles and amphibian; exploring the risks of biodiversity impacts of South Africa's biofuels policy; Risk assessments for invasive species in South African protected areas.

Partners:

Funder:

Focus Areas:

Invasion, Science, and Society

Development of models to facilitate effective management; Human attitudes to biological invasions, management and restoration; Participatory biodiversity monitoring and invasive species education programmes; The 'research-management' gap in invasion biology; Social science; Transdisciplinary studies.

Partners:

Funder:

Focus Areas: Eastern Africa

Research for the Integrated Management of Invasive Alien Species in collaboration with the Working for Water Programme (Natural Resources Management Programmes)

Using various approaches such molecular genetics, impact and risk assessments, and the collection of spatial and distributional data for a wide range of invasive species, this project aims to provide information to facilitate improved management of some of the worst invasive species in South African ecosystems. The project has had a strong focus on aspects of the invasion ecology of Australian wattles.

Partners:

Funder:

Focus Areas: Eastern Africa

Invasion Biology in Support of Environmental Sustainability during Times of Change

The bulk of work on this theme is being conducted as part of Stellenbosch University's HOPE Project. Overarching goals of the work are to undertake cutting-edge research in biology and to develop the policy implications and social dimensions of this work, with biological invasions forming the core around which the research revolves. To reach these goals, several projects have started and fit in two main strategies: 1)Environmental change effects on species of direct concern to humans: tsetse flies and climate change, climate change and the South African vectors of malaria, and climate change effects on the biocontrol agent of the invasive aquatic plant Salvinia molesta. 2) Habitat alteration and climate change effects on biodiversity.

Partners:

Funder:

Focus Areas: Eastern Africa

Main C.I.B Partners

Although the C•I•B is housed at the University of Stellenbosch, it does research work and student training with the help of a network of researchers at several South African universities and institutions. These include the University of KwaZulu-Natal, University of Cape Town, University of Pretoria, University of Venda, the CSIR, University of Johannesburg, City of Cape Town, South African National Parks (SANParks), South African Institute for Aquatic Biodiversity (SAIAB), South African

National Biodiversity Institute (SANBI), Western Cape Education Department and the Working for Water Programme.

Main C.I.B Collaborators

C.IB actively collaborates with a range of researchers and organisations devoted to invasion biology on a national and international level. These include the University of Tennessee; Iziko Museums; Cape Nature; City of Cape Town; Drankenstein Trust; LIB, Universidad de Concepción; Institute of Botany, Academy of Sciences of the Czech Republic, the Canadian Aquatic Invasive Species Network and BirdLife South Africa.

Stellenbosch University Water Institute

The institute, combines all the faculties and departments of Stellenbosch University to tackle water-related challenges; to provide technology transfer; and to develop relevant human resources, in order to address the issues like health, effluent treatment, agriculture, food and a sustainable environment.

Faculty: Science

Type: Research Unit

Website: http://water.sun.ac.za/

Head of the Unit: Gideon Wolfaardt (gmw@sun.ac.za)

Main Contact Points: Nico Elema (nicoelema@sun.ac.za); Supreme Sebata (ssebata@sun.ac.za)

Annual Budget:

Nationally/ Internationally Funded:

Research Projects (43)

EAU4Food

European Union and African Union cooperative research to increase Food production in irrigated farming systems in Africa) is an EU FP7 project related to water and food security. The project therefore stands with one leg in the WI. The aim of this project is to produce more food with less water. This is a multi-partner project in its 2nd year, involving South Africa, Mozambique, Ethiopia, Tunisia and Mali. Also collaborating is Altera in Wageningen, ODI in England, CIRAD in France, and CEMAGREF in Spain. On the Stellenbosch University side, we have 2 MSc students graduating in March 2014, and we have 2 PhD students involved in the project.

Partners: Faculty of Agri-Sciences

Funder: The total SU project funding for this research amounts to R2.5m

Focus Areas: European Union and African Union

NRF - NFI bilateral program

Based on the EAU4Food research, Stellenbosch University has since July 2013, a NRF - NFI bilateral program with the Eduardo Mondlane University in Maputu. This research program will run for 2 years, based on water use in agriculture.

Partners: Faculty of Agri-Sciences

Funder: NRF R100,000.00

Focus Areas: Mozambique and South Africa

INNO-Giyani

(Agribusiness development and sustainable entrepreneurship in South Africa) The Faculty of Agriculture with the SUWI as partner, started a PPP (Public Private Partnership) with the Manombe Trust in Giyani. The aim is to establish an innovation platform that can develop into and agri-business platform. Rural development in the Giyani area requires in particular a severe agri-business innovation and the development of sustainable entrepreneurship. Only new attractive, and locally processed and branded products brings enough added value for a commercial trade within Africa and abroad. At the same time local agribusiness development will support the community enhancing the socio-economic development of the region. All of this is made possible by adequate access to water.

Partners: Faculty of Agri-Sciences.

Funder: Total of R3m for 2013 (project budget R75m over 5 years, of which R38m comes from the Dutch government)

Focus Areas: Africa

ACCESS

The DST/NRF Center of Excellence for Climate and Earth system Science (The Applied Center for Climate and Earth System Science) is divided into 6 basic themes, of which the SUWI takes part in the Water Theme. The Water Theme has as primary task the continuation of water research related to a number of well recorded catchments.

Partners: SUWI and the Department of Soil Science

Funder: NRF R500000 for 2013

Focus Areas: South Africa

WRC K5/2063

Implementation of salinity and water management tools for the Berg and Breede catchments in the Western Cape. Completed 2014

Partners: Faculty of Agri-Sciences

Funder: R1m

Focus Areas: Western Cape

SASSCAL

SASSCAL is a joint initiative of Angola, Botswana, Namibia, South Africa, Zambia, and Germany, responding to the challenges of global change. The establishment of a Southern African Science Service Centre for Climate Change and Adaptive Land Management could create added value for the whole southern African region. It should be conceptualised and operationalised to complement the excellent existing research and capacity development infrastructures and research initiatives in the region. It should be embedded in the regional and national research. Its mission is to conduct problem-oriented research in the area of adaptation to climate and change and sustainable land management and provide evidence-based advice for all decision-makers and stakeholders to improve the livelihoods of people in the region and to contribute to the creation of an African knowledge-based society.

Partners: Angola, Botswana, Namibia, South Africa, Zambia, and Germany.

Funder: R500,000.00 per year for 4 years

Focus Areas: Southern Africa

WRC - Point of use disinfections systems designed for domestic rainwater harvesting (DRWH) tanks for improved water quality in rural communities.

The Water Research Commission is funding the project titled, "Point of use disinfections systems designed for domestic rainwater harvesting (DRWH) tanks for improved water quality in rural communities." The objectives of this project include; i) monitoring of the chemical and microbial quality of harvested rainwater, ii) investigating the social perception and acceptance of DRWH tanks by the end users and iii) developing and investigating the efficiency of point of use disinfections for DRWH tanks. The Kleinmond Housing Scheme Project, an initiative of the Council of Scientific and Industrial Research (CSIR), together with the Department of Science and Technology (DST) was chosen as the study site as each of the 411 houses was fitted with a DRWH tank. The study site enabled the monitoring of a cluster of 29 DRWH tanks in one primary location. The final project report to the WRC completed in April 2014.

