



# **SASSCAL**

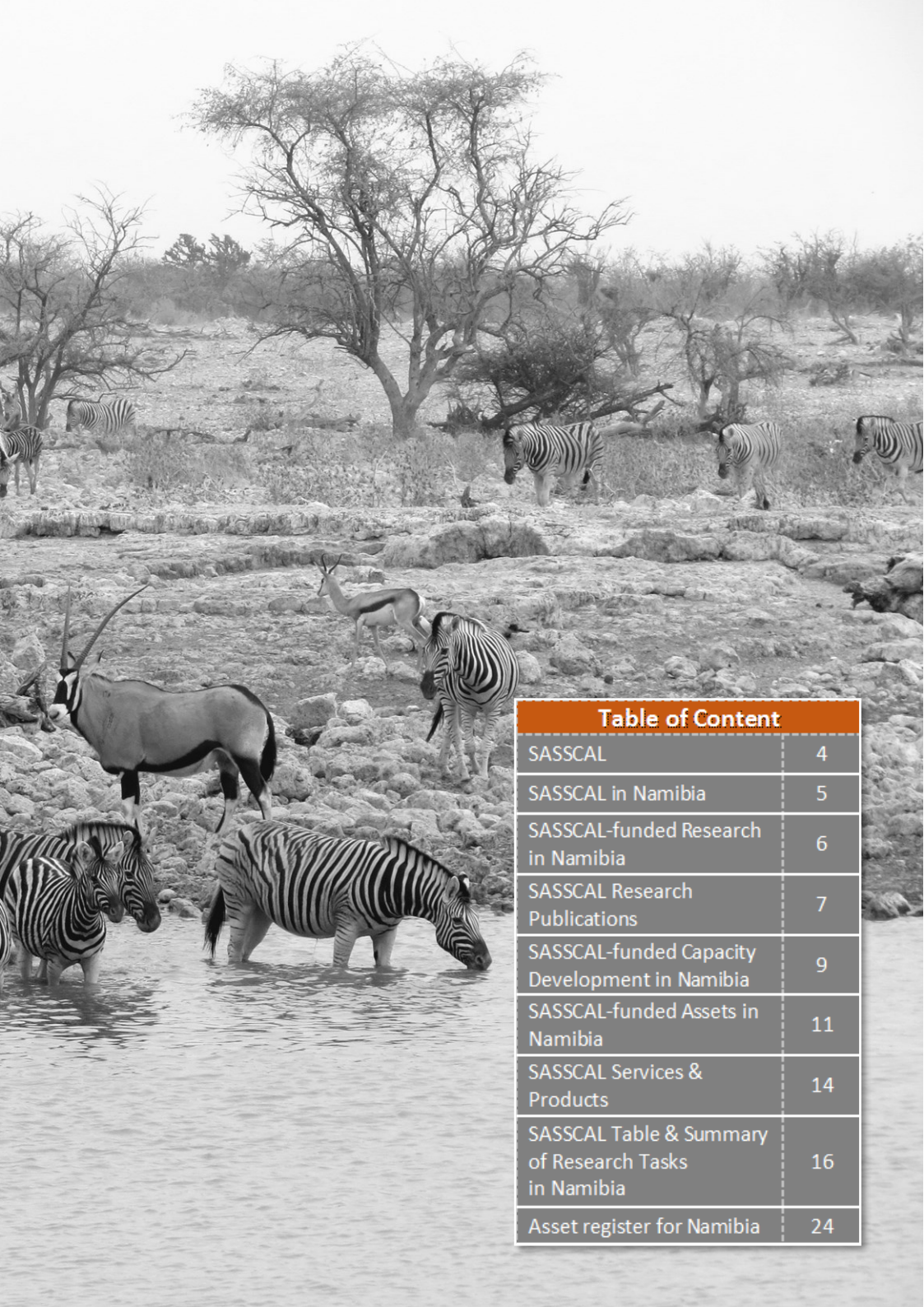
Southern African  
Science Service Centre for  
Climate Change and  
Adaptive Land Management

# **PASSPORT**



# **Republic of Namibia**





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SASSCAL is a joint initiative of Angola, Botswana, Namibia, South Africa, Zambia and Germany in response to the challenges of global change

### **Vision**

To be a leading regional centre in integrated climate change and adaptive land management science services for improved quality of life in southern Africa

### **Mission**

To strengthen the regional capacity to generate and use scientific knowledge products and services for decision making on climate change and adaptive land management through research management, human capital development and services brokerage

### **Objectives**

- to conduct research in adaptation to climate change and for sustainable land management
- to provide products, services and information for decision-making
- to contribute to the creation of a knowledge-based society through academic and non-academic capacity development programmes



