



# NEWSLETTER

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SASSCAL in good company at the GMES & Africa Forum with the WeMAST consortium and little environmental warriors (page 6)



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## Message from the Executive Director

### *“SASSCAL at the centre of Science Diplomacy”*

*Long-term financial sustainability and international recognition of regional climate change science services centres and other similar research and capacity development institutions are pivotal to the realisation of the UN Sustainable Development Goals (SDG) and the Paris Agreement aimed at tackling climate change.*



Successful implementation of both the UNSDGs and the Paris Agreement require continuous long-term environmental and socio-economic data to derive meaningful trends in the key variables that are being monitored. But science isn't enough to solve the cross country, transregional, and global environmental, socio-economic challenges. Thus, SASSCAL and other regional climate change science service centres are at the centre of science diplomacy. Such institutions facilitate international cooperation, which is one of the most important prerequisites for tackling the global challenges that the world is facing today.

In their attempt to give the concept of science diplomacy emphasis and currency, *Gluckman et.al, (2017)* note the following as the widely recognised facet for science diplomacy:

- Science in diplomacy: Science providing advice to inform and support foreign policy objectives
- Diplomacy for science: Diplomacy facilitating international scientific cooperation
- Science for diplomacy: Scientific cooperation improving international relations.

Countries have continued to embrace the evolving concept of science diplomacy. It is generally accepted that the main scientific gains of science diplomacy fall under two main categories of advancing knowledge and ensuring scientific capability. Moreover, a growing number of countries have established

formal structures and links to science diplomacy through signing science cooperation agreements.

SASSCAL is an example of one such initiative in response to challenges of global change. Its formation and regional approach in advancing the science and services in climate change and adaptive land management is an illustration of practical framing of science diplomacy.

SASSCAL has been framed within both the regional and international research and development agendas. It is premised on promoting research and collaboration in climate change and adaptive land management with a regional approach. With representative node offices in each member state, SASSCAL ensures that individual member states' national needs are catered for. Zambia has for example, through its Ministry of Higher Education embarked on a number of reforms to strengthen science and technology, research and innovation in line with its national development agenda.

SASSCAL has through its first research portfolio, SASSCAL 1.0, achieved and displayed the 2 main gains of science diplomacy. SASSCAL 1.0 has had unprecedented resounding success in terms of both human and infrastructural capacity development. Various knowledge advancement endeavours have been registered through several reviewed journal articles, PhD, MSc and Honours sponsored students.





Similarly, SASSCAL 1.0 funded the acquisition of various state of the art laboratories and field equipment. In Botswana, for example, an Ultra-Low freezer designed to meet the highest international requirements levels was procured. Angola infrastructural investment included funding of soil and water laboratories. Both laboratories are fully equipped with the latest scientific innovation products. SASSCAL funding enabled Zambia project teams to reach remote research sites through the purchase of boats that included an automated remote-controlled boat. The latest drone technology was acquired for the Namibia research teams to facilitate the monitoring of vegetation observatories.

All the three facets of science diplomacy stated in *Gluckman et al.* (2017) are equally important when considering the issue of international action on climate change. For example, ‘diplomacy was needed to establish and sustain the process associated with the Intergovernmental Panel on Climate Change (IPCC) (i.e., diplomacy for science), international scientific cooperation was needed to advance our understandings of the global climate system and facilitate international agreements (science for diplomacy), and scientific measurement will be used to monitor progress against various agreements (science in diplomacy)’ (ibid).

For a country to make any investment that supports science diplomacy, the actions must be seen to either directly or indirectly advance its national interest. SASSCAL achievements since its inception have validated the investment by member countries in the regional initiative. In addition to what has been mentioned above, an extensive operational seasonal forecast system was established under SASSCAL 1.0 by the CSIR.

Regionally, the well-being, water security and food security of millions of communal inhabitants are directly linked to the government’s ability to make quick and informed decisions, that respond to impending climatic catastrophes. Among others, the CSIR forecast system partly funded by SASSCAL, gave early warning of the 2015/16 drought conditions over Africa and continued to provide guidance, in terms of prospects of anomalous

rainfall over the drought-stricken southwestern Cape.

As already alluded to, one of SASSCAL’s cornerstones is capacity development. It feeds to the new paradigm for science diplomacy where countries have also highlighted the need for ministries to ensure they are equipped with and have access to appropriate expertise. SASSCAL continues to provide tailor made short courses for various governmental technical departments and this will be strengthened in SASSCAL 2.0 to include decision makers.

The critical role of science cooperation between member states is central in addressing regional and global climate change challenges and requires scientific verification. SASSCAL member states and Germany, who remains SASSCAL’s main funder, have pledged further support to SASSCAL. This will enable the institution’s sustained efforts to apply scientific expertise to address global challenges. Superimposed upon SASSCAL’s research outputs are member states’ science-based management plans and science advisory mechanisms that are needed in addressing climate change challenges at a local level. Thus, in part, SASSCAL has demonstrated that “Science knows no country, because knowledge belongs to humanity, and is the torch which illuminates the world” (Louis Pasteur).

Strengthening national science-advisory mechanisms is a prerequisite to progress on the SDGs. SASSCAL continues its endeavours in contributing to science diplomacy in the region through its three pillars of research, capacity development and provision of services and products.

Science is increasingly important in addressing and managing a wide range of emerging global threats thus regional initiatives like SASSCAL continue to remain relevant, but its long-term sustainability remains at the core of sustained international cooperation in science.

Dr Jane M Olwoch  
SASSCAL  
Executive Director

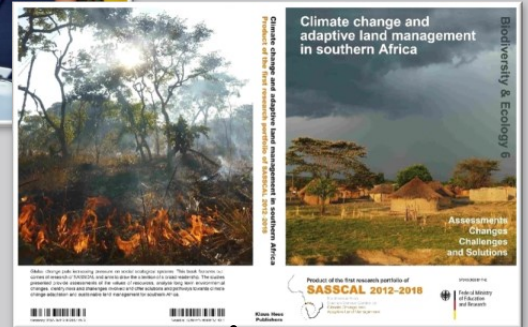




**SASSCAL reflecting on 2018**



**2018 SASSCAL Science Symposium**  
*"Science Diplomacy supporting Climate Change Action in SADC"*  
 Lusaka, Zambia from 16 to 20 April 2018



**SASSCAL Book Launch**  
 April 2018

**JAN**

**FEB**

**MAR**

**APR**

**MAY**

**JUN**



**SASSCAL Angola, Botswana and South Africa Mini-Symposia**  
 March 2018



**SASSCAL—NUST close-up workshop**  
 March 2018



**SEACRIFOG work package leaders convene**  
 June 2018







**1st GIS NSDI Forum**  
July 2018



**Extended Freshwater and Terrestrial Environmental Observation Network Workshop**  
September 2018



**SASSCAL Ministerial Meeting**  
*"Promoting Science for Sustainable Development"*  
Windhoek, Namibia,  
21 September 2018

**JUL**

**AUG**

**SEP**

**OCT**

**NOV**

**DEC**

**3rd Annual Women Conference**  
August 2018



**First MGEO Students graduate**  
October 2018



**International Data Week**  
November 2018



**2018 Science Forum South Africa**  
December 2018



**GMES & Africa Forum**  
November 2018







# GMES AND AFRICA



## WeMAST Project exhibits at 1st GMES & Africa Forum

The First Forum of the GMES & Africa Support Programme, under the theme "Unlocking the Potential of Earth Observation as a Key Driver of Africa's sustainable development", took place from 19 to 23 November 2018, in Libreville, Gabon.