Partners: Kleinmond Housing Scheme Project

Funder: Water Research Commission

Focus Areas: South Africa

Eskom collaboration

The SUWI has a research partnership with Eskom. The two research projects currently funded include the development and evaluation of efficacy of nanocoatings for cooling tower systems and the evaluation of cooling towers as biological contact reactor for treating cellar effluent water. The first project focuses on the fabrication of antimicrobial surfaces. In the second project, a biofilm reactor as an alternative to conventional wastewater treatment systems will be used to treat cellar waste water. Completed 2014

Partners: Eskom

Funder: Eskom

Focus Areas: South Africa

Exxaro collaboration

Exxaro is a South Africa-based mining group, listed on the JSE Limited, a constituent of the JSE's Top 40 index and one of the best-performing constituents of the JSE's Socially Responsible Investment (SRI) index. Exxaro has a diverse and world-class commodity portfolio in coal, mineral sands, base metals and ferroalloys, and growing exposure to iron ore through its interest in Sishen Iron Ore Company and acquisition of African Iron. As the second-largest South African coal producer with capacity of 47 million tonnes per annum and the third-largest global producer of mineral sands, Exxaro provides a unique listed investment opportunity into these commodities.

Partners: Exxaro

Funder: Exxaro

Focus Areas: South Africa

CSIR 1

This project involved a study on the quality of winery wastewater, determining the water balance in a winery and also evaluating treatment methods. One article entitled, "Overview: Influence of winemaking practises on the characteristics of winery wastewater and water usage of wineries" was published in The South African Journal of Enology and Viticulture. The experimental work is complete and the thesis handed in by January 2014.

Partners: The South African Journal of Enology and Viticulture

Funder: CSIR

Focus Areas: South Africa

CSIR 2

This project is aimed at providing insight into microbial population dynamics within an AMD impacted wetland before rehabilitation. This will be done to shed light on the complex interactions within a wetland ecosystem, even at primary producer level. The knowledge gained would then be applied to develop a microbial bio-indicator for ecosystem health assessment along with indices already used to improve insight provided.

Partners: Microbiology

Funder: CSIR

Focus Areas: South Africa

Construction methods for concrete water retaining structures

Investigated the use of prefabrication for concrete water retaining structures (WRS). Input was obtained from industry professionals, and from extensive literature sources on the topic. It was that found that precast concrete WRS hold a significant advantage over other construction methods in construction time. Other advantages include the quality of the precast structural elements, the possibility of cost saving if multiple structures are constructed, and the durability of precast products. The disadvantage of this construction method is the extensive planning needed. It was also found that using a standardised patented system which is familiar to the designer and contractor holds definite advantages.

Partners: Department of Civil Engineering

Funder: NRF

Focus Areas: South Africa

Links between lateral riparian vegetation zones and flow

Riparian vegetation communities that occur along perennial rivers are structured in lateral zones that run parallel to river flow. Similar patterns of lateral zonation appear to occur along rivers across the world despite variability in the flow regime, topographical setting and climate. However, there are few comparative studies of how zonation patterns may differ between different riparian communities and therefore there is no consensus on the number of zones expected to occur. I described the pattern of zones on Fynbos Rivers and explored whether the pattern would be the same on rivers in different biomes

Partners: PhD Student: Mr. Karl Reinecke; Supervisors: Prof. Karen Esler, Dr. Cate Brown and Prof. Jackie King:

Funder: NRF

Focus Areas: Western Cape

Improving Water Quality: Developing a Natural Toxic Free Nanomebrane

As the human population escalates within the next century, conservation will not be sufficient, as water quality will be compromised due to increased demand from municipal and industrial users competing for limited freshwater resources. As a result, there will be a reduction in adequate water resources. Currently, 1.1 billion people in rural, peri-urban and urban areas are deprived of sustainable access to safe drinking water and any water source is therefore used despite its quality. Water contamination has led to a lack of safe drinking water globally, affecting more than one billion people in developing countries. A nanomembrane resulting from this research will enable purification to take place prior to the use of the water. Treating water at POU is an ideal method that can save millions of lives, enabling particularly the poor urban community to have access to safe drinking water on its doorstep, since the majority of contamination occurs during handling, transport and storage, as opposed to obtaining water directly from source.

Partners: TsamaHub within Stellenbosch University School of Public Leadership (SPL).

Funder: NRF

Focus Areas: Africa

Decoupling economic growth from water consumption and degradation: A transition towards sustainable water resource management and planning

The proposed research explores the policy implications of an integrated water-resource management approach and the principles of decoupling within the context of economic growth and water use in sub-Saharan Africa. This research engages multiple theoretical foundations of integrated water-resource management and decoupling that correspond with the multi-disciplinary nature of sustainable water-resource management. This engages more holistically with how multiple stakes may shape efficient water supply and demand productivity by fostering a broader process of learning and problem solving with co-operation between different parts of society and science in order to meet the complex challenges of society.

Partners: PhD Student: Mr. Ernest Nti Acheampong; Supervisor: Prof Mark Swilling. TsamaHub within Stellenbosch University School of Public Leadership (SPL).

Funder: TsamaHub within Stellenbosch University School of Public Leadership (SPL).

Focus Areas: sub-Saharan Africa

Mitigation of Soil Degradation, and Ground Water Pollution caused by on-land disposal of Vegetable Oil mill Effluents

Research has revealed that these effluents are composed of heterogeneous (metabolisable carbon-source and toxin-inhibiting) compounds. Their nutrients are good enough for restoring degraded soils and enhancing crop yield but the complex organic pollutants in them contradict their potential. Their polluting effects are felt in the soil years after their application because of their slow biodegradable rate, for example, and they have the potential to affect groundwater. These effluents

are also very good sources for fertilisers, biofuel and bio-energy. At high rates of application, however, they not only inhibit or reduce crop yield but also contaminate soil with organotoxins and pollute groundwater, resulting in large-scale land degradation. The effluents contain 3.5 to 15% organic matter, 0.5 to 2% mineral salts, 83 to 95% water and 11.5% phenols. Unfortunately, the phenols in oil fruits all go to the effluents during the extraction process and then cause problems in the soil; only 1% is retained in the oil extracted.

Partners: PhD Student: Obiageli Umeugochukwu; Supervisor: Prof Andrei Rozanov. TsamaHub within Stellenbosch University School of Public Leadership (SPL).

Funder: TsamaHub within Stellenbosch University School of Public Leadership (SPL).

Focus Areas: South Africa

Economics of incremental infrastructure upgrading in informal settlements: A case study of sanitation upgrading in Enkanini, South Africa.

Current modes of delivering free basic sanitation to the urban poor are inconsistent with the South African government's aspirations to upgrade informal infrastructure incrementally. This research conceptualises and tests sanitation upgrading strategies that build on and support everyday upgrading undertaken by informal settlement residents. The research aims to produce knowledge to inform the implementation strategies of official upgrading responses.

Partners: PhD Student: Lauren Tavener-Smith; Supervisor: Prof Mark Swilling. TsamaHub within Stellenbosch University School of Public Leadership (SPL).