**RESEARCH**



**SERVICES & PRODUCTS**



**CAPACITY DEVELOPMENT**



## SASSCAL in Namibia

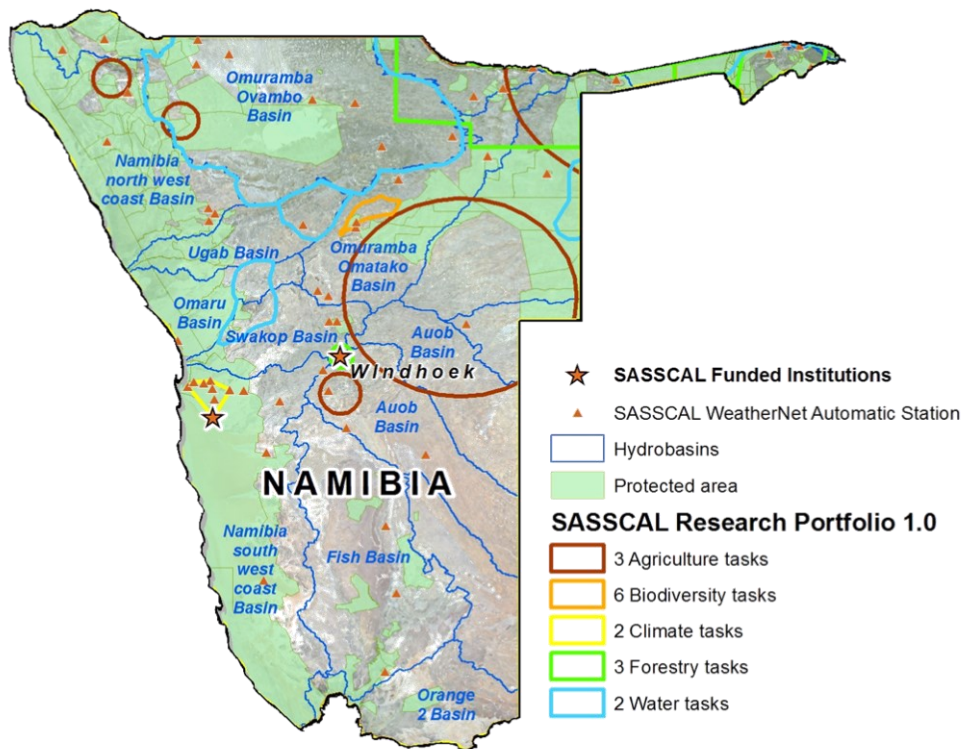
SASSCAL was initially established as the Regional Science Service Centre (RSSC) in Windhoek in 2010. The National Executing Agency (NEA) of SASSCAL in Namibia is the Namibia Agronomic Board and the line Ministry is the Ministry of Agriculture, Water and Forestry (MAWF). By 2014, the SASSCAL Regional Secretariat was established in Windhoek and the Open Access Data Centre (OADC) was first instated at the SASSCAL Namibia Node.

In Namibia, SASSCAL's Mission, to strengthen the regional capacity and to generate and use scientific knowledge products and services for decision making on climate change and adaptive land management, was achieved through SASSCAL's Research Portfolio 1.0, from 2012 to 2018, and facilitated by the SASSCAL Node in Namibia.



## SASSCAL-funded Research in Namibia

The map gives an overview of SASSCAL-funded research activities in Namibia:



The SASSCAL-funded Research Portfolio in Namibia, from 2012 to 2018, constituted 18 projects, referred to as tasks. The total budget for these tasks was € 4 383 550.00.

Tasks are performed under the leadership of eight partner institutions:

- Gobabeb Training and Research Centre (Task 054)
- Ministry of Agriculture, Water and Forestry (MAWF) (Tasks 001 and 014)
- Namibia Nature Foundation (NNF) (Task 166)
- National Botanical Research Institute (NBRI) (Tasks 059 and 060)
- Namibia University of Science and Technology (NUST, previously Polytechnic) (Tasks 033, 038, 041, 062, 073, 148, 159 and 303)
- TRAFFIC East/Southern Africa (Task 035)
- University of Namibia (UNAM) (Tasks 007 and 051)
- University of Stellenbosch (US) (Task 079)

Other partners in Namibian task consortiums were:

Botswana College of Agriculture (BCA)  
Cape Peninsula University of Technology (CPUT)  
Central Technical Supplies  
Centre for Biodiversity studies and Environmental Education (ISCED)  
Desert Research Foundation of Namibia (DRFN)  
Ecosystem Management Understanding (EMU)  
Integrated Rural Development and Nature Conservation (IRDNC)  
Ministry of Fisheries and Marine Resources  
Royal Botanical Gardens, Kew  
South African Institute for Aquatic Biodiversity  
South African National Biodiversity Institute (SANBI)  
Universidade Agostinho Neto de Luanda (UAN)  
Unidade de Pesquisa de Biotecnologia e Química  
University of Colorado, Boulder  
University of Bremen  
University of Hamburg  
University of Nebraska-Lincoln  
University of Oxford  
University of Trier  
University of Zambia (UNZA)  
University of Zimbabwe  
Zambia Department of Fisheries  
Zambia Wildlife Authority

## **SASSCAL Research Publications**

The SASSCAL Book, a culmination of six years of SASSCAL funded research, was launched at the SASSCAL Symposium in Lusaka in April 2018. The book is entitled “Climate change and adaptive land management in southern Africa – assessments, changes, challenges, and solutions”, edited by Revermann, R., Krewenka, K.M., Schmiedel, U., Olwoch, J.M., Helmschrot, J. & Jürgens, N. and published in the book series Biodiversity & Ecology, Vol. 6, Klaus Hess Publishers, Göttingen & Windhoek.