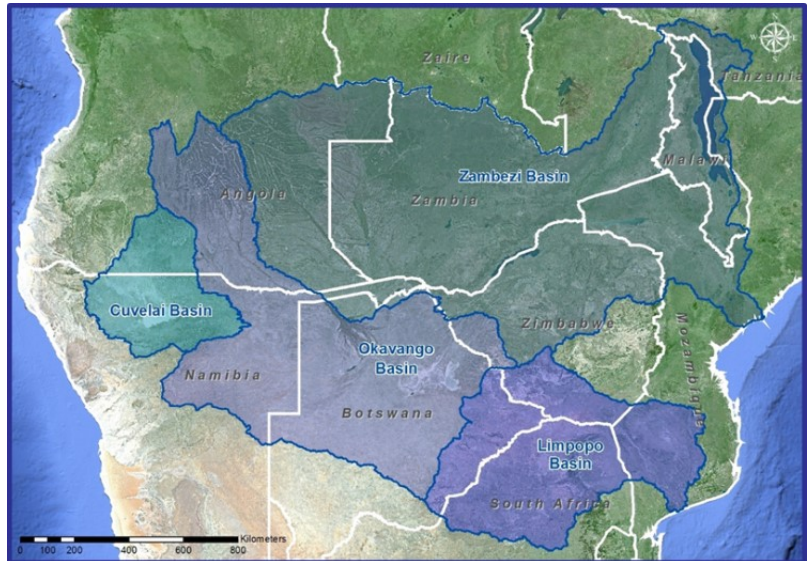
The Forum is a communication platform for GMES & Africa consortia that encourages and promotes the exchange of views and experiences among Earth Observation (EO) professionals and the end-users.

The WeMAST (Wetland Monitoring and Assessment Service for Transboundary Basins in Southern Africa) consortium is one of 13 consortia, across all African economic regions, awarded grants by the GMES & Africa Support Programme.

All GMES & Africa Support Programme consortia exhibited their projects at the GMES & Africa Forum.

The WeMAST consortium is led by SASSCAL and composed of key academic institutions, including the University of Botswana, University of Zambia, Cape Peninsula University of Technology, University of the Western Cape and Midlands State University. Other key members include the South African National Space Agency (SANSA) and the National Remote Sensing Centre (NRSC) of Zambia.

The WeMAST project (<http://wemast.sasscal.org>) will develop and implement an EO based online platform that supports Sustainable Wetland Assessment and Monitoring Services, promotes policy implementation and management practices in the SADC region, and

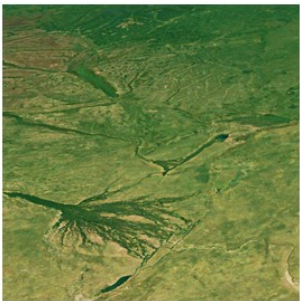


The WeMAST project will provide products and services for the management of the wetlands of the following basins: Cuvelai Basin, Limpopo Basin, Okavango Basin and Zambezi Basin

utilizes free satellite-based EO data and existing free software.

The WeMAST consortium aims to create products and services in line with the concept of "**with the Users for the Users**".

During the GMES & Africa Forum, SASSCAL's Executive Director, Dr Jane Olwoch, opened the Service Development and Delivery Session of the Forum, with a key note address of the title "Tailor-made services for end users: challenges and opportunities".



Wetlands in Southern Africa are highly productive and biologically diverse ecosystems that contribute significantly to livelihoods and to economic development. However, they are under significant pressure from both human activities and natural phenomena, including agricultural practices, land cover and land use change, human settlements, water harvesting, invasive species infestation, climate change and unsustainable development practices.

The future of these wetlands is therefore dependent on effective assessment and monitoring initiatives that can inform policy and decision making to promote sustainable management and use of these wetland ecosystems. Moreover, the necessary skills and institutional capacities, to exploit existing and freely available data and information resources, in particular Earth Observation (EO) products, are often lacking and therefore constrain effective wetland management efforts.



Dr Olwoch introduced the audience to SASSCAL, as the WeMAST consortium leader, and how SASSCAL addresses the provision of services and products for its stakeholders. Dr Olwoch further discussed the challenges encountered for providing these products and services, which included the lack of collaborations and communication between institutions, the cost of providing these products and services, the lack of capacity for creating tailor-made products and services.

Dr Olwoch continued to explain that the shortage of data is not a challenge, however, the skill-set to harvest these data, to efficiently analyse and process them and moreover, to make them available to the users, is the challenge.

The keynote address was followed by a panel discussion between Dr Olwoch, Bamaaji Rakiya Abdullahi (NASDRA), Georges Gulemvuga Guzanga (CICOS), Zoltan Szantoi (JRC), Patrick Omondi (Kenya Wildlife Authority) and Hedia Chakroun (l'Association Africaine pour la promotion du Geospatial). Panellists stressed the importance of addressing quality and usefulness for the end users in ensuring that user needs are addressed and met, and underlined the linkages between the donor organisation, the consortium and the end-user.

Panellists further agreed that we live in an “age of rich data” and that the shortage of data is not the challenge. “The data is there!” However, challenges were encountered in how to ensure that the data and information reach the intended end-user. In this regard, the importance of generating creative solutions and exploring simple communication mediums such as printed maps, fact sheets and pamphlets were mentioned by Dr Olwoch.

In addition to exploring creative solutions for communicating data and information to end-users, the need for capacity development was further emphasised, in order to ensure that the large amounts of EO data are processed, assimilated and analysed to produce manageable products that can be easily transmitted and distributed.

During the Forum, regional economic centres and GMES and Africa consortia also engaged in regional discussions.

Five GMES and Africa consortia are active in the southern African region and are lead by

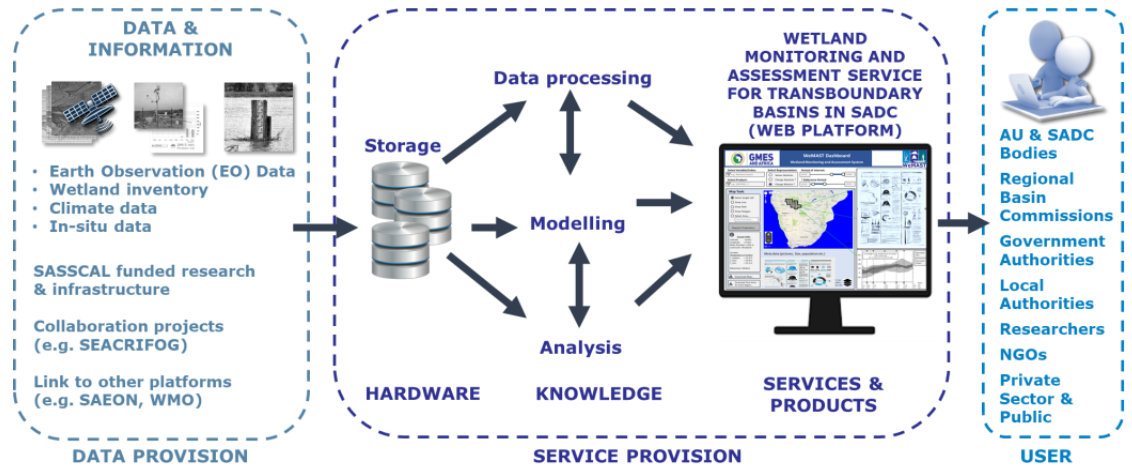
- SASSCAL (Southern African Science Service Centre for Climate Change and Adaptive Land Management), SADC-CSC (Southern African Development Community Climate Services Centre), IGAD Climate Prediction and Application Centre, RCMRD (Regional Center for Mapping of Resources for Development), all providing water and land resource services
- MOI (Mauritius Oceanography Institute) and the CSIR (Council for Scientific and Industrial Research), providing marine and coastal areas services.



Top to bottom: The SASSCAL Executive Director, Dr Jane Olwoch, with HE Helmut Kultz, Ambassador, Delegation of the European Union to Gabon and Madame Chantal Thér se Akouosso, Minister Delegate for Culture; SASSCAL colleagues at the WeMAST exhibit; Dr Helmschrot during a panel discussion



The WeMAST project work flow involves the ingestion of various data sources, including notably earth observation products, climate data, in-situ data and wetland baseline information, the processing, modelling and analysis of these data sources to produce various services and products to be made available via an online web portal



During the Forum, each consortium leader also introduced their project scope, consortium members, planned methodology, as well as expected services and products.

In this context, SASSCAL's Dr Jörg Helmschrot, Director of Science and Technology / Capacity Development, presented the WeMAST (Wetland Monitoring and Assessment) project. Dr Helmschrot explained the regional need for wetland monitoring and assessment services and products, and moreover highly underpinned the huge reliance of millions of people in the region on the wetland resources of southern Africa.