Funder: TsamaHub within Stellenbosch University School of Public Leadership (SPL).

Focus Areas: Western Cape

Institutional economics approaches and Developmental State: A case in Northern Ethiopia (Tigray), Raya Valley Ground water Irrigation Project

This study will focus on the role of institutional environments and arrangements in creating conducive environments for developmental states in the realisation of economic development and growth and of simultaneously building a democratic process. The primary question of this study will therefore be the following: Can developmental states achieve economic growth, democracy and decentralisation and, if so, how? The general aim of the study will be to assess how institutional environments and arrangements support developmental states in bringing about economic growth and building democratic processes and decentralisation. To achieve the overall objective, the study will undertake a transdisciplinary research approach through engaging different stakeholders at different levels, accompanied with detailed case studies at community level. The contribution of this research will be to develop an alternative approach to how developmental states can achieve cooperation between market and non-market actors and co-ownership of infrastructure at community level.

Partners: PhD Student: Muleta Yirga; Supervisor: Prof Mark Swilling. TsamaHub within Stellenbosch University School of Public Leadership (SPL).

Funder: TsamaHub within Stellenbosch University School of Public Leadership (SPL).

Focus Areas: Ethiopia

ERWAT Research Chair

SUWI was selected to host the ERWAT Chair in Wastewater Management. The goal of this 5-year Program, which started in 2013, is to foster partnerships in water research utilisation and training, with specific objectives including

Partners: Wastewater Management

Funder: ERWAT

Focus Areas: Stellenbosch and Canada

EWSETA Project

Stellenbosch University's Water Institute (SUWI) and the Energy and Water Services Sector Education and Training Authority (EWSETA) have signed a Memorandum of Agreement to address the critical need for specific technical and management skills in the water and energy sector.

Partners: Further Education and Training (FET) College educators

Funder: Energy and Water Services Sector Education and Training Authority (EWSETA)

Focus Areas: South Africa

AU/NEPAD Networks of Water Centres of Excellence

The African Union (AU)/New Partnership for Africa's Development (NEPAD) Water Centres of Excellence (WCoE) aim to create a network for institutions who are involved in research and training within the water sector. Such a network will provide the basis for network members to communicate and collaborate, in order to build capacity and stimulate innovative research within the water sector on the African continent. The AU/NEPAD WcoE initiative has been adopted by the African Ministers Council on Water and Technology (AMCOST) and African Ministers Conference on Water (AMCOW) in 2009.

Partners: Stellenbosch University (South Africa) – as the hub; International Centre for Water Economics and Governance in Africa (Mozambique) – Node; University of KwaZulu-Natal (South Africa) – Node; University of Western Cape (South Africa) – Node; University of Malawi (Malawi) – Node; University of Zambia (Zambia) – Node; University of Botswana (Botswana) – Node; The Council for Scientific and Industrial Research, CSIR (South Africa) – Node; The Namibia University of Science and Technology, NUST (Namibia) – Node

Funder: AU/NEPAD SANWATCE; African Union (AU)/New Partnership for Africa's Development (NEPAD) Water Centres of Excellence (WCoE)

Focus Areas: Africa

Endocrine Disruptors in South African Waters

Over the last decade scientific research has shown that all major aquatic wildlife groups, as well as humans, are experiencing endocrine disruption. Concerns that environmental contamination in water threaten the health of humans and wildlife, and specifically the possibility of endocrine disruption.

Partners: Department of Botany and Zoology, Faculty of Science

Funder: Water Research Commission, NRF

Focus Areas: South Africa

Reducing the risk of endocrine disruption through early detection

A number of chemicals present in the environment have been shown to mimic or antagonise the actions of steroid hormones. This adversely affects the production of fish, alligators and humans. This projects aims to take cost-effective actions to reduce the risk of disruptions in tap water; carry out targeted monitoring to evaluate the concentrations of these substances.

Partners: Department of Biochemistry, Faculty of Science

Funder: Water Research Commission

Focus Areas: South Africa

Faecal contamination in rivers and health sanitation risks for community health

High levels of faecal contamination in the rivers in the Western Cape are seriously undermining the health of local communities that use the water for drinking and food production. The best ways to protect impoverished communities from the harmful effects of failing sanitation urgently needs scientific study.

Partners: Department of community health; faculty of health science

Funder: DAAD; NRF; Harry Crossley Foundation; Claude Leon Foundation; Water research commission

Focus Areas: South Africa

The DST-NRF Centre of Excellence for Invasion Biology

Invasive species are a major threat to South Africa's biodiversity and the region's natural capital. With the focuses such as managing catchments; restoring riparian systems; assessing river health; assessing impacts of invasive of alien species; developing protocols.

Partners: Centre for Invasion Biology

Funder: DST; NRF

Focus Areas: South Africa

Water engineering to ensure sustainable use of our river

IWESU carries out research, training and specialised consultancy projects in the following fields: river hydraulics and sedimentation; design of hydraulic structures; water quality modelling of rivers and lakes; water resources planning and management; water services and water use management; water reserve determination for rivers; flood hydrology; water treatment and coastal and port engineering.

Partners: Department of civil engineering; faculty of engineering

Funder: Water Research Commission; Department of Water and Environmental Affairs; World Bank; and various municipalities

Focus Areas: South Africa

Understanding ecology of riparian habitats to enable effective catchment management

Habitats along rivers are particularly sensitive to climate change and invasion and yet relatively little work has focused on how plants and people in these regions respond to such stressors. The important roles that intact riparian vegetation play in maintaining ecosystem health and services have been increasingly highlighted this project acknowledge the degradation of these habitats.

Partners: Department of Conservation Ecology and Entomology; Faculty of Agriscience

Funder: Working for Water Programme; ASSET Research; Water Research Commission; NRF

Focus Areas: South Africa

Database development to support critical resource management

Resource management protocols are essential to sustain the fragile balance between human activities and ecological systems. In an effort to provide a foundation for the development of appropriate protocols. A comprehensive database of physical and geochemical parameters of the groundwater resource in the semi-arid to arid Namibnaukluft region is being compiled.

Partners: Department of Earth Sciences; Faculty of science

Funder: NRF-SADC bilateral programme; Stellenbosch University; University of Lausanne

Focus Areas: Namibia and South Africa

Understanding the hydrogical cycle

Soil science complements our understanding of water issues, resulting from specific knowledge about soils and how soils respond to water. Sustainability in agriculture and our environment is based on a sound knowledge of the interaction between soils and water.

Partners: Department of soil science; faculty of Agrisciences

Funder: Water Research Commission; Department of Water and Environmental Affairs; Department of Agriculture Forestry and Fisheries; Department of Science and Technology; European Union

Focus Areas: South Africa

Financial-economic planning of water use Agriculture

Sustainable land and water resource use on micro and macro levels requires an inventory of the relevant resources. The identification and quantification of benefits and costs in monetary terms, and decision criteria to allow entrepreneurs and policy makers to take wise decisions.

Partners: Department of Agricultural Economics; Faculty of Agriscience

Funder: NRF

Focus Areas: South Africa

Conservation through Research and Development

Key research areas of the water resource management and sustainable development portfolio, focuses on African collaboration. They are cross-cutting in terms of education, service delivery, outreach and networking.