The Book is freely available for download:

**[WWW.BIODIVERSITY-PLANTS.DE/BIODIVERS\\_ECOL/VOL6.PHP](http://WWW.BIODIVERSITY-PLANTS.DE/BIODIVERS_ECOL/VOL6.PHP)**

## **SASSCAL IN NAMIBIA**

*18 SASSCAL-funded  
Projects*

*€ 4 383 550.00*

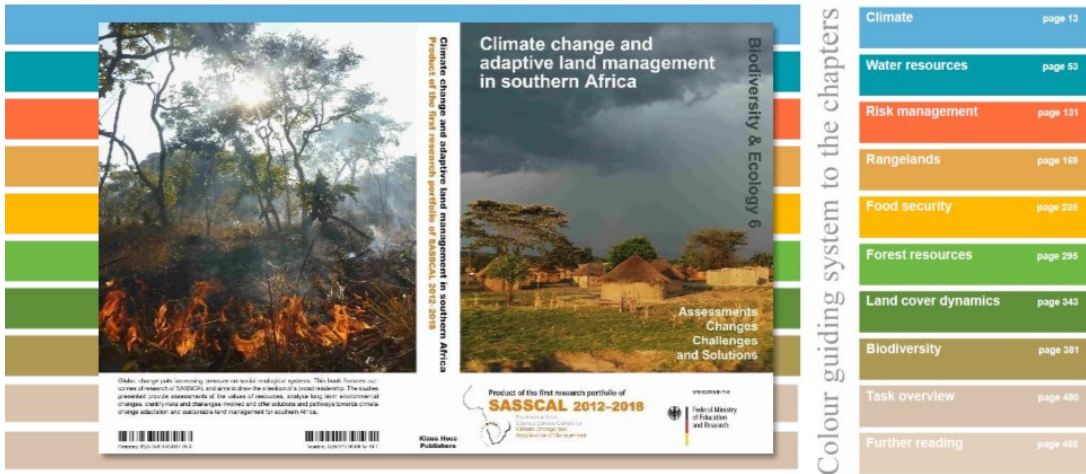
*31 Institutions*

*70 Individuals*

*(excluding students)*



Namibian SASSCAL partners contributed to 21 of the publications featured in the SASSCAL Book and further contributed to every thematic chapter in the book.



In addition to the SASSCAL Book, SASSCAL-funded researchers in Namibia authored 31 peer-reviewed publications and co-authored 42 peer-reviewed publications. SASSCAL-funded research contributed to 12 non-peer-reviewed publications. Non-peer reviewed publications include various contributions to the SASSCAL Newsletter ([WWW.SASSCAL.ORG/NEWSLETTERS/](http://WWW.SASSCAL.ORG/NEWSLETTERS/)).

In the context of task 041, *Landscape Literacy*, a 23 minute video was produced: ***The Power of Raindrops***, which explains how the application of grazing management is usually insufficient to restore protective grass cover where gullies dry the landscape.

## Other research highlights

- 47 Automatic Weather Stations, 9 FogNet Stations, 9 Rain Gauge Stations, 20 Surface Water data loggers**
- 5 Boreholes & 6 Defluorisation Filters, 5 Groundwater data loggers**
- 1 Video/ Film**
- 1 BRAHMS Database with ca 90.000 herbarium collections**
- 1.384 Vegetation Relevés**
- Aerial surveys of 21 Vegetation Observatories**



## SASSCAL-funded Capacity Development in Namibia

### Graduate Programmes

The *Collaborative Master Degree in Earth Observation, GIS and Remote Sensing* (Task 303) was officially launched on 1 November 2016 at NUST, in cooperation with Cape Peninsula University of Technology (CPUT), the University of Botswana (UB) and the University of Zambia (UNZA). It has already been implemented in Namibia, Zambia and Botswana and aims to meet the capacity limitations in field of earth observation, geographic information systems and remote sensing. Moreover, a total of 35 students, who are enrolled in this program, are benefitting from SASSCAL-funded scholarships. In addition to scholarships, SASSCAL also funded IT infrastructure for the programme.

SASSCAL also further significantly contributed to the implementation of the two MSc-programmes 'Applied and Environmental Geology' (Task 082, in collaboration with the University of Namibia and the Federal Department for Geosciences and Natural Resources) and 'Dryland Forestry' (Task 079) at the University of Stellenbosch (in cooperation with the University of Namibia and the University of Botswana).

Also funded under the Namibian SASSCAL research portfolio is the development of a regional *Master programme on Dryland Forestry* (Task 079), that aims to address the lack in capacity of forestry professionals with sufficient expertise to implement adaptive resource management strategies in the face of climate change.

*Launch of Master programme in Earth Observation, Geographical Information Science and Remote Sensing at NUST, November 2016*



## SASSCAL-funded Graduate Degrees through Namibian Research Portfolio

SASSCAL funding supported 107 students to obtain a degree (some students are still busy with their studies):

- 10 PhD students (6 already graduated)
- 60 Master students (23 already graduated)
- 25 Honours students (20 already graduated)
- 12 Bachelor students (9 already graduated)

The students that have not graduated by the end of the SASSCAL 1.0 funding are still in the process of finalising their thesis' and studies. Except for two studies, that have discontinued their studies.

The six PhD degrees were obtained by

- DE CAUWER V. (2016). Autecological aspects of the African timber tree *Pterocarpus angolensis* in support of its sustainable management (PhD). KULeuven, Leuven, Belgium.
- HAMUTOKO JT. (2018). Groundwater recharge of perched aquifers in the Cuvelai-Etosha Basin, Namibia.
- KAMWI J. (2015). Dynamics of land use and land cover: Implications for rural livelihoods in the Zambezi Region, Namibia
- PEEL RA. (2015). Colonisation and succession of fishes in Lake Liambezi, an ephemeral floodplain lake in north-eastern Namibia. PhD thesis, Rhodes University, RSA.
- STROHBACH BJ. (2014). Vegetation Survey of Namibia: Conceptualisation and implementation of a nation-wide vegetation survey serving practical land management needs. Department of Biology, Faculty of Mathematics, Informatics and Natural Sciences, University of Hamburg, Hamburg.
- TAYLOR GC. (2016). Comparative fish ecology in three periodically connected rivers in the Upper Zambezi and Okavango ecoregions. PhD Thesis, Rhodes University, Grahamstown, South Africa.