Dr Helmschrot further emphasised that WeMAST will build on

previous successful initiatives and projects, including SASSCAL's own research programme.

WeMAST will engage actively with the four river basin commissions (Cuvélai Commission, Okavango River Basin Commission, Zambezi River Commission and Limpopo River Basin Commission) that are active in the four WeMAST basins: the Cuvélai, the Okavango, the Zambezi and the Limpopo basin.

During the following panel discussions, clear synergies were identified between the different southern African GMES and Africa consortia. The audience invited consortia to consider more active engagement with each other, to ensure a pan-African GMES and Africa initiative, instead of respective, stand-alone initiatives. Most consortia do already engage with thematically related consortia.

The WeMAST consortium members attending the First GMES & Africa Forum





## SASSCAL-funded Students of the collaborative Master of Geographic Information Systems and Earth Observation graduate

SASSCAL feels privileged and humbled to have been invited to the graduation ceremony of the Namibia University of Science and Technology (NUST), that took place on 12 October 2018, at the Safari Hotel in Windhoek, Namibia. Dr Jane Olwoch, the Executive Director and Kevin Stephanus, the Human Capacity Development Coordinator represented SASSCAL at this graduation ceremony.

We are proud to announce that two SASSCAL-funded students obtained their MSc degree in Geographic Information Systems and Earth Observation (MGEO), after successful defense of their theses during oral presentations held at NUST on 18 September 2018.

The MGEO is a collaborative Master degree, developed and funded during SASSCAL's Research Portfolio 1.0 from 2013 to 2018. It is a two year regional postgraduate programme that was developed by NUST in collaboration with Cape Peninsula University of Technology (CPUT), the University of Botswana (UB) and the University of Zambia (UNZA) with the assistance from the Germany Aerospace Center (DLR) and the University of Trier.

SASSCAL congratulates the two NUST graduates:

- Edward Mukoya Muhoko graduated with distinction for his thesis "Spatio-Temporal Analysis of Land Cover Change in the Perspective of Modelling Land Uses". Edward gives us an insight into his thesis on page 12 of this newsletter

- Nicodemus Amelia Nauwanga graduated with her thesis on "Developing a Web based GIS for the Documentation of Historical Buildings in Namibia", and notably the first of its kind in Namibia.

In Zambia, the following two students also graduated from the MGEO programme at UNZA:

- Masauso Sakala graduated with his thesis "Validation of satellite derived rainfall products over a Namibian rainfall gradient"
- Bwalya Kawimbe graduated with his thesis "A combined GIS and Remote Sensing analysis approach to map and predict gully erosion, in Namibia, using TanDEM-X derived digital elevation models"

SASSCAL would like to seize this opportunity to wish all graduates the best for their future as they join a growing list of people that are trying to change the world with their contribution to natural resource management and the Geoinformation industry.



*The NUST graduates (front seated) Edward Mukoya Muhoko, who graduated from the MGEO with distinction and Nicodemus Amelia Nauwanga with (left to right standing) (Frickie Louw, Principal Investigator of SASSCAL-funded Task 303, through which the MGEO program was developed, Dr Jane Olwoch, SASSCAL Executive Director and Kevin Stephanus, Human Capacity Development Coordinator*



## Showcasing SASSCAL's data initiatives at the International Data Week

The International Data Week of 2018 (IDW 2018) was held from 05 to 08 November 2018 in Gaborone, Botswana. It was hosted by the Botswana Open Science and Open Data Forum,

IDW 2018 brought together data scientists, researchers, industry leaders, entrepreneurs, policymakers and data stewards from all disciplines and geographies across the globe. IDW 2018 combines the 12th Research Data Alliance (RDA) Plenary Meeting, the bi-annual meeting of the research data community, and SciDataCon 2018, the scientific conference addressing the frontiers of data in research.

With the theme of 'The Digital Frontiers of Global Science', this landmark event was a rich week of science and data, featuring world renowned keynote speakers, plenary panels and discussions, and the presentation of high quality research implementation and practical working sessions for international collaborations. Focus topics included:

- Research issues in a global and digital age
- Applications, progress and challenges of data intensive research
- Data infrastructure and enabling practices for international and collaborative research

Dr Jörg Helmschrot, the SASSCAL Director of Science and Technology / Capacity Development, delivered a key note on "The SASSCAL Open Access Data Centre (OADC) – A regional data, information and knowledge hub supporting open data exchange in Southern Africa". During his speech to the data community, he underpinned that the Open Access Data Centre (OADC) (<http://www.sasscal.org/services/>) of SASSCAL aims to address the need for innovative and effective solutions that inform decision-making processes. He highlighted that the OADC has developed and implemented

- an operational openly-accessible online platform, referred to as the SASSCAL Data and Information Portal,
- data base systems to ensure that products are safe-guarded utilizing international standards,
- procedures to harvest data, information and services from the SASSCAL-funded research and from collaborating initiatives and partners, and

- platforms to further ensure the creation of knowledge products and services based on the user requirements of the stakeholder community.

During the presentation and the following panel discussion, Dr Helmschrot provided an overview of the flagship developments, such as the SASSCAL Data and Information Portal (<http://data.sasscal.org/>) and the SASSCAL WeatherNet (<http://www.sasscalweather.net.org/>). He further underpinned the need for open data policies and systems that support cross-border data sharing, in order to provide data and information at highest quality to decision makers in various sectors.

In line with his work on the SEACRIFOG project (see SASSCAL Newsletter Vol. 3, Issue 1, of January 2018, pg 7, <http://www.sasscal.org/sasscal-newsletter-january-2018/>), Mr Johannes Beck gave a talk on "Reducing the uncertainty of the African greenhouse gas budget: Observational gaps and needs", at SciDataCon, in the session "Applications and utilization of data in understanding the effect of changing weather and a warming climate over Africa". Mr Beck presented SASSCAL's work done to date in line with the SEACRIFOG project. This includes the identification of a set of essential variables for the characterization and quantification of climate forcing on and around the African continent and an assessment of the availability and coverage of corresponding observation infrastructures and data products.

The conference provided an excellent platform for exchange with other actors from the open research data movement globally and across Africa. It was thus highly relevant not only for SASSCAL's work in line with the SEACRIFOG project, but also for SASSCAL's open data approach in line with the OADC.



*Dr Jörg Helmschrot, the SASSCAL Director of Science and Technology / Capacity Development, delivering a key note address*



## SASSCAL research highlighted at 2018 the Science Forum South Africa

SASSCAL hosted a vibrant and very interactive exhibition stand at the Science Forum South Africa (SFSa). The SFSa was held at the CSIR in Pretoria from 12 to 14 November 2018. The forum attracted more than 3.000 delegates and more than 70 exhibitors. The SFSa served as a large, open, public platform for debating the “science and society interface”. The forum is an initiative of the South African Department of Science and Technology and attracts scientists, students, public and private sector representatives as well as civil society.

The SASSCAL exhibition stand created further space for future-shaping conversations. SASSCAL also hosted a special session where Mr Gabin Ananou from the Project Management Agency (PT-DLR) made a presentation. Mr Ananou, in his presentation, highlighted the activities of SASSCAL and WASCAL in light of Climate Change Challenges in Africa. He further discussed the ‘state of the Art and New perspectives’ of climate change initiatives and strategies. The session was facilitated by the SASSCAL Executive Director Dr Jane Olwoch and the South Africa Node Director Mr Peter Shisani. The special session was concluded with a quiz session where some delegates won the SASSCAL Book. The exhibition stand was featured in the SABC broadcast of the event through an interview with Dr Olwoch and a BMBF representative, Dr Karsten Hess.