Partners: Department of Animal Science; Faculty of Agriscience

Funder: Water Research Commission

Focus Areas: South African and Uganda

Bridging the gap between science and strategy

Sensible water management strategies should primarily include should primarily include initiatives to minimise water loss and waste. However, population growth and related agricultural and industrial expansions result in a steady increase in water demand. Consequently, and insufficient supply of clean water can often be ascribed to inadequate strategic planning or ineffective design and operation of treatment systems, rather than to the actual availability of applicable technologies to treat and recycle water.

Partners: Department of Process Engineering; Faculty of Engineering

Funder: SU Overarching Strategic Plan; Veolia Water Systems; Sasol

Focus Areas: South Africa

Small-Scale water and wastewater treatment technologies

IWESU carries out research, training and specialised consultancy projects in the field of river hydraulics and sedimentation, design of hydraulic structures, water quality modelling of the rivers and lakes, water resource planning and management, water services and water use management

Partners: Department of Civil Engineering; Faculty of Engineering

Funder: Water Research Commission; Department of Water and Environmental Affairs; World Bank and Various Municipalities

Focus Areas: South Africa

Geochemical Evolution of Water and Waste Waters

The environmental geochemistry group applies their knowledge to better understand process that affect water quality in terrestrial surface and sub-surface environments such as ground water, mine water and coastal marine environments.

Partners: Department of Earth Science; faculty of science

Funder: University of Cape Town; CSIR; University of Pretoria

Focus Areas: South Africa

Nanotechnology Applications in Providing Potable Water

While one sixth of the world population does not have access to safe water. The reliability of chemical disinfectants such as chlorine and membrane-based water filtration systems that are currently being used to control microbial pathogens, is in question, the use of nanotechnology. However, shows the potential

Partners: Department of Microbiology; Faculty of Science

Funder: NRF; Eskom

Focus Areas: South Africa

Membrane and Membrane process development

Fouling has a negative effect on the productivity of membranes used to treat drinking water. Much of the research and development associated with membrane process development focus on fouling abatement.

Partners: Department of Chemistry and Polymer Science; Faculty of Science

Funder: Water Research Commissions

Focus Areas: South Africa

Teabag Water Filter: The Way Forward

The invention of the teabag water filter is one of the first major projects of the Water Institute, and has already placed the research abilities of Stellenbosch University researchers in the limelight as never before.

Partners: Department of Microbiology; Faculty of Science

Funder: Eskom; NRF

Focus Areas: South Africa

Ethics of Freshwater Management

The ethics of freshwater management is a cross-cutting theme that underlies most if not all research and policy-development initiatives regarding the sustainable use and equitable sharing of the vital natural resource of water.

Partners: Department of Phiolosophy; Faculty of Arts and Social Science

Funder: Various Funders

Focus Areas: South Africa

Climate Change, Water-Related Matters and Human Rights

Partners: Department of Mechantile Law; Faculty of Law

Funder:

Focus Areas: Africa

Exposition of the legal framework within which the new water dispensation operates

Although water has always been a scare commodity in South Africa, it has not always been the property of the government; instead water fell in both the public and private domains

Partners: Department of private law; faculty of law

Funder:

Focus Areas: South Africa

Water Governance and Management

The current position in South Africa involves supply of thousands of litres of free water to all residents with a commitment of costs recovery even if it result in excluding access to those who do not meet the obligation to pay for the water use in excess of the free provision

Partners: School of Public Leadership

Funder: Centre on regulation and competition; University of Manchester UK

Focus Areas: South Africa

Impact of Water Quality on Safety of Agricultural Produce

If irrigated products are contaminated by microbes it will affect the health of the consumer and have an immediate negative impact on the national and international trading status.

Partners: Department of Food Science; Faculty of Agriscience

Funder: Water Research Commission; Department of Agriculture; NRF

Focus Areas: South Africa

Food Industry Waste-Water treatment and re-use

By the year 2030 South Africa's water demand will overtake the water supply. However shortages already exists on a regional basis and it is therefore critical to encourage reuse of factory effluents

Partners: Department of Food Science; Faculty of Agriscience

Funder: Water Research Commission; Department of Agriculture; NRF

Focus Areas: South Africa

6.3.4 The University of the Western Cape

Institute of Poverty, Land and Agrarian Studies (PLAAS)

Faculty/s: Economic and Management Science
Department/s: Government
Type: Research Unit
Website: http://www.plaas.org.za
Head of the Unit: *Prof. Andries du Toit (info@plaas.org.za)*
Main contact points: *Administrative Manager: Ursula Arends (info@plaas.org.za)*
Media Liason: Rebecca Pointer (infobrokers@plaas.org.za)
Nationally/internationally funded: Both national and international funders
Research Partners: Future Agricultures Consortium, POVFISH, The Souther Africa Food Lab, Land Deal Politics Initiative, Water Research Consortium, Too Big to Ignore-Global Partnership for Small-Scale Fisheries Research, Economic Policy Research Institute, Custom Contested, Programme to Support Pro-Poor Policy Development, Studies in Poverty and Ineguality, WELFARE.

PLAAS does research, policy engagement, teaching and training about the dynamics of chronic poverty and structural inequality in Southern Africa, with a particular emphasis on the key role of restructuring and contesting land holding and agro-food systems in the subcontinent and beyond. Our focus is on the analysis of marginalised livelihoods in Southern Africa, especially of subsistence and smallholder farmers and farm workers, of coastal and inland artisanal fisheries and fishing communities; and of informal self-employment in rural and urban areas

Research Projects

Integrating the human dimensions into an ecosystem approach to fisheries

Project focus areas: Southern African coastal communities **Funder:** **contact person:** Prof. Moenieba Isaacs

The review and further development of management objectives for EAF human dimensions, based on objective indicators identified which will be used to measure the impact on management discussions on the socio-economic context of fisheries. A time series for the indicators will be developed by collecting data from relevant information sources and a structured monitoring framework will be outlined for future data collection. The development of data collection and extraction methodology will be designed for human dimension of EAF data.

Project partners: Barbara Patterson (Independent researcher) **For more information**: misaacs@plaas.org.za

Fish for whom-required nutrition for the poor and luxury consumption for the wealthy, can small-scale fisheries supply both consumers

Project focus areas: South Africa and Tanzania **Funder:** NRF and COSTECH **contact person:** Prof Moenieba Isaacs

Poor people's consumption of good quality nutrition from fish protein is compromised by the high demand for high quality fish protein from wealthy consumers in the developed world (particularly United States, Europe and Japan). In this paper we argue that there must be a trade-off between meeting the nutritional needs of the poor fishers and meeting the demands of the wealthy. This requires a governance system that is responsive to the needs and aspirations of the poor while at the same time remaining conscious of the demands of the wealthy. Our argument is informed by data we have collected from a joint study between researchers in South Africa and Tanzania that is currently going on. The main goals of this study are to examine the governance processes of the existing community value chain in contributing to food security and livelihoods; analyse the various stages in the small-scale fisheries value chain and who are the participants in the chain and at various stages and where do their fish go; determines the role small-scale fisheries plays in the food security of local community through assessing their purchasing and consumption practices in small scale fisher communities. In this paper governance of the value chain will be situated within the interactive governance framework, the notion of food security within the food system in understanding the politics of the food system, food quality. We also explore the role mobile technology can play in securing sustainable small-scale fisheries for the poor.

