



**DAAD**

Deutscher Akademischer Austauschdienst  
German Academic Exchange Service

# **Virtual DAAD climapAfrica Conference**

**29-30 October 2020**

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## LADIES AND GENTLEMEN,

Climate change is one of the most important challenges the world now faces. Internationally oriented joint research and exchange are crucial in developing corresponding strategies and solutions. With funding from the German Federal Ministry of Education and Research (BMBF), the DAAD has thus initiated the climapAfrica programme, which enables African researchers to work on topics related to climate change in international environments and groups. The Southern African Science Service Centre for Climate Change and Adaptive Land Management (SASSCAL) and the West African Science Service Centre on Climate Change and Adapted Land Use (WASCAL) are playing an important role in the realisation of these activities. The climapAfrica programme is also embedded in the DAAD's strategy for 2025, which emphasises the importance of sustainability and global responsibility.

As part of the surrounding funding programme, the climapAfrica Conference 2020 provides an innovative new platform for the African and German climate research community. More than 150 climate change experts and practitioners from 30 countries will share their ideas on effective strategies and solutions for addressing the record-breaking rise in temperatures, increasing greenhouse gas emissions, prolonged droughts, and the devastation of natural habitats and resources.

The first day of the conference will feature experts, research groups, and institutions presenting their work, followed by a virtual networking event. On the second day, further specialists will offer their input and discussions will be held within the climapAfrica working groups. Meanwhile, opportunities to discover and deliberate on new and different approaches will help further the efforts of the researchers in attendance. By bringing together a diverse range of stakeholders, the conference will promote personal networking and open doors to future scientific collaborations. It will thus serve as an international networking platform with a focus on finding solutions to regional challenges in Africa.

The DAAD is grateful for the commitment and expertise of everyone involved in this important conference. We are dedicated to strengthening the network of climate researchers and practitioners in Africa and beyond, and look forward to continuing our collaboration with our partners both at home and abroad.

**Gudrun Chazotte**  
Head of Section Scholarship Programmes Africa  
German Academic Exchange Service (DAAD)

**Dr Christian Schäfer**  
Head of Section Research and Studies  
German Academic Exchange Service (DAAD)

LINK to learn more about [DAAD climapAfrica – Climate change research in Africa](#)

# VIRTUAL DAAD CLIMAPAFRICA CONFERENCE

## 29-30 October 2020

### INTRODUCTION

In the comprehensive programme “Climate Research Alumni and Postdocs in Africa (climapAfrica)”, the DAAD connects high-potential African scientists in climate change research and protection with African experts who are alumni of German funding initiatives in the same field. Through a current seven thematic working groups, it seeks to encourage the uptake and use of research output within a vibrant, highly connected network and thereby facilitate the development of regional solutions.

Sponsored by the German Federal Ministry of Education and Research (BMBF) and in cooperation with the climate competence centres Southern African Science Service Centre for Climate Change and Adaptive Land Management (SASSCAL) and West African Science Service Centre on Climate Change and Adapted Land Use (WASCAL), the programme aims to foster application-oriented research to tackle climate change in southern and western Africa.

The DAAD welcomes you to join this two-day conference, which will help build a growing professional network across Africa by serving as a platform for connecting and sharing ideas with peers, regional and international experts, and practitioners in the field of climate change and related research.

### Thursday, 29 October 2020

Meet and Exchange with the seven climapAfrica working groups, SASSCAL and WASCAL and networking with representatives of African and German Universities.

Note that time changeover takes place on Sunday, 25 October 2020, therefore the indicated times correspond to Central European Time (CET+1) / Coordinated Universal Time (UTC+1): Amsterdam, Berlin, Bern, Rome, Stockholm, Paris, Vienna on 29 and 30 October 2020.

8.45 – 9.00	Meeting in the virtual „lobby“ and quick final tech briefing
9.00 – 9.10	<b>Welcome words and outline of the day</b>
Moderation	<b>Gudrun Chazotte</b> Head of Section Scholarship Programmes Africa German Academic Exchange Service (DAAD), Germany
9.10 – 9.25	<b>Welcome address</b>
	<b>Professor Dr René Haak</b> Head of Division “Global Change” German Federal Ministry of Education and Research (BMBF), Germany
9.25 – 9.55	<b>Keynote address followed by Q&amp;A</b>
	<b>Dr Christoph Gornott</b> Working Group Leader, Adaptation in Agricultural Systems Potsdam Institute for Climate Impact Research (PIK), Germany
9.55 – 10.00	Short break
Moderation	<b>Dr Christian Schäfer</b> Head of Section Research and Studies German Academic Exchange Service (DAAD), Germany