Four students are still in the process of finalising their PhD studies: Billy McBenedict for Microbiology, Nyasha Musekiwa for Agriculture, Werner Mbongo for Forestry and Siddique Motala for Education.

*“Where would we have been if SASSCAL hadn’t come along?”*

Student at  
SASSCAL-NUST  
close-up workshop

*Dr Josefina Hamutoko also was awarded the NCRST National Research, Science, Technology and Innovation Award for Young Scientist of the Year Award in 2016*



## SASSCAL-funded Assets

SASSCAL's contribution to the southern African region, through the SASSCAL-funded Research Portfolio, also impacted the available research infrastructure.

### The SASSCAL WeatherNet

A total of 58 automatic weather stations (AWS) of the total 154 AWS of the SASSCAL WeatherNet, are strategically distributed in Namibia. 47 of these 58 AWS have been installed since 2010. Notably, the installations were made possible through joint funding between SASSCAL and the Ministry of Agriculture, Water & Forestry (MAWF).

AWS were installed in the context of Task 001 *Improved weather observation network* and Task 054 *Examine impact of predicted altered climate and reduced fog along the Namib coast as a result of warming of the Benguela*. The latter count 9 AWS, being referred to as the FogNet stations.

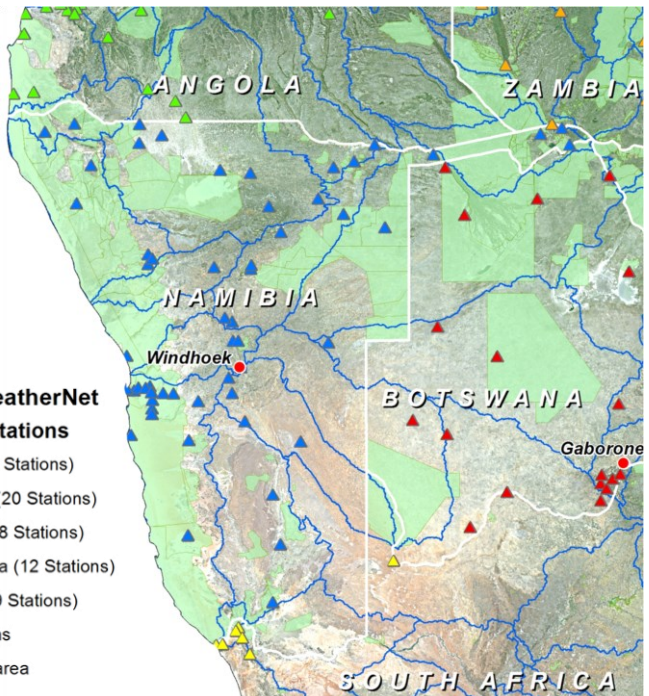
All data transmitted by these stations are made available in near real-time on the SASSCAL WeatherNet ([WWW. SASSCALWEATHERNET.ORG](http://WWW.SASSCALWEATHERNET.ORG)) and are freely accessible. The stations transmit hourly rainfall, air and soil temperature, humidity, wind speed and direction, barometric pressure, solar radiation, leaf wetness and other sensor data.

(bottom) The AWS at the NBRI in Windhoek and (right) SASSCAL WeatherNet AWS in Namibia



#### SASSCAL WeatherNet 154 Weather Stations

- ▲ Angola (45 Stations)
- ▲ Botswana (20 Stations)
- ▲ Namibia (58 Stations)
- ▲ South Africa (12 Stations)
- ▲ Zambia (19 Stations)
- Hydrobasins
- Protected area





Three AWS were also installed in the Cuvelai, in the context of Task 014 *Flood monitoring and assessment for Cuvelai-Etoshia and Zambezi basins*, but these have not yet been integrated into the SASSCAL Weather-Net.

## Vehicles

SASSCAL-funded research enabled the investment in four off-road vehicles (Toyota Fortuner, Ford Ranger, Toyota Hilux) and one boat (Aliboats Kafue 495).

*The SASSCAL-funded vehicles were heavily engaged during field work - this one for a maintenance trip for WeatherNet AWS and (bottom) NUST students proudly demonstrate the eBee drone*



## Drones

Technology evolves rapidly. A good example is the drone technology over the past years. The first drone purchased through the SASSCAL Research Portfolio (Task 033) was a steadidrone hexacopter. The drone broke on numerous flights, including its maiden flight, had very limited endurance and range and was not entirely suited for the Namibian environment. Even though this drone was procured at the end of 2013,

the technology, both from a hardware and software perspective, was already vastly outdated by 2015. The eBee drone is a fixed-wing drone that came with an RGB and near infrared camera sensor. The field successes prompted the procurement of a 2nd eBee by 2016. Both eBee drones were procured by Task 159, for facilitating the monitoring of vegetation observatories.

## Boreholes and groundwater research equipment

In the context of Task 007 *Improving knowledge and understanding of groundwater flow, water quality and quantity variations, improve methodology of groundwater availability study: Cuvelai – Kunene*, 6 shallow boreholes (one collapsed) were monitored in the Oshana area, at which groundwater levels are still being recorded.

In addition, equipment to facilitate the research in establishing an understanding of groundwater flow, quality and quantity, was procured and included various sensors.



## Buffalo Tracking Collars

In the context of Task 148, *The impacts of fire on biodiversity and ecosystem processes in woodland savanna*, four buffalos were fitted with wildlife monitoring collars in October 2013. The data collected were used to conduct research on animal behaviour in relation to fires and areas burned by fires on the Waterberg Plateau.

## IT Equipment & other

IT equipment, whether hardware or software, forms an integral part of any research activity. In this line, IT procurements included 29 laptops/computers, 1 printer, GIS software and remote sensing software.