Project partners: The University of Dares Salaam Tanzania **For more information**: misaacs@plaas.org.za

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How important is fish as food for human nutrition?

Project focus areas: subsistence fishing communities **Funder:** unfunded **contact person:** Prof Moenieba Isaacs Concern about food security and malnutrition continues to rise globally, including among communities living near water bodies where fish should go directly to feed local populations. Competition for fish in these communities is prevalent, not only in terms of harvesting for human consumption but also for feed production industries that rely on fish as raw materials. The reliance of aquaculture on wild-caught fish, fishmeal and fish oil add to food security concerns. How vulnerable are small-scale fishers to malnutrition and with whom do they compete in order to secure food for their families? The Too Big To Ignore Fish as Food research cluster will address these pressing questions through a global scan of small-scale fisheries in marine and inland systems. We pose five main research questions: How important are small-scale fisher catches to family consumption and nutrition? Do small-scale fishers value catch as a source of protein or as a livelihood to purchase other food? How do small-scale fisher catches contribute directly and indirectly to food consumption? Have consumer preferences for small-scale fisher catch consumption changed over time? How have national and international food policies influenced small-scale fishers and domestic fish consumption? This ultimate aim of this cluster is to provide evidence that fish, and in particular small fish, are a critical source of nutrition for humans and that when more fish are prioritized for human consumption, the global food security will be enhanced.

Project partners: Social Science and Humanities Research Council of Canada. **For more information**: misaacs@plaas.org.za

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A decision support tool for response to global change in marine systems: the IMBER-ADApT Framework

Project focus areas: coastal communities in the Western Cape Province of South Africa **Funder: unfunded**
Contact person: Prof. Moenieba Isaacs

Global change is occurring now, often with consequences far beyond those anticipated. Although there is a wide range of assessment approaches available to address-specific aspects of global change, there is currently no framework to identify what governance responses have worked and where, what has facilitated change and what preventative options are possible. To respond to this need, we present an integrated assessment framework that builds on knowledge learned from past experience of responses to global change in marine systems, to enable decision-makers, researchers, managers and local stakeholders to: (i) make decisions efficiently; (ii) triage and improve their responses; and (iii) evaluate where to most effectively allocate resources to reduce vulnerability and enhance resilience of coastal people. This integrated assessment framework, IMBER-ADApT is intended to enable and enhance decision-making through the development, a typology of case-studies providing lessons on how the natural, social and governance systems respond to the challenges of global change. The typology is developed from a database of case-studies detailing the systems affected by change, responses to change and, critically, an appraisal of these responses, generating knowledge-based solutions that can be applied to other comparable situations. Fisheries, which suffer from multiple pressures, are the current focus of the proposed framework, but it could be applied to a wide range of global change issues. IMBER-ADApT has the potential to contribute to timely, cost-effective policy and governing decision-making and response. It offers cross-scale learning to help ameliorate, and eventually prevent, loss of livelihoods, food sources and habitat.

Projects partners: Bedford institute of Oceanography, Fisheries and Oceans (Canada), department of geography, Memorial University of Newfoundland, Marine chemistry and Geochemistry Woods hole Oceanography Institute, University of the Republic (Uruguay), Faculty of Marine Science, German Society of Human Ecology, National Institute of Fisheries Science (Japan), Pacific biology station, Fisheries and Ocean (Canada).

For more information: misaacs@plaas.org.za

Social protests in water and sanitation in peri-urban slum settlements in South Africa

Project focus areas: South African informal settlements **Funder: Water research commission**

Contact person: Dr. Barbara Tapela

This study was focused on documenting and understanding the attitudes and perceptions of people involved in social protests concerning water and sanitation in peri-urban slum settlements in South Africa. What solutions do the households involved proffer? **Project partners:** Water research commission **For more information**: btapel@plaas.org.za

Centre of Excellence in food Security

Project focus areas: South Africa and partly SADC regions **Funder:** NRF **Contact person:** Prof. Julian May

The aim of the COE is to undertake research in the dynamics of the agro-food system and its outcomes. It intends to take the discourse on food security in South Africa beyond a narrow focus on agricultural productivity and disaster management, to focus on the food system as a whole, including the complex dynamics of change in the highly concentrated, corporatized, vertically integrated manufacturing, retail and processing sector. The Centre considers what food system change means for South African consumer food environments, their socio-economic outcomes, and the impacts on nutrition-related disease in a rapidly urbanizing population. The contention is that in the South African context, food and nutritional security is shaped not simply by agricultural productivity per se but also by the terms under which producers, processors, distributors and consumers are incorporated into the food system as a whole. As such, the focus of the centre is the South African agro-food system, 'from farm to fork'. The food system is understood as a complex system nested both within a broader political economy and within changing climate- and ecosystems. While production (particularly smallholder and sustainable production systems) is important, the FSCC's concern is the dynamics of value chains, distribution networks and food retail due to corporate penetration and financialization of agriculture, and how this shapes the choices both of producers and consumers. Attention will be paid to both large and small-scale enterprise and to formal and informal economies. The aims of the centre are to use its research, advocacy and teaching activities to develop capacity to manage food system change in ways that promote nourishing local and regional food economies that can sustain decent livelihoods and healthy nutritional practices. Its activities are based on collaborative, inter-institutional and trans-disciplinary research undertaken as virtual 'laboratories'. These are thematically organized as investigations into four interlocking systems: the ecosystem; the institutional system; the livelihoods system and the health system -- with gender, climate change and poverty forming cross-cutting themes. Research, teaching and dialogue activities will seek both to build an evidence base for policy and to support experimentation and innovation at key leverage points in the agro-food system in production, post-harvest processing, distribution and governance. The centre will also provide interdisciplinary teaching and training through post-graduate qualifications, including the development of new modules that can be transferred across disciplines and teaching institutions, executive short courses aimed at policy makers and other change agents, and new post-graduate degree programmes. The FSCC will create multi-stakeholder social and policy dialogue platforms to disseminate research evidence, facilitate knowledge transfer, and build the leadership capacity for adaptive systems management and management and regulatory approaches that can respond to complex changes.

Project partners: University of Pretoria **For more information**: http://www.wuc.ac.za/EMS/COEFS

Hydrogen South Africa (HySA)

Faculty/s: Natural Sciences
Department/s: South Afican Institute for Advanced Materials Chemistry (SAIAMC)
Type: Research Unit
Website: *http://hysasystems.com/*
Head of the Unit: *Dr. Siva Pasupathi*
Main contact points: *Administrative Assistant: Lucille Thomas (lthomas@hysasystams.org)*
Nationally/internationally funded: National funding

HySA Systems, a Systems Integration and Technology Validation Competence Centre on HFCT was established in 2007 at the SAIAMC at the University of the Western Cape. The main objective with HySA Systems is to (i) develop HFC systems and prototypes, (ii) perform technology validation and system integration in three key HySA programmes: (1) Combined Heat and Power (CHP), (2) Portable systems and (3) Hydrogen Fuelled Vehicles (HFV). HySA Systems is also responsible for the development, prototyping, testing, validating and commissioning of the following key technologies: Membrane Electrode Assemblies (MEAs) for High Temperature (HT) (≥120 oC) Proton Exchange Membrane (PEM) fuel cells, HT-PEM fuel cell stacks, metal hydrides for hydrogen storage and compression, Li-ion batteries and system integration of Energy Storage Devices for domestic and automotive applications.