*Top to bottom: Dr Jane Olwoch, SASSCAL Executive Director, engaging with Forum participants; Gabin Ananou from the Project Management Agency (PT-DLR), presenting on behalf of SASSCAL and WASCAL; winners of the SASSCAL Book with Dr Jane Olwoch and Peter Shisani (SASSCAL National Director, South Africa) on far right; Dr Phil Mjwara, Director General of the South African Department of Science and Technology (far right) during his visit to the SASSCAL exhibit, pictured with Dr Jane Olwoch (second from right) and SASSCAL South Africa Director Mr Peter Shisani (far left)*





## **Spatio-Temporal Analysis of Land Cover Change in the Perspective of Modelling Land Uses: a case study in Kavango East, Namibia**

by Edward Muhoko  
Ministry of Agriculture, Water and Forestry, Namibia

Edward Muhoko is one of 35 students that benefitted from SASSCAL-funded scholarships to obtain their MSc degree in Geographic Information Systems and Earth Observation (MGEO), a programme developed and funded during SASSCAL's Research Portfolio 1.0 from 2013 to 2018.

SASSCAL congratulates Edward on graduating with a distinction for his Master thesis "Spatio-Temporal Analysis of Land Cover Change in the Perspective of Modelling Land Uses: a case study in Kavango East, Namibia".

### **About Edward**

Edward is a Forester at the Directorate of Forestry, in the Ministry of Agriculture, Water and Forestry, in Namibia. His area of specialisation is in GIS, Remote Sensing and Geostatistics. Within the Directorate, Edward's duties include forest fire mapping, vegetation and land cover mapping and field data collection.

### **Why was Land Cover Change Modelling in the Kavango of Namibia, chosen as a thesis topic?**

Land cover change is a global problem but effects can be particularly severe in developing countries such as Namibia because it affects the social, cultural, and ecological functions of ecosystems, and can negatively affect sustainable development. Detailed studies on land cover change and the associated spatial drivers which are either directly or indirectly driving this change in the north-eastern parts of Namibia are limited. This is despite the area being part of the Kavango Zambezi Trans Frontier Conservation Area (KAZA-TFCA) which is the

largest transboundary conservation area in the world.

### **What was the aim of the study?**

The purpose of the study was to determine the extent of land cover change during the period 1990 - 2016 in Kavango East Region, Namibia, as well as the spatial variables that may influence land cover change, their interactions and variability over time. Using Remote Sensing, GIS and Boosted Regression Trees, the study analysed the relationship between land cover change and the spatial variables, and evaluated the evolution of the spatial variables based on the statistical models during the 26-year period.

### **The results, which earned Edward a distinction**

The results showed that a large portion of the study area's land cover has remained unchanged between 1990 and 2016 (*Figure 1*). The influence from the variables varied in each epoch (Table 1). The predictor variables such as population density, distance to road, distance to river and distance to settlement were found to have the highest influence in the conver-





sion of forest land to cropland.

Human related predictor variables contributed more to model performance than natural factors.

**The way ahead?**

It is recommended that further studies should use high resolution satellite imagery such as Sentinel data, and other variables such as cattle density, game density, annual mean tempera-

ture, precipitation seasonality, NDVI, crown cover and slope to provide a comprehensive land cover change analysis including the variability of these predictor variables over time.

The results from the models in this study may be used in a land cover change framework for environmental monitoring, spatial planning and situation analysis at local and national levels of government.

Figure 1: The distribution of land cover types in the study area

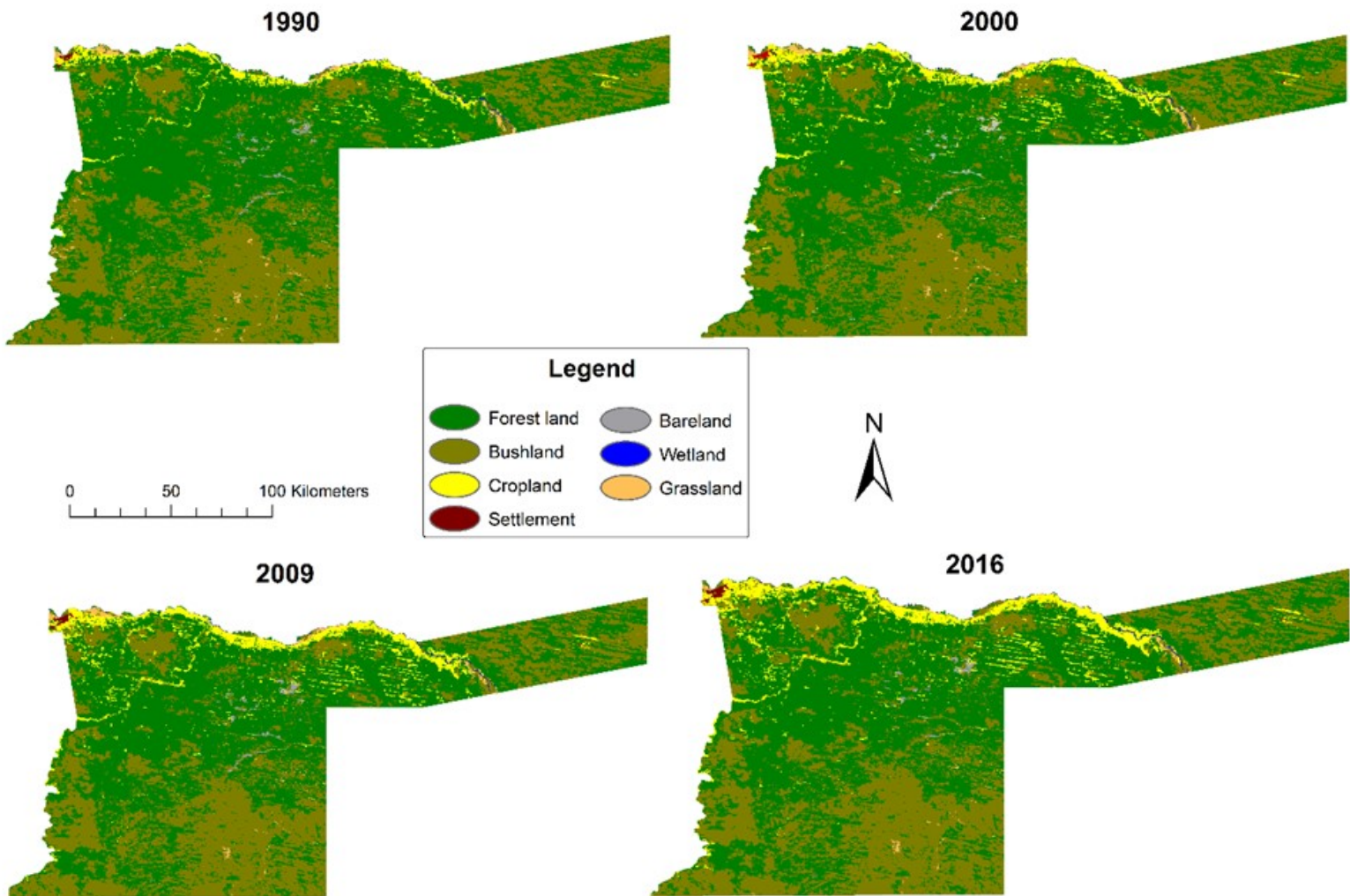


Table 1: An overview of the relative contributions of the predictor variables for each period

1990-2000 Period	2000-2009 Period	2009-2016 Period
Distance to River (35 %)	Population Density (51 %)	Population Density (41 %)
Distance to Settlement (28 %)	Distance to Road (12 %)	Distance to Settlement (17 %)
Elevation (11 %)	Distance to River (9 %)	Distance to River (14 %)
Fire Return Period (11 %)	Elevation (8 %)	Elevation (9 %)
Population Density (8 %)	Distance to Settlement (8 %)	Soil Type (9 %)
Distance to Road (7 %)	Fire Return Period (8 %)	Distance to Road (6 %)
Soil Type (0 %)	Soil Type (4 %)	Fire Return Period (4 %)
Average Rainfall (0 %)	Average Rainfall (0 %)	Average Rainfall (0 %)



## Life after studies

SASSCAL is in the process of establishing a SASSCAL Alumni Network. Through the SASSCAL-funded Research Portfolio from 2012 to 2018, around 290 students obtained their Bachelor, Honours, Master or PhD degrees from Angola, Botswana, Germany, Namibia, South Africa or Zambia. Through this funding, an invaluable contribution has been made to the region's research programmes, the region's scientific capacity and the region's natural resource knowledge economy.