For the Namibian Herbarium at the NBRI, in the context of Tasks 059 (*Plant and vegetation databases of the National Botanical Research Institute, Namibia*) and 060 (*Establish and improve baseline inventories for spatial data on biodiversity - Flora of Namibia Project*), a herbarium scanner for inventorying specimens, and associated protective covers, to protect specimens, Illustrator botanical imagery and an extended BRAHMS licence were acquired.

Essential to many research activities in the field are cameras and GPS devices: 3 cameras and 2 GPS devices were procured.

In addition, various specialised equipment was purchased to facilitate the specific research agendas: water quality sensors, water level loggers, microscopes, LiCOR tools, laser vertex & level, leaf porometer, etc.



## Infrastructure benefitting communities directly

In the context of Task 007, *Improving knowledge and understanding of groundwater flow, water quality and quantity variations, improve methodology of groundwater availability study: Cuvelai – Kunene*, and in an effort to monitor substances of concern with community involvement, six defluoridation filters have been installed in communal areas in Windhoek/Oshanashiwa.

*Groundwater samples being analysed in the field with SASSCAL-funded equipment*



## SASSCAL Services & Products

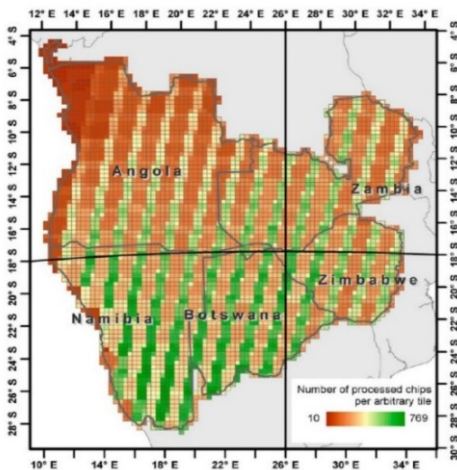
SASSCAL ensures that the research deliverables resulting through the SASSCAL-funded Research Portfolio, are made available openly and free of charge.

All research publications and deliverables, from all SASSCAL-funded research, will be accessible via the **SASSCAL Data and Information Portal**:

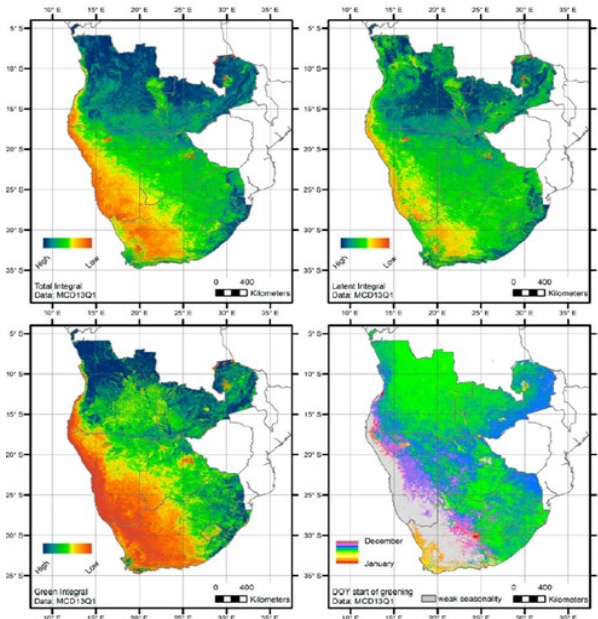
**[WWW.SASSCAL.ORG/SASSCAL-DATA-AND-INFORMATION-PORTAL/](http://WWW.SASSCAL.ORG/SASSCAL-DATA-AND-INFORMATION-PORTAL/)**

It is noteworthy to highlight that besides the invaluable research results stemming from the Namibia portfolio, deliverables from other SASSCAL research of interest to Namibian partners include, but are not limited to:

- Full Landsat archive processed to surface reflectance (This data collection contains 1 912 733 images stored in 4 524 tiles of 30 x 30 km<sup>2</sup> (28 TB)) (University of Trier)
- 4 Phenological metrics for SASSCAL countries: total integral, related to overall biomass, latent integral associated with standing biomass, green integral, day of year of start of greening (University of Trier)
- Fire regime related parameters from 2000 to 2015: fire frequency, seasonality and intensity (University of Trier)
- Woody tree cover map (CSIR)



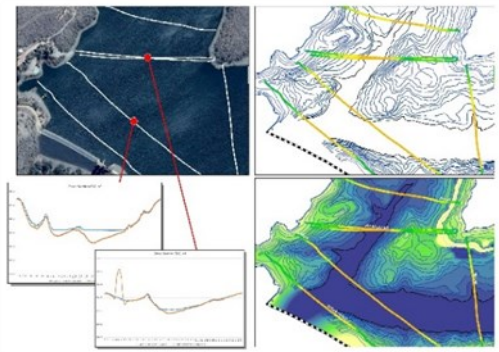
(left top) Number of processed Landsat images per tile, (right) phenological layers



- Global Urban Footprint (DLR)
- Regional Climate Change Projections for CORDEX-Africa (GERICS)
- EasyRemo climate modelling software (GERICS)

SASSCAL has further supported Namibian decision-support processes by, amongst others, the following products and services:

- Mapping 30 years rainfall over Etosha National Park
- Analysing dam siltation in Von Bach Dam
- Mapping Namibia's landscapes, National Parks and providing support in establishing the zonation for the Namib Sand Sea World heritage site
- Establishing the human footprint in the Zambezi State Forest
- Providing analysis and mapping support in various conservation and water management applications
- Creating fire analysis maps of Zambezi to support the clearing of cutlines
- Providing support in ensuring the accuracy of geographical layers such as Communal Conservancies and Tourism Concessions
- Providing training to conservation, vegetation and water practitioners on the potential and use of GIS technology for their specific application domains
- Creating an online geo-decision support platform for the Ministry of Mines and Energy and Ministry of Environment and Tourism
- Creating a platform independent Rainfall App to ensure that all the daily rainfall captures through crowd sourcing is digitally captured



Examples of Products & Services

## SASSCAL Table of Research Tasks

Task ID	Task Name	Lead	Budget (Euro)
<b>Agriculture</b>			
TaskID 041	Landscape literacy	NUST	€ 335 613.00
TaskID 051	Improved soil fertility management	UNAM	€ 23 111.00
TaskID 073	Impact of bush encroachment on ground water resources	NUST	€ 522 044.00
<b>Biodiversity</b>			
TaskID 059	Plant and vegetation databases of the National Botanical Research Institute, Namibia	NBRI	€ 99 927.00
TaskID 060	Establish and Improve baseline inventories for spatial data on biodiversity - Flora of Namibia Project	NBRI	€ 78 844.00
TaskID 062	Vegetation Survey of Namibia	NUST	€ 150 000.00
TaskID 148	The impacts of fire on biodiversity and ecosystem processes in woodland savanna	NUST	€ 161 007.00
TaskID 159	Strengthening a regional Biodiversity Observation Network in the region	NUST	€ 156 000.00
TaskID 166	Improved knowledge of aquatic ecosystems supporting fisheries, development of integrated strategies for sustainable fisheries and improved fisheries management	NINF	€ 150 311.00
<b>Capacity Development</b>			

TaskID 079	Development of Regional Masters Programme on Dryland Forestry	SU	€ 330 745.00
TaskID 303	Post graduate Programme in Applied Science in Earth Observation, GIS and Remote Sensing	NUST	€ 506 400.00
<b>Climate</b>			
TaskID 001	Improved weather observation network	MAWF	€ 160 000.00
TaskID 054	Examine impact of predicted altered climate and reduced fog along the Namib coast as a result of warming of the Benguela	Go-babeb	€ 302 257.00
<b>Forestry</b>			
TaskID 033	Development of a national forest monitoring program for Namibia	NUST	€ 210 006.00
TaskID 035	A Critical Assessment of the Economic and Environmental Sustainability of the Namibian Indigenous Forest/ Timber Industry	TRAFFIC	€ 210 511.00
TaskID 038	Forest regeneration, growth, threats and trends in different forest types	NUST -	€ 209 935.00
<b>Water</b>			
TaskID 007	Improving knowledge and understanding of groundwater flow, water quality and quantity variations, improve methodology of groundwater availability study: Cuvelai – Kunene	UNAM	€ 311 835.00
TaskID 014	Flood monitoring and assessment for Cuvelai-Etoshia and Zambezi basins	MAWF	€ 465 004.00
			<b>€ 4 383 550.00</b>

## Summary of Tasks

### Task 001 - MAWF (€ 160 000.00)

#### Improved weather observation network

- Improved short-term weather forecast
- Weather data time series available in electronic format
- Improved link between in-situ measured weather data and remotely sensed measurements
- Training manual for installing and maintaining automatic weather stations (AWS)

47 Automatic  
Weather Stations  
(AWS) installed



### Task 007 - UNAM (€ 311 835.00)

#### Improving knowledge and understanding of groundwater flow, water quality and quantity variations, improve methodology of groundwater availability study: Cuvelai – Kunene

- Variables and parameters for groundwater recharge assessments were observed
- Knowledge base about ephemeral groundwater bodies in Kalahari Sediments was enhanced
- Running hydrochemical and isotope lab

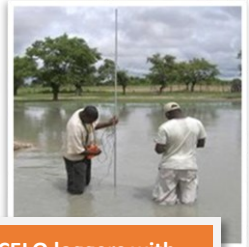
5 boreholes in Ohangwena &  
6 defluoridation filters in  
communal areas in Wind-  
hoek/Oshanashiwa  
5 Groundwater data loggers



### Task 014 - MAWF (€ 465 004.00)

#### Flood monitoring and assessment for Cuvelai-Etosha and Zambezi basins

- Real-time hydro-meteorological information for flood monitoring and early warning available
- Integrated Flood-forecasting System for the Cuvelai-Etosha Basin available
- Integrated early warning-based flood risk information products



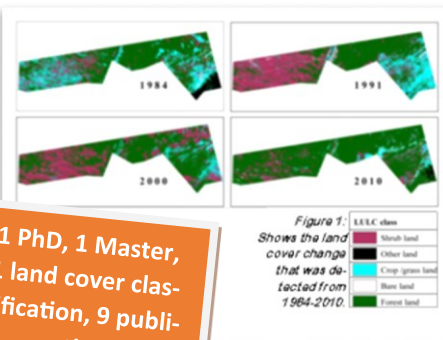
20 CELO loggers with  
sensors & 9 automatic  
rain gauges



Task 033 - NUST (€ 210 006.00)

## Development of a national forest monitoring program for Namibia

- Methods for assessing changes in deforestation rates
- Current deforestation rates in Namibia
- Indications of changes in soil respiration associated with different land-use / land-cover types



1 PhD, 1 Master,  
1 land cover classification,  
9 publications

Task 035 - Mr Markus Burgener, TRAFFIC EAST/ SOUTHERN (€ 210 511.00)

## A Critical Assessment of the Economic and Environmental Sustainability of the Namibian Indigenous Forest/ Timber Industry