10.00 – 10.20 **Introduction of the Southern African Science Service Centre for Climate Change and Adaptive Land Management (SASSCAL)**

**Dr Jane Olwoch**

Executive Director  
SASSCAL, Namibia

10.20 – 10.40 **Introduction of the West African Science Service Centre on Climate Change and Adapted Land Use (WASCAL)**

**Professor Dr Daouda Kone**

West African Science Service Center on Climate Change and Adapted Land Use - WASCAL  
Ghana

10.40 – 10.45 Short break

10.45 – 12.40 **Project presentation – part 1** | poster session | 4 teams

**Getting to know the climapAfrica thematic working groups**

The working groups are composed by the cohorts of climapAfrica postdoctoral fellows and alumni of German funding initiatives with expertise in the field of climate change, climate protection and land use.

- Climate change and agriculture:  
**Climate change and african agriculture: Challenges and opportunities**

**Dr Rosaine Yegbemey**

Assistant Professor  
Department of Rural Economy and Sociology, Faculty of Agronomy  
University of Parakou, Benin

- Climate change and land use:  
**Innovative strategies for climate mitigation and adaptation in urban areas in Africa**

**Dr Olumuyiwa Adegun**

Lecturer  
Department of Architecture  
School of Environmental Technology  
Federal University of Technology Akure, Nigeria

- Climate change and indigenous knowledge:  
**Towards indigenous knowledge integration in climate change: Prospects from a multiple evidence approach**

**Dr Nelson Chanza**

Senior Lecturer and Postdoctoral Research Fellow  
Department of Town and Regional Planning  
University of Johannesburg, South Africa

- Climate change and meteorology:  
**Mainstreaming climate information into policy formulation in Africa**

**Gloria Chinwendu Okafor**

Lecturer  
Nigeria Maritime University  
Delta State, Nigeria

11.45 – 11.55	Short break
	<b>Project presentation – Part 2</b>   poster session   3 teams
	<b>Getting to know the climapAfrica thematic working groups</b>
	<ul style="list-style-type: none"><li>• Climate change animal &amp; plant physiology: <b>Focus on climate change mitigation strategies to improve resilience in food/fodder and cash crops/species in West Africa</b></li></ul>
	<p><b>Dr Thierry Tovignan</b> Research Assistant Ecophysiology &amp; Crop Improvement Department of Genetics and Biotechnology, Faculty of Sciences and Techniques University of Abomey-Calavi, Benin</p>
	<p><b>Dr Ibrahima Zan Doumbia</b> Researcher and Plant Breeder Program of Fruits and Legumes Institut d'Economie Rurale (IER), Mali</p>
	<ul style="list-style-type: none"><li>• Climate change and modelling: <b>Resolving challenges associated with climate change modelling in Africa</b></li></ul>
	<p><b>Dr. Josefina Hamutoko</b> Southern African Science Service Centre for Climate Change and Adaptive Land Management (SASSCAL), Namibia</p>
	<ul style="list-style-type: none"><li>• Climate change and biodiversity: <b>Addressing climate change in Africa: Challenges and the way forward – focus on biodiversity and ecosystem functioning</b></li></ul>
	<p><b>Dr Lova Marline</b> Postdoctoral Fellow Université d'Antananarivo, Madagascar</p>
12.40 – 13.40	Lunch break
Moderation	<p><b>Professor Richard Calland</b> Associate Professor in Public Law University of Cape Town, South Africa</p>
13.40 – 14.10	<b>Response/comments on the project presentations by participants from African and German academia</b>
14.10 – 15.25	<b>Networking event</b>   7 mixed parallel breakout sessions of 10 min each A rapid-fire opportunity to get to know some of the other participants and to quickly exchange ideas and contact details. Think of it in terms of 'speed dating'!
15.25 – 15.30	<b>Closure for the day and preview of the next day</b>
	<p><b>Gudrun Chazotte</b> Head of Section Scholarship Programmes Africa German Academic Exchange Service (DAAD), Germany</p>
15.30	End of day 1

## Friday, 30 October 2020

Meet and Exchange with international experts and practitioners in the field of climate research and climate change: "Multisectoral perspective on the applied research and policy solutions.