With the "Life after studies" feature, SASSCAL will be providing insight into how these young people, who obtained their qualifications through SASSCAL funding, are making a contribution in the region's natural resource sectors.

In this issue, we introduce Paul Mwansa and Anthony Chabala.



## Cum Laude for Master of Science in Forestry and Wood Sciences

by Paul Mwansa  
Ministry of Agriculture, Zambia

### Who is Paul Mwansa?

I am a Zambian citizen residing in Solwezi town of the Northwestern Province of Zambia. In February 2016, I enrolled for a Master of Science in Forestry and Wood Sciences (Forest Science) tenable in the Faculty of AgriSciences at Stellenbosch University in the Republic of South Africa. The Masters programme lasted from February 2016 to March 2018. I graduated "Cum laude" and thereafter I returned to my home country, Zambia.

### Investigating the impact of fire on the natural regeneration of woody species in dry and wet Miombo woodlands

My study was one of the many academic research projects supported by SASSCAL under Task ID 038, which was looking into forest regeneration, growth, threats and trends in different forest types. My study entitled, "Investigating the impact of fire on the natural regeneration of woody species in dry and wet Miombo woodlands" was supervised by Prof. Ben du Toit (Stellenbosch University) and Dr Vera De Cauwer (Namibia University of Science and Technology).

#### Study aim

The study aimed to contribute to the broader objectives of the task that sought to understand the effects of environmental factors, forest stand factors and fire history on the success of natural regeneration of tree species favoured by the local communities in Namibia. Six tree species, *Baikiaea plurijuga* Harms, *Burkea africana* Hook, *Guibourtia coleosperma* (Benth.) J. Léonard, *Pterocarpus angolensis* DC, *Schinziophyton rautanenii* (Schinz) Radcl. -Sm and *Terminalia sericea*

Burch. Ex DC were selected as species of focus for the study. The species were selected because, they were important timber and/or utilitarian species most favored by the local people, were abundant in Namibia and were also known to occur across Zambia. Unlike species of the genera *Brachystegia*, *Julbernardia* and *Isoberlinia*, which, even though they are dominant in the Miombo woodlands, are not readily found in the dry woodlands of Namibia.

The study sought to answer the fundamental research question; 'Does fire treatment (period since the last fire) impact on the density and composition of natural regeneration of woody plants along a rainfall gradient in miombo woodlands?'

Subsequently, the overall objective of the thesis work was to investigate the impact of rainfall and fire treatment on the natural regeneration abilities of socio-economical important woody species of Namibia and Zambia and contribute to the knowledge pool on good fire management practices for natural forests.

#### Study area

The study took place in two countries of Southern Africa, Namibia and Zambia following a rainfall gradient from a dry site to a wetter site. Four study sites were chosen with each country having two study sites based on mean annual precipitation (MAP) and the primary land use of being a protected forest area. The different study sites along a rainfall gradient provided a good measure of comparing the same fire effect and how it impacted woody species exposed to availability of different amounts of rainfall. The study was also limited to state (protected) forests in a bid to limit (mainly) anthropogenic disturbances that could have influenced natural regeneration. In Namibia, the study sites were at Kanovlei and Caprivi State Forests whereas in Zambia they were at Sesheke and Kabompo State Forests. The trajectory of the study from Kanovlei (in the southwest of the study area) to Kabompo in the northeast marked the longest distance along the rainfall gradient covering a distance of 1 897 km apart and represented a rainfall gradient from approximately 500 to 1 000 mm per annum.



### **Effects of wild fires**

The study highlighted effects of wild fires on the woody species. Many parameters investigated in the study revealed significant differences due to interaction effects, fire treatment or site effect in cases where interaction effect was non-significant. The effects of fire frequency were found to significantly affect regeneration, mean diameter, mean height, substrate cover with an exception of canopy cover. As the study sought to get a better understanding of the fire treatment impact on the density and composition of natural regeneration of woody species along a rainfall gradient in miombo woodlands. Therefore, having evaluated the impact of fire treatment on floristic composition, natural regeneration density, stand structure of selected species and vegetation cover, two of the study objectives were answered in the affirmative.

It was, therefore, concluded from the study that fire treatment affected the density and composition of natural regeneration and vegetation cover in the short-term. It was also shown that floristic composition and stand structure were not significantly affected by fire treatment in the short-term.

### **My life after completing my studies**

Since joining the government service in 2007, much of my career experience has been in the agricultural sector specifically dealing with policy implementation, field extension and advisory services, mainly to the small-scale farmers who constitute bulk of farmers in the country. I work for the Ministry of Agriculture in the Republic of Zambia as a Senior Agricultural Officer for Kalumbila District in Northwestern Province. Taking up my studies at Stellenbosch University meant that I had to take time off work to pursue my studies. Hence, upon completion of my studies and subsequently returning to my home country, I just resumed my duties at work.

It is not clear to many people that forestry and agriculture are interlinked and affect each other in several ways. This is so true, especially among the small-scale farming community. However, with the ever-increasing evidence of climate change effects on weather patterns and low crop productivity, the link between the two sectors is beginning to be appreciated much more. My newly acquired knowledge and skills from the MSc study could not have come at a better time than now, when the country as a whole needs to pay greater attention to sustainable environmental management. I am confidently providing adequate information and technical support to my subordinates

and farmers to ensure food and nutrition security at household level; and at the same time able to take better care of the environment (forests and production fields) to mitigate the adverse effects of climate change.

I was first introduced to SASSCAL in the middle of 2015 by Martin Kambayi who was a SASSCAL student at Stellenbosch University (at the time supervised by Prof Ben du Toit). SASSCAL Namibia provided funds through a bursary for my two-year period of study. The bursary covered the tuition fees, stipend, travelling expenses, data collection expenses and other incidentals relating to the study.

SASSCAL has provided a good platform for me where I have been able meet and link with eminent people in the science realm. SASSCAL has made it easy for me now to create synergies and work with colleagues within and outside SADC. I took part and learnt a lot from the presentations at the 2018 SASSCAL science symposium as it was an eye opener for me. I presented orally at the symposium on one of the objectives and the findings of my thesis work.

My aspiration is to take part more and more in regional projects across SADC and beyond that seek to develop appropriate interventions in agriculture and forestry in the light of climate change. Since SASSCAL is encouraging transdisciplinary research with a regional approach to forge regionality, I too feel this is the best approach in solving regional problems that may or may not be common to all SASSCAL/SADC member countries.

I thank God the Almighty for this privilege and wonderful opportunity to be part of SASSCAL work. Much as I would love to mention everyone who contributed to the successful completion of the thesis work, space limitation does not allow me to do so since they are too numerous. However, SASSCAL and my supervisors deserve special mention here. My sincere and heartfelt gratitude to SASSCAL for funding my study and opening doors to endless possibilities. I am so grateful to my supervisors, Prof Dr Ben du Toit and Dr Vera De Cauwer for their mentorship, support and motivation during my studies. I thank my family for their prayers and support for the time I was absent from their lives. Lastly but not the least, my sincere gratitude to individuals and organisations in Namibia, South Africa and Zambia who opened their doors wide to accommodate me in my quest for knowledge during my study. I say thank you so very much and I am forever indebted to you all.



*Conducting a field scouting for Fall Armyworms (*Spodoptera frugiperda*) in a maize field and providing spot technical support to the farmer on local interventions to use in controlling the pests*



## Mapping the spatial and temporal variability of water quality parameters for the Barotse Floodplain for his Master of Science

by Anthony Chabala  
Lunsemfwa Hydro Power Company

### Who is Anthony Chabala?

My name is Anthony Chabala and am one of the students in Zambia, who were privileged to be sponsored to conduct graduate studies under the SASSCAL-funded research portfolio. I was involved with SASSCAL Task 191, whose objective was to develop a water quality and quantity database for Western Zambia. Before commencing my studies, sponsored by SASSCAL, I worked for the Government of the Republic of Zambia in the Department of Water Affairs as a Hydrologist, in the central part of Zambia. Still busy with my studies in 2016, a private company involved in hydro power generation offered me employment in a similar capacity. Lunsemfwa Hydro Power Company (LHPC) had attended one of the presentations on my work and consequently made me an offer. Mainly due to my skill-set and knowledge, partly obtained during my research work in the Barotse Floodplain.