- A report containing a comprehensive independent assessment of the status and sustainability of Namibia's forest and timber trade management control measures and associated recommendations for enhanced transparency of such management and trade.
- A Biodiversity Management plan/ Legality Framework
- A completed NDF and Draft CITES listing proposal for *Pterocarpus angolensis*



Task 038 - Dr Vera De Cauwer , NUST (€ 209 935.00)

## Forest regeneration, growth, threats and trends in different forest types



- Establishment of a germination protocol for seven tree species
- Establishment of a tissue culture protocol for two species of the *Baikiaea* woodlands
- Creation of a seed manual for woody species of north-eastern Namibia
- Establishment of an age-diameter relationship and of individual tree growth and yield models for the southern African timber tree *P. angolensis*

1 PhD, 4 Master, 4 Publications

*Task 041 - Dr Ibo Zimmermann , NUST (€ 335 613.00)*

## **Landscape literacy**

- Landscape literacy field courses that address land degradation and provides insight into reversing the damage
- Restored demonstration sites for other farmers and extension workers to visit and learn from
- Culturally contexed manuals that guide farmers to applying the EMU framework
- A film, translated into different languages, which illustrates how landscapes become leaky, how this can be prevented and how the leaky landscapes can be restored



**Demonstration sites at 3 communal sites, 2 commercial farms and 3 urban landscapes  
1 Video/Film**

*Task 051 - Prof Percy Chimwamurombe, UNAM (€ 23 111.00)*

## **Improved soil fertility management**

- Rhizobial symbionts provided for draught-tolerant legumes
- Inoculation technology and training established, culture collection build up

*Task 054 - Dr Mary Seely , Gobabeb Training and Research Centre (€ 302 257.00)*

## **Examine impact of predicted altered climate and reduced fog along the Namib coast as a result of warming of the Benguela**

- Improved fog occurrence and precipitation records across gradient, W-E & S-N in the central Namib and other sites that become involved.
- Weather data time series with emphasis on fog available, in electronic format
- Improved link between in-situ measured weather data and remotely sensed measurements with emphasis on types of fog
- Integrated modelling involving measured fog data and remotely sensed measurements
- Interpretation of climate, climate change and fog for training materials for tertiary and secondary education
- Interpretation of climate, climate change, fog and related biodiversity for tourism materials



**9 FogNet stations**

Task 059 - Frances Chase, NBRI (€ 99 927.00)

## Plant and vegetation databases of the National Botanical Research Institute, Namibia

- BRAHMS database
- Plant checklists
- Field guides
- Taxonomic revisions

BRAHMS with around 90.000 herbarium collections  
collecting intensity



Task 060 - Frances Chase, NBRI (€ 78 844.00)

## Establish and Improve baseline inventories for spatial data on biodiversity - Flora of Namibia Project

- Identification keys and guides
- Taxonomic revisions
- Scientific and popular publications

1 Honours  
2 Publications  
85% of BRAHMS data cleaned

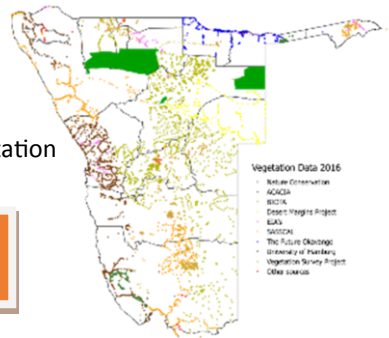


Task 062 - Dr Ben Strohbach, NUST (€ 150 000.00)

## Vegetation Survey of Namibia

- Vegetation maps
- Detailed descriptions of floristic composition of vegetation

1.384 relevés added in Phytosociological DB  
1 PhD, 2 Master, 3 Honours, 6 Publications



Task 073 - Dr Dave Joubert, NUST (€ 522 044.00)

2 PhD in prep, 5 Master & 7 Publications

## Impact of bush encroachment on ground water resources

- Information on vegetation dynamics following clearing
- An improved understanding of the ecohydrology of cleared and encroached savannas



Task 079 - Prof Ben Du Toit , University of Stellenbosch (€ 330 745.00)

## Development of Regional Masters Programme on Dryland Forestry

- Training needs report & action plan
- M.Sc. Dryland Forestry with focus on dryland forestry

5 Masters



Task 148 - Dr Dave Joubert, NUST (€ 161 007.00)

## The impacts of fire on biodiversity and ecosystem processes in woodland savanna

- Improved Expert system for fire management in the Waterberg Plateau Park
- Various scientific research articles on the study
- Biodiversity field courses for Namibian students (Honours in Nature Conservation, NUST, etc.)

3 Honours, 2 Master, 1 Publication



Task 159 - Dr Ben Strohbach , NUST (€ 156 000.00)

## Strengthening a regional Biodiversity Observation Network in the region

- Data on local patterns of (plant) diversity on in selected areas
- Sound data on trends in plant species composition and plant population dynamics
- Improved understanding of plant responses on climate signals
- Improved models on the impact of climate and land use on plant species composition
- Improved projections of future biodiversity change under climate change condition
- Improved link between in-situ measured biodiversity data and remotely sensed measurements
- Visual guide to the plant species of the Observatories
- Bonus: Drone images previously not planned / anticipated

2 Honours, 2 Master  
Annual survey of 10 observatories  
Aerial survey of 21 observatories  
Data analysis of 4 Kalahari observatories  
8 Publications



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*Task 166 - Dr Denis Tweddle , NNF (€ 150 311.00)*

## **Improved knowledge of aquatic ecosystems supporting fisheries, development of integrated strategies for sustainable fisheries and improved fisheries management**