Research Projects

Combined Heat and Power

Project focus areas: N/A **Funder:** DST **contact person:** Lucille Thomas

Combined heat and power (CHP) systems based on fuel cells offer high efficiency, low emission, and decentralised power and heat supply for buildings and industries. They can operate from the existing natural gas distribution network, using a reformer to convert methane gas to hydrogen thus minimizing infrastructure requirements.There is considerable interest in installing CHP systems in domestic properties, called micro-CHP or dCHP (domestic CHP), and for large scale applications such as community heating or industries. Globally, pre-commercial projects have already been initiated for the implementation of dCHP systems on the larger scale. A combination of low-temperature reforming with a high-temperature PEMFC (120°C – 180°C) opens a unique perspective in thermal management for both domestic (up to 10kW) and industrial (up to 150kW) CHP systems, with a total efficiency yield of primary energy above 80%. The high temperature operation of the PEMFCs tolerates higher impurity levels in fuel, and thereby simplifies the reforming system (fuel cell and reformer synergy).PEMFCs depend critically on PGMs to catalyse the fuel and oxidant to produce electricity and heat. Also, PGMs are essential to achieve low-temperature reforming and thereby to improve the efficiency of CHP systems. South Africa, with its vast PGM resources can benefit immensely from the development of CHP systems by adding huge value to SA resources and improved socio-economics through local manufacturing, increased job opportunities and skilled human resource development. The main purpose of the R&D programme on CHP is to develop internationally competitive and marketable CHP-systems and critical CHP-system components.

Projects

- Fuel cell catalysts and membrane electrode assemblies for micro CHPs
- High temperature MEAs for hybrid FCVs
- CHP systems integration and technology validation up to 5kW HT-PEMFC stacks for micro-CHPs
- Portable power system integration and technology validation assembly and validation of PEMFC stacks up to 15 kW

Project partners: Confidential **For more information**: *http://hysasystems.com/*

Hydrogen fuel cell Vehicles

Project focus areas: N/A **Funder:** DST **Contact person:** Lucille Thomas

An important part of achieving the objectives of the HySA programme is to integrate the technology into end-user applications that could lead to the commercial use of the technology and the resultant socio-economic benefits of new

industry development and PGM and mineral beneficiation. Transport applications are seen as a major opportunity for the use of Hydrogen Fuel Cells globally and are already being demonstrated by mainstream automotive companies and even used commercially in various niche vehicle applications.The largest demand for FCVs is expected to be in passenger vehicles, with several models already being displayed by automakers across the world. Encouraged by the significant government investments and progressively harsher emission legislations, all of the large automotive companies have established R&D in this field. It seems however, that infrastructure overall cost and fuel cell durability remain significant challenges that are still holding back the mainstream market uptake of FCVs. Rather than trying to compete directly with these large companies and national programmes, HySA's strategy is to pursue opportunities in niche vehicles with the expectation that if successful, its technologies will spill over into the mainstream automotive field. In collaboration with various vehicle partners, HySA Key Programme 3, Hydrogen-Fuelled Vehicles addresses mainly niche FCVs, including material handling vehicles (e.g. forklifts), light passenger vehicles (e.g. three-wheelers, golf carts and micro-cars) and special-purpose vehicles (e.g. mining locomotives).The scope of HySA Key Programme 3 is to develop and integrate systems and modules that can be used in these niche vehicles, based on HySA technologies. This includes the on-board Hydrogen storage (including Metal-Hydrides), the Fuel-Cell System (the FC-stack and its controller), power electronics and the Li-ion Battery System. A modular 'HySA Power Module' is being developed that incorporates the FC Stack, Battery System, Hydrogen Storage and controlling electronics. This can be retro-fitted into existing niche battery-powered vehicles with minimal changes to the vehicle itself.

Projects

- MH H2-storage for LT-PEMFC power systems for 0.5 t0 5 kW portable and standby systems
- On-board use of metal hybrids for utility vehicles, MH H2 storage systems for FC powered forklifts trucks
- On-board Hydrogen storage for advanced lightweight Mg-based Nanocomposites for H2 storage
- Metal hydride integrated energy systems-Refuelling systems for H2-fulled forklifts based on MH compressors
- CHP system integration and technology validation for micro CHP 2.5 kWe
- Portable power systems integration and technology validation up to 5Kw backup power
- HVF systems integration and technology validation for integration of MH storage and FC into 3-ton forklift, establishing FCV test protocols using 15 kW FCV emulator, development of an integrated FC/battery power module and integration of an FC into a three-wheeler community vehicle.

Project partners: confidential **For more information**: *http://hysasystems.com/*

Environmental nanoscience research group (ENS)

Faculty/s: Natural Science
Department/s: Chemistry
Type: Research Unit
Website: http://www.uwc.ac.za/Faculties/NS/Chemistry/
Head of the Unit: Prof. L. Petrik (lpetrik@uwc.ac.za)
Main contact points: Prof. L. Petrik (lpetrik@uwc.ac.za)
Nationally/internationally funded: Nationally funded

The Environmental Nanoscience research group (ENS) is focused on development of nano phase materials and catalysts including the synthesis, modification, characterization and application of nanostructured catalysts for hydrocarbon conversion and treatment of fluegases. Electrocatalysts are being developed for fuel cell and renewable energy technologies. Other applications of novel nanomaterials currently under investigation include the disinfection of water and removal of organics through electrochemical systems. Composite photocatalysts and electrohydraulic discharge systems are being developed for organics decomposition and disinfection of contaminated effluent water.

Research Projects

PGM Nanoarchitecture

Project focus areas: N/A **Funder:** DST and NRF **contact person:** Prof. L Petrik

Explorations around the effects of nanoscale ordering of PGM systems on their physical and chemical properties. The aim is to gain a deeper understanding of the design, fabrication and performance of nanostructures in order to engineer new nanometal alloys and catalysts which will provide valuable knowledge for the intelligent design and application of future materials and structures, and the generation of affordable renewable energy through the design of catalysts for fuel cell and hydrogen-based processes. The focus is on developing and applying nanophase materials such as catalysts for hydrogen production or fuelcell, DeNOx and DeSOx, hydrocarbon or biofuels conversion.