### Mapping of the Barotse Floodplain

The Master of Science thesis I submitted to the University of Zambia (UNZA) involved the mapping of the spatial and temporal variability of water quality parameters for the wet and dry seasons in the Barotse Floodplain.

Furthermore, my work also involved hydrological modeling of the Barotse Floodplain, using the Soil and Water Assessment Tool (SWAT) as a plugin to a Geographic Information System (GIS) software.

The main objective was to test the SWAT model in this poorly gauged basin, with little to no data. With this model, the

spatial distributions of sediments in the area were plotted. The Barotse Floodplain is an agrarian area and hence, the study of sediment movements and spatial distribution was quite essential. In addition to this, sediments act as sinks for elements and nutrients. Accordingly, the results of his research are key to advising policy makers on which areas are best suited for farming. The results of his research further verified the pristine state of the water in the Barotse Floodplain, as it had been suspected to suffer from mining contamination from upstream (Zuijdgeest *et al*, 2015).

### My work as hydrologist

My day to day activities as a hydrologist at LHPC require a continuous application of the skill-set and knowledge acquired from my SASSCAL-funded training. Some of the recent work that I've been involved with include developing a flood inundation model as input to a flood hazard and safety document, that the company has been working on. And in addition, rainfall analysis of the basins in which LHPC has its investments. The supply of hydro power reservoirs is dependent on the surface runoff, resulting from the intensity, duration and the spatial heterogeneity of rainfall events within the basins and hence, those employees involved in generation constantly need flow data to be advised on how much to generate. This level of analysis and advise in the area of hydrology is enabled by the training received in the area of climate change modeling.

With all this said, I would love to convey my most sincere gratitude to the German Government via the SASSCAL initiative, for sponsoring African countries in capacity building, especially for the younger generation and across gender. The skill and knowledge obtained is indeed a valuable investment that will be passed on to others for a better today and tomorrow.





## Students in the Field - Case Study 1

### Estimation of fire behaviour in controlled burn in the Ngongoinga Experimental Farm (Huambo, Angola)

by Isaú Alfredo Bernardo Quissindo  
Facultad de Ciencias Agrarias (Chianga)  
Universidad José Eduardo dos Santos

A controlled burning experiment was carried out in a field of *Hypharrena rufa* (Nees) Stapf (commonly known as Jaragua) and *Brachystegia boehmii* Taub (locally known as Ussamba, Lussamba, Misike, Quenge) from 30 May to 01 June 2018 at the Experimental Farm of Ngongoinga, in the Huambo province.

The aim of this research was to predict the behaviour of fire in an attempt to feed into best practices for the planning of forest fire prevention and fire fighting in the region.

During burning, observations and measurements of variables were conducted on the prepared experimental site for burning, thus allowing the estimation of parameters related to fire behaviour. These included the flame dimensions, the spread of the flame and the fire intensity.



It was observed that the variables related to the dimensions of the flames vary directly proportionally to the intensity of the fire.

It was concluded that among the factors that influence the rapid spread of fire, the most influential variable was the wind, especially in the east-west and north-south directions.





## Students in the Field - Case Study 2

### Carbon storage assessment of the Brito Teixeira and Miombo forests in Chianga (Huambo) through Dasometric data

by Freitas Moisés V. Cachenhe and Isaú Alfredo B. Quissindo

Facultad de Ciencias Agrarias

Universidad José Eduardo dos Santos

This study evaluated the potential of carbon storage in the Brito Teixeira Exotic Forest and the Miombo Natural Forest in Chianga (Huambo).

Twelve rectangular plots (6 in each of the forests) with an individual size of 25 m x 20 m (500 m<sup>2</sup>) were marked, for which the following parameters were measured: number of individuals, species, diameter at breast height, height, tree height, age, bark thickness, length of branches and crown diameter. In the study area, *P. patula* (20%), *E. grandis* (17%) and *B. spiciformis* (14%) were the most common species. The Brito Teixeira Exotic Forest had a higher volume of wood (with a mean of 0.503 m<sup>3</sup> per plot) and biomass (average of 16 t per plot) in relation to the Miombo (average wood volume of 0.023 m<sup>3</sup> ha<sup>-1</sup> and 6 tons ha<sup>-1</sup> of net biomass) trees that are older than this. However, higher carbon sequestration rates were observed in the Miombo forest, due to its young trees (mean

age of Miombo trees is 15 years, Forest Brito Teixeira is 50 years) and associated to the fact these species presented the greatest carbon sequestration capacity rate throughout the year: *Pericopsis angolensis* (1679 Mg(C) ha<sup>-1</sup>, representing 16%), *Ochna schweinfurthiana* (533 Mg(C) ha<sup>-1</sup>, 12%), *Terminalia brachymama* (274 Mg(C) ha<sup>-1</sup>, 6.3%) and *Parinari curatelifolia* (257 Mg(C) ha<sup>-1</sup>, 6%).





## Analysis of the impacts of Livestock Sedentarism on soil carbon fluxes in the Kalahari Ecosystem

by M. Bitsang (PhD Student)  
Department of Environmental Science,  
University of Botswana

*Livestock sedentarism enhances GHGs emissions due to the presence of active "hotspots" GHGs production through continuous supply of animal dung and urine and the trampling effect that increases compaction. These "hotspots" predominately represent high local additions of readily available carbon resulting in surface emissions of CO<sub>2</sub> and other greenhouse gases. In the south-western region of the Kalahari ecosystem, rangelands, which historically supported a diversity of wildlife, are now inundated with the establishment of ranches and drilling of boreholes that has sedentarized cattle production. This has resulted in localised soil degradation.*

This study undertook to analyse the impact of livestock sedentarism on soil carbon fluxes and other soil characteristics in Kgalagadi District, in south-western Botswana.

The study was conducted along a north-south moisture gradient. The area has a semi-arid to arid environment covered by deep to very deep sandy soils, very low in terms of fertility for crop production. The rainfall is characterised by high annual variation and on average, it ranges between 150 mm and 350 mm in the Kgalagadi North (KGN) and the Kgalagadi South (KGS) part of the district respectively. Ambient temperatures fluctuate widely on a daily and seasonal basis, with the mean, maximum and minimum temperatures being 37.4 °C and 19 °C in summer and 22.2 °C and 1.2 °C in winter.

### Materials and Methods

Following the piosphere principle, this study analysed how soil carbon fluxes changed with distance from the livestock concentration area (i.e watering sites). A total of 90 soil samples from top soil layer (0 – 15cm) and subsurface layer (30 – 40cm) were collected: 72 from 6 livestock watering boreholes at distances of 10m (a), 30m (b), 50m (c), 100m (d), 500m (e), and 1000m (f) from each borehole; 12 from WMAs and 6 from the national Park (KTP) which acted as a control in this study. 40 Composite soil samples were made for laboratory analysis. Soil CO<sub>2</sub> fluxes with 3 replicates were measured using the LI-8100A soil gas flux system (Figure 1) at each soil sampling site.