**2 PhD, 2 Master  
8 Publications**



- Improved knowledge on fish species biodiversity and trends over time in Lake Liambezi
- Improved knowledge on fish species biodiversity and trends over time in other inland fisheries in the region
- Improved knowledge on sustainable fisheries yields
- Improved knowledge on the role of fish in livelihoods of communities on the floodplains

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*Task 303 - Mr Frikkie Louw , NUST (€ 506 400.00)*

## **Post graduate Programme in Applied Science in Earth Observation, GIS and Remote Sensing**

- Curriculum development & Master programme in Earth Observation and satellite applications
- Implementation of programme in Angola, Zambia and Namibia
- 35 students are already being funded by SASSCAL





## Asset register for Namibia

Institution	Asset specification	#	Location
<b>Boreholes</b>			
UNAM	6 shallow boreholes	6	Ohangwena villages
<b>Cameras</b>			
NNF	NIKON D3200 + 18-55MM DX & -200 mm	1	NNF Offices
CAN	Canon PowerShot SX260 HS 12MP	2	CAN office, Opuwo
NUST	Canon PowerShot SX260 HS 12MP	2	Office Building, NUST
<b>Drones</b>			
NUST	ebee Drone S/N EB-03-06779	1	Windhoek
NUST	ebee Drone S/N EB-03-11059	1	Windhoek
NUST	Steadidrone Hexacopter	1	NUST
<b>GPS</b>			
NUST	GPS Garmin GPSMap	1	NUST
NUST	GPS Garmin Montana 600	2	NUST
<b>Hardware</b>			
MAWF	HP 840 G5 Core i7 16GB 512GB SSD	2	Windhoek
MAWF	HP Design Jet T2530 Printer & Cartridges	1	
MAWF	HP Desktop Computers	3	Windhoek
NUST	HP ProBook		PI office, NUST
MAWF	HP Zbook Laptops	5	Windhoek
UNAM	Lap top computers	2	UNAM Geology
CPUT	Laptop	2	Cape Town
NUST	Laptop	8	Windhoek
UB	Laptop	6	Gaborone
UNZA	Laptop	6	Lusaka
NBRI	Laptop/HP PRO Book 470 G2	4	Windhoek
NUST	Toshiba Laptop	2	Windhoek
<b>Lab equipment</b>			
NBRI	Microscope camera/CAMSC30 3.3 Mpx, 1/2 inch, colour CMOS camera OLE043175	1	Windhoek
NBRI	Microscope/SZ61TR Trinocular Stereo Microscope - OLN1197700	1	Windhoek
NBRI	Microscope/SZXZB7 Trinocular Stereo Microscope - OLN1200300	1	Windhoek
<b>Sensor/logger</b>			
UNAM	Groundwater level logger, Solinst	6	
MAWF	Mobile Water Quality Sensor/ Unit	2	
UNAM	Sensor and logger sysetme (soil moisture, temp, salinity, matrix potential and precipitation)	2	Ohangwena villages
MAWF	Water Level Loggers, Sensing Meters and Rain Gauge	3	

Institution	Asset specification	#	Location
<b>Software</b>			
NBRI	3 years BRAHMS licence	1	Windhoek
NUST	ENVI/IDL software		GST server - network licence
<b>Specialised equipment</b>			
UNAM	Alkalinity titrator, Hach	1	Hydrogeology Lab
NUST	Balance FX1200i	1	NUST, ROOM 265
NUST	Buffalo collars	4	African Wildlife Tracking
UNAM	Generatore	1	Hydrogeology Lab
NUST	Ground penetrating Radar and Accessories	1	UNAM, Room Y236
UNAM	Groundwater submersible pump	1	Hydrogeology Lab
NBRI	Herbarium scanner	1	Windhoek
NBRI	Illustrator botanical images	1	Windhoek
UNAM	Ion selective electrodes F, Na, NO <sub>3</sub> , Cl, Hach	1	Hydrogeology Lab
NUST	Laser level AGL Eagle 1 Touch	1	CAN storeroom, Windhoek
NUST	Laser Vertex	1	NUST
NUST	leaf Porometer SC-1	2	NUST
NUST	Licor 6400XT Infrared gas analyser and Accessories	1	UNAM, Room M029
NUST	LICOR 6400XT IRGA	1	GST store room
NUST	LICORsoil Chamber	1	PI office, NUST
UNAM	ORP electrode and meter, Hach	1	Hydrogeology Lab
UNAM	OXYGEN electrode and meter, Hach	1	Hydrogeology Lab
UNAM	pH electrode and meter, Hach	1	Hydrogeology Lab
NBRI	Protective specimen covers	1	Windhoek
UNAM	Scholander	1	Hydrogeology Lab
NUST	Spare leaf clip for porometer	1	NUST
NUST	Total station (second hand)	1	NUST
<b>Vehicles</b>			
NNF	Boat & Accessories - Aliboats Kafue 495, the engine is a Yamaha F40FEHDL TILLER operated 40HP four stroke, trailer registration number N172565W	1	Katima Mulilo
NNF	Boat Accessories - batteries, fishing gear, propeller	-	Katima Mulilo
NUST	Ford Ranger 4x4	1	Windhoek
MAWF	Toyata Fortuner, White	1	Windhoek
NUST	Toyota Hilux 4x4 Diesel	1	NUST
NUST	Toyota Hilux Surf	1	Windhoek
<b>Weather stations</b>			
MAWF	Automated Weather Station	11	Various
Gobabeb	Additional sensors for stations	-	Gobabeb
Gobabeb	Automatic Weather Station	9	Various



RESEARCH



CAPACITY  
DEVELOPMENT



SERVICES &  
PRODUCTS



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