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9.45 – 10.00	Meeting in the virtual „lobby”
10.00 – 10.05	<b>Outline of the day</b>
	<b>Dr Christian Schäfer</b> Head of Section Research and Studies German Academic Exchange Service (DAAD), Germany
10.05 – 12.10	<b>Expert input session</b>   7 sessions of 15 min each
Moderation	<b>Professor Richard Calland</b> Associate Professor in Public Law University of Cape Town, South Africa
10.05 – 10.20	Words of introduction
	<b>New modelling approaches for a better understanding of climate change in Africa</b>
	<b>Professor Richard Washington</b> Professor of Climate Science School of Geography and the Environment University of Oxford, United Kingdom
10.20 – 10.35	Words of introduction
	<b>Investigating and understanding climate extremes in a data-sparse continent like Africa</b>
	<b>Professor Andreas Fink</b> Institute of Meteorology and Climate Research Karlsruhe Institute of Technology (KIT), Germany
10.35 – 10.50	Words of introduction
	<b>Innovative agricultural methods/production to cater to changing climate (e.g. soil salinization)</b>
	<b>Professor Rattan Lal</b> Director of Carbon Management and Sequestration Centre The Ohio State University, USA
10.50 – 10.55	Break

10.55 – 11.10	Words of introduction  <b>How to maintain biodiversity in a changing climate</b>  <b>Professor Guy Midgley</b> Department of Botany and Zoology Stellenbosch University, South Africa
11.10 – 11.25	Words of introduction  <b>Alternative energy sources for Africa/ innovative fuels</b>  <b>Dr Rabia Ferroukhi</b> Deputy-Director of Knowledge, Policy and Finance International Renewable Energy Agency (IRENA), United Arab Emirates
11.25 – 11.40	Words of introduction  <b>Committees', a promising institution in climate change communication and adaptation?</b>  <b>Professor Dr Sabine Tröger</b> University professor development geography Department of Geography University of Bonn, Germany
11.40 – 11.55	Words of introduction  <b>Innovative strategies for mitigating the effects of climate change in metropolitan areas</b>  <b>Professor Shuaib Lwasa</b> Associate Professor Department of Geography Geoinformatics And Climatic Sciences Makerere University, Uganda
11.55 – 12.10	Words of introduction  <b>Climate change and migration: A review of West African case studies</b>  <b>Professor Kees van der Geest</b> Academic Officer / Head of EMIC Section Environment and Migration: Interactions and Choices Section (EMIC) Institute for Environment and Human Security ( UNU-EHS ) United Nations University (UNU), Germany
12.10 – 12.15	<b>Submission of priorities</b> for carousel sessions in the afternoon by Zoom survey
12.15 – 13.00	Lunch break

13.00 – 14.30	<b>Carousel breakout sessions with experts</b>   8 speakers x 3 sessions à 25 min An opportunity to move between three of the experts, and to have a deeper-dive conversation in a small group. <b>(closed session)</b>
Moderation	<b>Professor Richard Calland</b> Associate Professor in Public Law University of Cape Town, South Africa
Representatives of the DAAD will facilitate the carousel breakout sessions:	
	<b>Niels Böhm</b> Senior Desk Officer, Section Research and Studies
	<b>Jana Bömer</b> Senior Desk Officer, Section Scholarship Programmes Africa
	<b>Gudrun Chazotte</b> Head of Section Scholarship Programmes Africa
	<b>Simone Kolz</b> Senior Desk Officer, Section Scholarship Programmes Africa
	<b>Friederike Krist</b> Team Leader, Section Scholarship Programmes Africa
	<b>Dr Christian Schäfer</b> Head of Section Research and Studies
	<b>Berit Stoppa</b> Senior Desk Officer, Section Higher Education Management
	<b>Luca Matti Wettlaufer</b> Senior Desk Officer, Section Research and Studies
14.30 – 14.45	Short break
14.45 – 15.15	<b>Plenary – highlights of the previous sessions</b>
15.15 – 15.30	<b>Farewell address</b>
	<b>Dr Christian Schäfer</b> Head of Section Research and Studies German Academic Exchange Service (DAAD)
	<b>Gudrun Chazotte</b> Head of Section Scholarship Programmes Africa German Academic Exchange Service (DAAD)
15.30	End of DAAD virtual climapAfrica conference

## DAAD climapAfrica conference report

**GOOD QUALITY RESEARCH HAS NEVER MATTERED MORE THAN AT THIS POINT IN HISTORY – ESPECIALLY ABOUT CLIMATE CHANGE IN AFRICA**