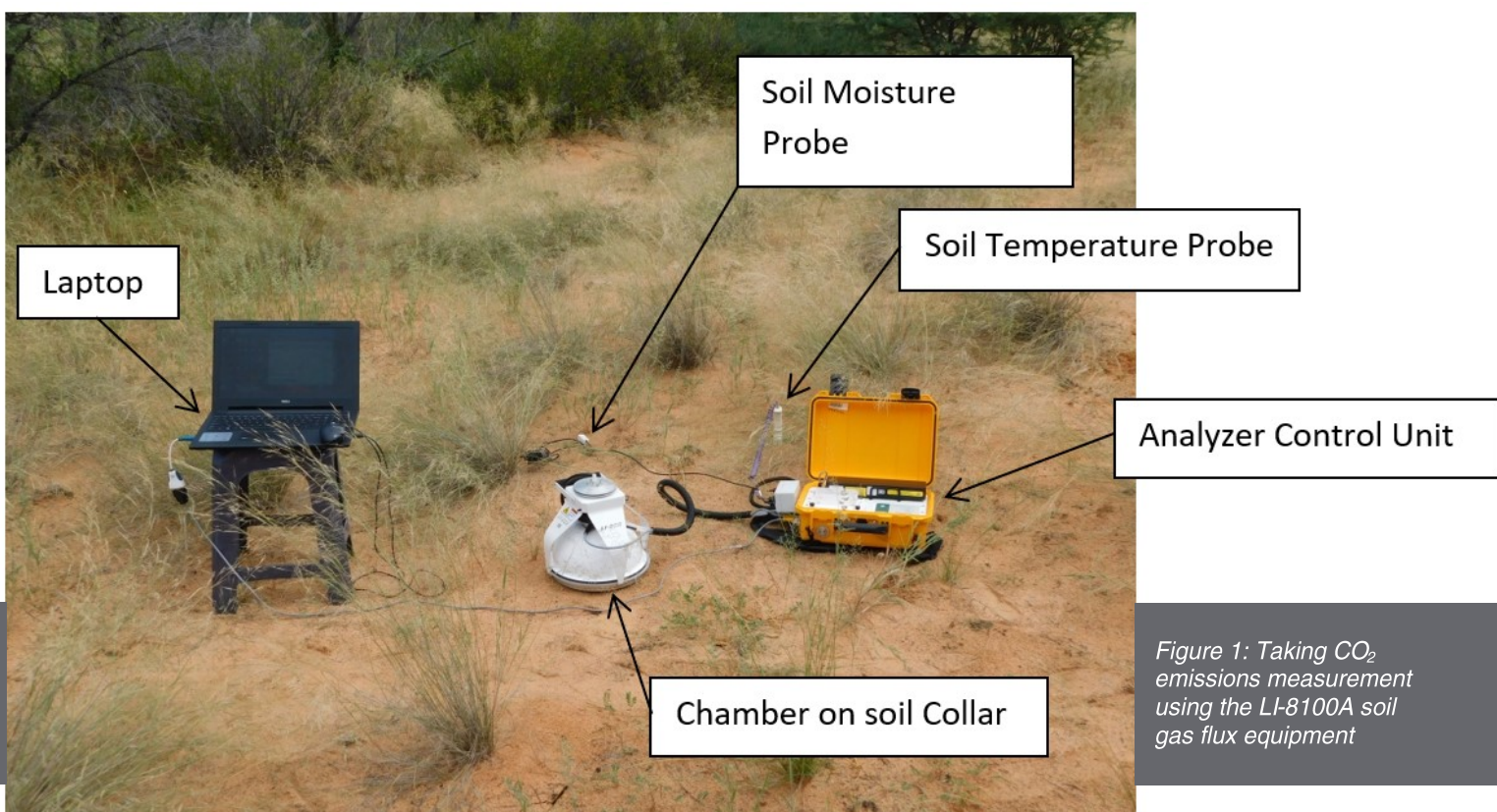


Figure 1: Taking CO<sub>2</sub> emissions measurement using the LI-8100A soil gas flux equipment



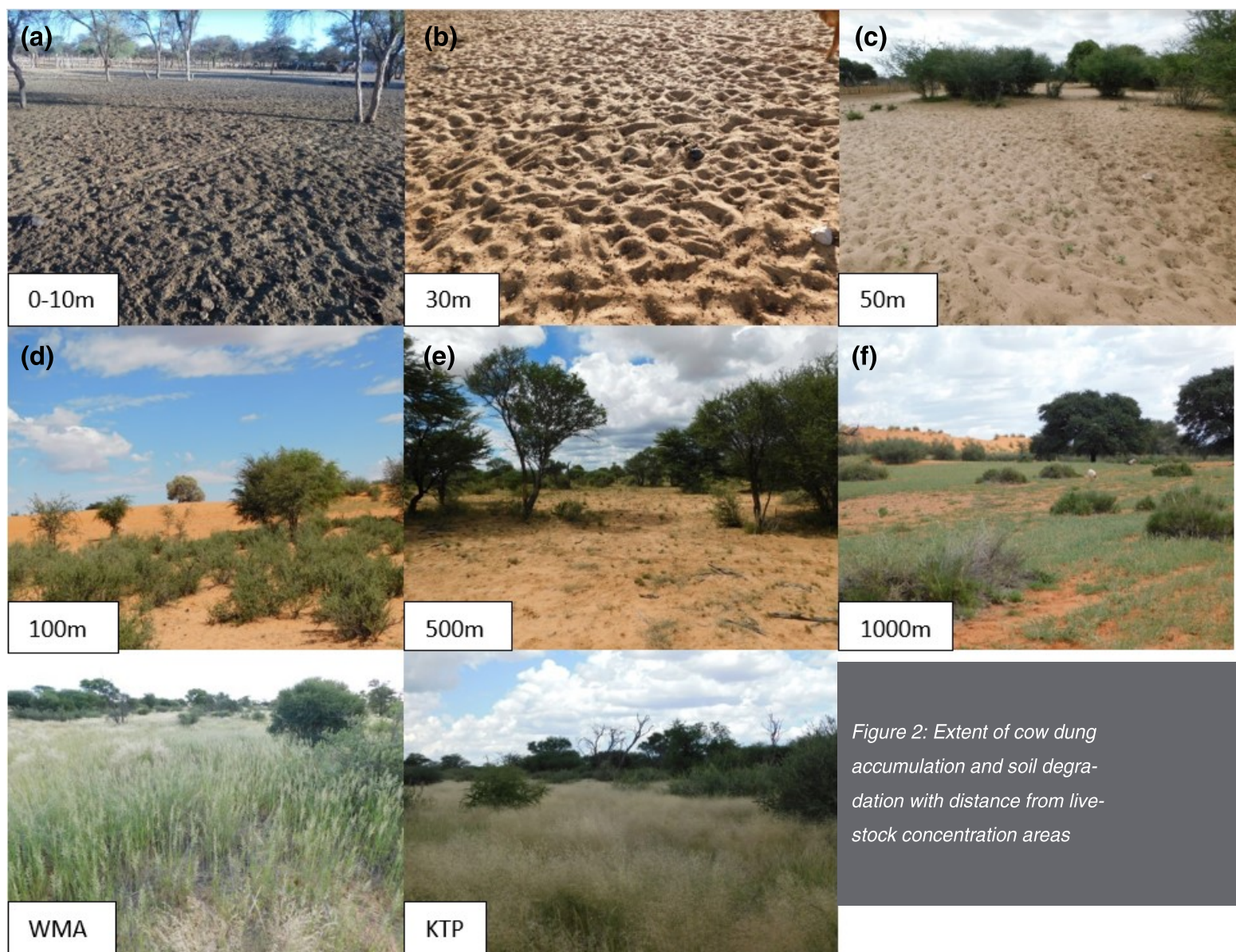


Figure 2: Extent of cow dung accumulation and soil degradation with distance from live-stock concentration areas

### Results

Soil degradation was observed to be concentrated in close vicinity to watering sites, gradually affecting changes on soil properties.

The soil pH decreased (8.0 to 4.5) with distance from the water source. Similarly, Electrical Conductivity (EC) and organic carbon indicated the same pattern whereas the results for particle size distribution demonstrated that the soils are predominately sand (> 95% sand). Soil carbon fluxes measurements showed a significant decrease ( $P < 0.05$ ) with distance from within a 10m radius of the livestock watering site. The  $\text{CO}_2$  fluxes decreased from  $7.41 \mu\text{mol}/\text{m}^2/\text{s}$  to  $0.34 \mu\text{mol}/\text{m}^2/\text{s}$  at livestock watering sites and remained the same in WMAs and control at  $0.32 \mu\text{mol}/\text{m}^2/\text{s}$  (Figure 3).

Other soil characteristics, such as percentage of organic carbon (%OC) (Figure 4), pH and EC, followed similar patterns as the soil  $\text{CO}_2$  emissions, with measurements radiating from the

livestock concentration sites to a radius of 1 km and also in WMAs and control (KTP).