Project partners: WITS, UCT, UKZN. **For more information**: http://www.pgmnano.org/index.html

Nano in Water

Project focus areas: N/A **Funder:** Water research commission **Contact person:** Prof. L Petrik

The research focus was on synthesis and application of micro and mesoporous materials including zeolites from waste, nanostructured adsorbents, functional nanofibres and ion exchangers for brine treatment and toxic element removal from water. Composte photocatalysts and electrohydraulic discharge systems were also developed for organics decomposition and disinfection of contaminated effluent water

Project partners: CPUT **For more information**: http://www.wrc.org.za

Eskom SASOL Research Initiative- Sustainable Salt Sinks

Project focus areas: Mmpumalanga **Funder:** ESKOM and Sasol **Contact person:** Prof. L. Petrik

This study investigated integrated and sustainable management of inorganic waste products (fly ash, sludge and brine) from mining and industrial water treatment processes that have disposal problems. Current solutions for disposal or concentration, or stabilization of brines upon fly ash were assessed. Problems and research questions relating to ash generation and disposal, generation of saline effluents during coal processing and combustion processes, water and salt management at coal processing facilities located inland in water short areas were identified by Eskom and Sasol. Fundamental understanding of ash and ash water chemical interactions within ash disposal sites was seen as a key area of theinvestigation.

Project partners: Sasol, Eskom, UKZN and UOFS **For more information:**

Treatment of mine water using a combination of coal fly ash and the flocculants in a jet loop reactor system

Project focus areas: Mpumalanga coal fields **Funders:** WRC, Eskom and Coaltech **Contact person:** Prof. L. Petrik

We have successfully treated acid and neutral mine water with waste coal fly ash by using a jet loop reactor at an 80 L pilot scal, patented and being upscaled at present. According to the Department of Water Affairs standard guidelines, the product water is of good quality for agricultural and industrial purposes. This technology can be applied for the remediation of acid mine drainage from any coal or gold mining operations. Since coal fly ash is a waste material, this treatment technology to remediate acid mine drainage would reduce the process costs, thereby making the treatment of acid mine drainage sustainable. Well established ion exchange resin technology that already exists may subsequently be applied as a polishing step which removes the last remaining sodium ions to produce even higher quality water (category/class 1, 2, 3).

Project partners: CPUT **For more information:** http://www.WRC.org.za/

Industrial brine minimization: Determining the physical chemical parameters that affect evaporation rates on multi-component hyper-saline effluents

Project focus areas: N/A **Funders:** WRC **Contact person:** Prof. L. Petrik

Minimization of industrial waste water, through its reuse, or safe re-entry into the hydrological cycle is a critical part of water management and integral in tackling water scarcity issues. Industrial brines are complex liquid mixtures of various salts with a composition that can vary dramatically depending on the intake water quality or water treatment process from which the final saline effluent derives. Currently, the typical method of brine disposal is the use of evaporation ponds to reduce the liquid volume and provide a manageable solid product. Predicting the evaporation rate of the pond is critical in effective management of the brine disposal holding area. However the meteorological models or empirical methods with evaporative pans which are used to predict evaporation from natural water bodies are generally considered to be inappropriate to highly saline systems. Thus, this study investigated adequate models that can be applied to predict evaporation rates in order to limit accidental release of saline effluents and prevent impacts on the receiving environment. This study investigated and ascertained the relative importance of critical chemical and physical parameters that could affect evaporation rates of industrial brines typically found within the Mpumalanga region of South Africa.

Project partners: Earth Science dept. UWC **For more information:** http://www.WRC.org.za/

Advanced oxidative water treatment process for water disinfection using an electrohydraulic discharge reactor and TiO2 immobilised on nanofibers

Project focus areas: N/A **Funders:** WRC **Contact person:** Prof. L. Petrik

The conventional water treatment approaches identified in the literature have not produced the desired results and often generate toxic intermediate products. These disadvantages have driven research interest into the development of new water treatment that will supplement the existing techniques. Thus, the use of advanced oxidation technologies such as the electrohydraulic discharge (EHD) system for decomposing organics and microbes was considered due to its greater efficiency, energy saving, high speed, use of few or no chemicals, and non-destructive impacts upon the ecosystem. In this project, the design and methods for applying electrical energy to multiple electrodes was explored and described. The system is capable of degrading organic pollutants in wastewater within 20 minutes without chemical additives therefore presenting an advantage over current technologies

Project partners: US Electrical Engineering **For more info:** http://www.WRC.org.za/

Application of mineral carbonation processes for brine remediation

Project focus areas: Mpumalanga **Funders:** WRC **Contact person:** Prof. L. Petrik

Various industrial processes such as power generation from coal combustion, mining and reclamation of waste waters (such as sewerage and industrial via desalination) lead to the generation of hyper-saline wastewater called brines. Brines are considered as potent surface and ground water pollutants. Co-utilization of the major waste streams from coal combustion (FA and CO2) for brine remediation was developed and recovery of cleaner water could augment the water requirements at power plants or other industrial outfits. Application of mineral carbonation for brine clean-up purposes has not been reported before. This study achieved the reduction of the salt load in waste brine effluent emanating from reverse osmosis retentates by a carbonation process using fly ash, in order for the maximum water recovery and the maximum stabilization by secondary mineralization of problem elements in brine.

Project partners: Council of GeoScience **For more info:** http://www.WRC.org.za/

Degradation of emerging micropollutants by combined advanced oxidation with immobilized plasmon titanium dioxide nanocomposites in an electrohydraulic discharge reactor

Project focus areas: N/A **Funders:** WRC **Contact person:** Prof. L. Petrik

The activity for organics decomposition in water due to the plasmon effect and/or the free radicals generated from combining plasmon enhanced photo catalytic material such as semiconductor TiO2 with electrohydraulic discharge reactor in an advanced oxidation system. The system enhanced the photo catalytic oxidation efficiency of PPCPs/EDCs/antiscalants because the reaction is accelerated by both the high energy plasma species and the UV emission as well as the plasmon enhanced photocatalyst.

Project partners: US Electrical Engineering **For more info:** http://www.WRC.org.za/

Synthesis, characterization & applications of zeolites from South African fly ash.

Project focus areas: N/A **Funders:** NRF **Contact person:** Prof. L. Petrik

Fly ash, being the major combustion residue produced during the combustion of pulverized coal, presents an ongoing disposal challenges due to concerns raised on potential contamination of ground water due to leaching of toxic elements, potential risk of air pollution, and also rendering of large tracks of land unusable. Even though a considerable amount of research on the utilization of fly ash has been conducted in recent years, the use of coal fly ash as a raw material in zeolite synthesis stands out as the most environmentally friendly way of recycling the coal fly ash. By utilizing fly ash in the synthesis of zeolite products, potential environmental burdens associated with fly ash disposal can be mitigated. In addition, the zeolitic products can be sold to generate extra income for the power plant. The fly ash zeolitization process can be a competitive way of producing zeolites to satisfy the new emerging applications of zeolites, especially if high value zeolite phases are prepared. South African fly ash derived zeolites are highly crystalline and devoid of residual fly ash particles, further in-depth characterization of these material are required to determine their full potential applicability as catalysts in industrial processes such as hydrocarbon processing, and to catalytic application as well as adsorption studies such as post-synthesis modification by ion-exchanging, and metal-doping.