### Conclusion

These results suggest that livestock production is a major factor in soil carbon flux processes and soil degradation in the Kgalagadi District. The findings of this study further add more knowledge on the effects of livestock sedentarism, resulting in formation of eroded areas “sacrifice zones” or “hotspots” on soil carbon fluxes and other selected soil physical and chemical properties.

Intensification of the livestock sector in the region and sedentarization causes soil erosion and accumulation of dung and urine that manipulates normal chemical and physical soil properties. Loosening of soil enhances mineralization of organic carbon leading high  $\text{CO}_2$  soil emissions into the atmosphere, enhancing global warming.



Figure 3: CO<sub>2</sub> fluxes (μmol/m<sup>2</sup>/s) in WMAs, KTP and along 1km transects radiating from livestock watering sites in KGN and KGS

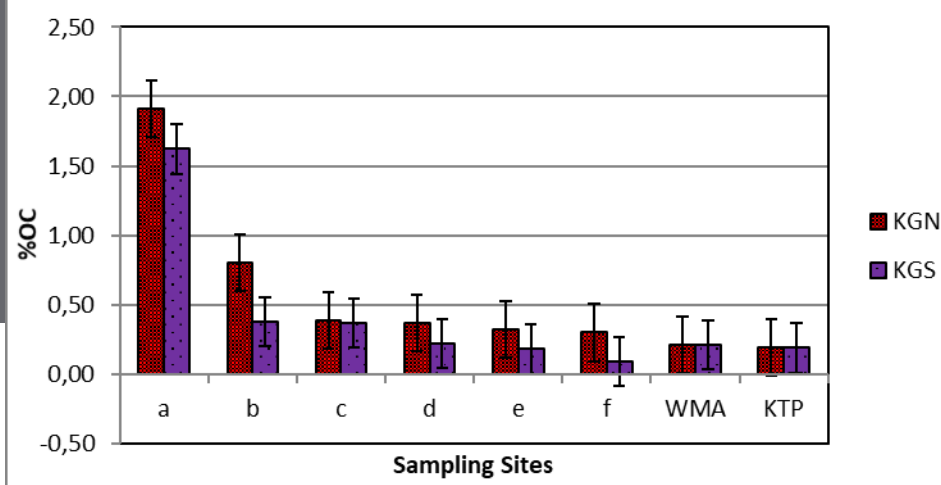
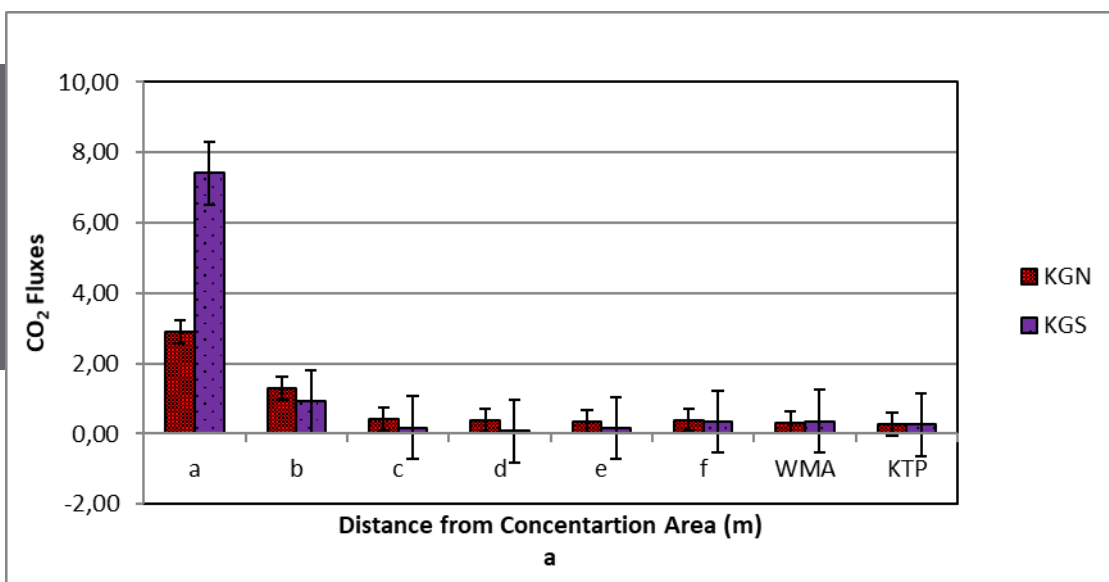


Figure 4: % OC in top soil layer from WMAs, KTP and along transects radiating from livestock concentration sites in KGN and KGS

**SASSCAL PhD candidate wins best oral and poster presentation awards at the University of Zambia**



During the just ended postgraduate seminar week, Mr. Manoah Muchanga, a PhD Student in the Department of Geography and Environmental Studies in the School of Natural Sciences at the University of Zambia was awarded with two awards for the best oral and best poster presentations. He was amongst 13 other PhD students that made their final presentations to the examining board during the November 2018 seminar week. Manoah specialised in fluvial geomorphology and focussed on understanding the sedimentation process in small ungauged reservoir catchments in Zambia.

In a poise with his never-ending enthusiasm Manoah said, “My study developed empirical and conceptual models that can enhance understanding of sedimentation in small reservoir catchments and guide decision making around water resource management in view of achieving water related Sustainable Development Goals (SDGs). I was awarded the topmost awards in both oral and poster presentations out of 13 other strong candidates that made good presentations. In as far as I am concerned this would not have been possible without the lucrative support from SASSCAL, through Task 109:

Understanding the burden of sediment on ecosystems and national economy under the supervision of Prof. Henry Sichingabula, which gave me an unprecedented opportunity to use advanced scientific equipment that was acquired for the project. Part of the equipment was being used for the first time in Africa and Zambia in particular. I am grateful to SASSCAL and the principal investigator for making this possible”.



## Upcoming Events

WHAT	WHEN	WHERE	INFO
WACREN 5th Annual Conference	14 to 15 March 2019	Accra, Ghana	<a href="https://www.wacren.net/en/news/call-for-papers-wacren-2019">https://www.wacren.net/en/news/call-for-papers-wacren-2019</a>
1st Annual Environmental, Climate Change, Conservation, Maritime & Waste Management Conference	27 and 28 March 2019	Windhoek, Namibia	<a href="mailto:samuel@benguelatrainingc.com">samuel@benguelatrainingc.com</a>
Africa 2019—Water Storage and Hydropower Development for	02 to 04 April 2019	Windhoek, Namibia	<a href="https://www.hydropower-dams.com/africa-2019/">https://www.hydropower-dams.com/africa-2019/</a>
Regional Consultation on the Post-2020 Global Biodiversity Framework for Africa	2 to 5 APRIL 2019	Addis Ababa, Adis Abeba, Ethiopia	<a href="http://sdg.iisd.org/events/regional-consultation-on-the-post-2020-global-biodiversity-framework-for-africa/">http://sdg.iisd.org/events/regional-consultation-on-the-post-2020-global-biodiversity-framework-for-africa/</a>
International Conference On Environmental Sustainability And Climate Change	22 to 23 April 2019	Osaka, Japan	<a href="https://environmental.gavinconferences.com/">https://environmental.gavinconferences.com/</a>
10th Water Research Horizon Conference	18 to 19 June 2019	Geozentrum Hannover, Germany	<a href="http://www.water-research-horizon.de/index.html">http://www.water-research-horizon.de/index.html</a>
3rd Multi/Interdisciplinary Research Conference	23 to 25 July 2019	Windhoek, Namibia	<a href="http://www.unam.edu.na/conferences/3rd-multiinterdisciplinary-research-conference">http://www.unam.edu.na/conferences/3rd-multiinterdisciplinary-research-conference</a>
African Climate Risks Conference 2019 Dismantling barriers to urgent climate adaptation action	07 to 09 October 2019	Addis Ababa, Ethiopia	<a href="https://www.africanclimaterisksconference2019.org/">https://www.africanclimaterisksconference2019.org/</a>
4th International Conference on Global Food Security	16 to 19 June 2020	Montpellier, France	<a href="http://www.globalfoodsecurityconference.com/">http://www.globalfoodsecurityconference.com/</a>





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The newsletter is compiled by Sylvia Thompson from the SASSCAL OADC (Open Access Data Centre).

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