Project partners: Prof. P. Pale Strasbourg University, Fracnce **For more info:** N/A

Novel consolidated core/shell nanomaterials based on noble metals and semiconductors for hybrid photovoltaic membrane processes in water purification

Project focus areas: N/A **Funders:** NRF and JINR Russia **Contact person:** Prof. L. Petri

Membrane technology plays a vital role in that of water treatment technology. A mayor problem in membrane technology is that of membrane surface fouling by water contaminants such as organics. A new trend in membrane technology is the development of membrane photocatalytic reactors which dramatically improves the water treatment process. The study developed special polymeric membranes with multifunctional properties. goal of the project is to successfully synthesise composite membranes based on a consolidated [(Ag/Au/Pt/Pd)-(TiO2/ZnO)] nanocatalyst on the surface of microfiltration polymeric track etched membranes. Therewith, effectively separate and oxidise bio- and organic pollution from water. A fouling free filter using a photovoltaic catalysts “skin layer”, synthesised from p-n junction nanocatalyst, was able to meet the particular applications requirement for advance photocatalyst with higher destruction rates that that of currently commercially available ones. These layers would have higher destruction rates than photocatalyst that did not contain a p-n junction.

Project partners: Prof. Sergey Pavlovich Gublin, Dr. A. Nechaev, Russia. **For more info:** N/A

The Synthesis of Highly Selective Immobilized Ligands for Extraction of Toxic Metal Ions from Waste Water

Project focus areas: N/A **Funders:** WRC and NRF **Contact person:** Prof. L. Petrik

About 80% of the water in South Africa is used in mining and heavy industries for cooling, creating slurries, separation processes, etc. Mine dumps contain radioactive elements such as U-235 which are by-products in Au mining. These heavy metal ions dissolve easily and get washed into rivers and streams. Some industries even dump the untreated water directly into rivers and streams. Although there are a number of conventional extraction methods that produce high yields, in most cases, the ligands used, are destroyed and the metal ions cannot be recovered for re-use. Highly selective tailored chelating separation materials for hydrometallurgical applications in which extremely high selectivity or reversed selectivity order are being developed. The overall focus of this study is to develop highly selective ion exchangers and adsorbents (in

the form of particulates or nano fibres). Novel developments are typically materials composed of organic ligands tailored for specific metals and of either organic or inorganic supports, which are optimized for selective ligand-metal interactions.

Project partners: Uni,Toulon, France, Lapeenrate University of Technology, Finland **For more info:** http://www.WRC.org.za/

Construction of a DeNOx and DeSOx rig to test the ability of zeolites synthesised from Eskom fly ash to remove certain gases from flue gases produced at power stations

Project focus areas: Power stations **Funder:** ESKOM **Contact person:** Prof. L. Petrik

The research focused on the production and applications of high quality zeolite Na-P1, A, and X from South African fly ashes. The initial results from small scale pilot studies lead to development of suitable supports for consolidated systems suitable for SCR DeNOx. The research focus is on: Identification and optimization of other better quality zeolites (A and X) from fly ash; Investigate cost effective ways of fly ash zeolitization such as the use of mine waters as the synthesis solvent; Optimize small pilot scale (1 kg) synthesis conditions; investigate the requirements for disposal of spent zeolites; investigate requirements for preparing catalyst/zeolite in plate and frame or other suitable configuration for DeNox of flue gases.

Project partners: Eskom **For more info:**

Recovery and application of useful products from coal combustion products

Project Focus area: Mpumalanga **Funders:** SASOL **Contact person:** Prof. L. Petrik

The conversion of coal combustion products, specifically fly ash, into geopolymer, or foamed geopolymer by developing formulations which are suitable for ash dump capping or lining grout , insulation materials, building construction elements. Geopolymers of various formulations are being implemented in niche applications, such as quick setting cements for binding nuclear and toxic waste spillage, and grouts. Foamed geopolymers are lighter and more easily reworked in the dry solid state than densely solid geopolymers and are more easily moulded in the plastic state into a final article.

Projects partners: N/A **for more information:** N/A

Institute of Water Studies

Faculty/s: Natural Science
Department/s: Earth Science
Type: Research Unit
Website: http://www.uwc.ac.za/Faculties/NS/Water_Studies/Pages/default.aspx
Head of the Unit: *Prof. Dominic Mazvimavi (dmazvimavi@uwc.ac.za)*
Main contact points: *Administrative officer: Ms. Mandy Naidoo (manaidoo@uwc.ac.za)*
Nationally/internationally funded: both national and international funding

The Institute for Water Studies (IWS) at the University of the Western Cape was formed in 2009 with the goal of promoting research, postgraduate training, and outreach on water-related issues through the collaborative efforts of UWC staff. The Institute for Water Studies aims to increase the understanding of surface water, groundwater, and ecosystems linkages and how water users are affected and affect these linkages. IWS has a multi-disciplinary approach to its research since water issues cut across disciplines.

Research Projects/Areas

Heuningnes Catchment research project

Project focus areas: Cape Agulhus **Funder:** WRC and NICHE **contact person:** Prof D. Mazvimavi

The Heuningenes catchment research project has four main objectives these are: to determine the contributions of sub-catchments of the Heuningnes River to inflows into the Soetendalsvlei and Heuningnes Estuary.to establish the effects of land uses and water uses on quantity and quality of inflows into the Soetendalsvlei and Heuningnes Estuary.to establish the extent to which marshes occurring along stretches of the Nuwejaars River and tributaries modify inflows into the Soetendalsvlei.to determine how river inflows, the interactions between surface water and groundwater affect the water balance dynamics of Soetendalsvlei, and outflows into the Heuningnes Estuary.

Project partners: Nuwejaars Nature Reserve Forum and the University of Twente (Netherlands)

Capacity building for integrated water resource management in South Africa

Project focus areas: N/A **Funder: NUFFIC** **contact person:** Prof. D. Mazvimavi

This project aims at enhancing the research and teaching capacities of CPUT and UWC in the area of intergrated Water Resource Management which focuses on equitable, efficient, effective and sustainable management of water resources in South Africa. This will be accomplished by the installation of equipment and software for receiving remote sensing images in near real-time in the Environmental and Water Science section of the Department of Earth Science.

Project partners: the Centre for Water and Sanitation (CPUT)

Understanding the effects of global change on water resources through long-term catchment monitoring

Project focus areas: Global study **Funder:** DST/NFR ACCESS **contact person:** Prof. D. Mazvimavi

Information not made available

Project partners: N/A **For more information**:

The application of stable isotopes to the study of groundwater recharge and flow: Primary and fractured aquifers of South Africa and Argentina

Project focus areas: South Africa and Argentina **Funder:** NRF and STRC **contact person:** Prof. D. Mazvimavi

Information not made available

Project partners: Information not made available **For more information**:

Information has been confirmed by HySA

Using IWRM best practices to develop appropriate capacity and training for the benefit of Sub-Saharan African water security

Project focus areas: Sub-Saharan Africa **Funder:** African Union **contact person:** Prof. D. Mazvimavi

Information not made available

Project partners: Information not made available **For more information**:

WDS design principles to strengthen planning for water sensitive cities of the future

Project focus areas: Sub-Saharan Africa **Funder:** Water Research Commission **contact person:** Prof. K. Carden

Project partners: UCT **For more information**: kirsty.carden@uct.ac.za.

Exploring lowest appropriate levels of water governance in South Africa

Project focus areas: Sub-Saharan Africa **Funder:** Water Research Commission **contact person:** Mr. L Jonker

Project partners: UCT **For more information**: ljonker@uwc.ac.za