## CONFERENCE REPORT

By Richard CALLAND

Professor of Law, University of Cape Town, South Africa  
Conference Co-Moderator

*The climapAfrica conference was remarkable for its scale – both in terms of the number of participants and the range and diversity of the topics. This reflects the state of the art of climate change research, which necessarily involves inter-connected, inter-disciplinary research. The challenges posed by climate change in Africa are intense, but full of opportunity. However, policy-makers need the best possible, evidence-based research to guide them in taking urgent action. Only by collaborating across disciplines, and by building a stronger pool of African researchers and experts can we succeed in addressing the challenge and seizing the opportunity.*

Professor Shuaib LWASA | Associate Professor | Department of Geography Geoinformatics And Climatic Sciences | Makerere University, Uganda.

**Good quality research has always mattered.** Now it matters even more – especially in an era of digital communications and ‘fake news’. The ‘truth’ is contested territory. The stakes are higher, because the system-level pressures and shocks are so intense, and the need for transformational change is so urgent and complex. Policy-makers face a daunting challenge. They need to make the best possible choices under the most extreme pressure. Hence, they need to be armed with the best possible research so that they can reach evidence-based decisions.

**Africa faces capacity challenges and blind spots,** so the need to ramp up climate research as the continent confronts numerous climate change threats is critical for the socio-economic development of over 1.2 billion people living on the continent. For African climate researchers, the opportunity is enormous – to deliver climate research that is relevant and needed, and which will have a significant impact.

**In this context, co-operation and partnership with like-minded peers from a country such as Germany** that places such a premium on high quality scientific and other research, can contribute to the transformational development, and impact, of African climate researchers. As the German Academic Exchange Service’s (DAAD) nifty motto puts it: Change by Exchange!

**This is the context, but what is the background to the climapAfrica conference?** With the objective of building bridges between researchers in Africa and Germany, DAAD initiated with the funds of the Federal Ministry of Education and Research (BMBF) the “climate change research Alumni and Postdocs in Africa” programme – referred to now as “the climapAfrica programme”. In this programme DAAD enables African researchers not only to do their research work, but to work in an international environment. Currently, 39 postdocs and 114 Alumni are part of the climapAfrica programme, working together in seven thematic working groups related to climate change, criss-crossing the continent.

**Research stays in Germany are possible and desired.** As Gudrun Chazotte, Head of Section of Scholarship Programmes Africa at DAAD put it in her opening remarks to the conference “the programme is a winning offer and the fellows and alumni are taking the opportunities with full engagement.” She also told the conference that the climapAfrica programme is embedded in the DAAD strategy 2025, emphasising the importance of sustainability and global responsibility: “we are convinced that working and researching, even thinking in an international context is key for facing challenges and finding solutions for problems.”

**The various activity lines of DAAD contribute to the internationalisation of higher education systems and research.** More than 145,000 individuals are funded per year to study and research abroad, more than 4000 university cooperation projects are realised yearly and the relevance of DAAD as information source for higher education worldwide is high. Said Chazotte: "Working together with partners worldwide is an important element of DAAD's institutional behaviour."

**In the climapAfrica programme DAAD is working closely with African partners.** In his opening remarks to the climapAfrica Conference, the Head of Division "Global Change" at the German Federal Ministry of Education and Research (BMBF), Professor René Haak stated that one of the key aims of the international cooperation between Germany and Africa is to strengthen the science base in Africa by supporting local capacities and developing and combining their respective scientific joint efforts. The climate competence centres "Southern African Science Service Centre for Climate Change and Adaptive Land Management" (SASSCAL) and "West African Science Service Centre on Climate Change and Adapted Land Use" (WASCAL) play an important role in the realisation of its activities. The yearly conference gives the opportunity of discussing research methods, research results and how to transfer the findings into policy environment. Bringing together a diverse range of stakeholders, the conference creates excellent opportunities to get connected and to open doors for future scientific collaborations.

*Climate change is one of the most important challenges worldwide.  
International oriented, joint research and exchange is crucial for developing strategies and finding climate solving solutions.*

Gudrun CHAZOTTE | Head of Section of Scholarship Programmes Africa | German Academic Exchange Service (DAAD) in her opening words to the conference.

## ONE OF THE LARGEST GATHERINGS OF AFRICAN CLIMATE RESEARCHERS

Of course, 2020 was a little different from usual – but there was upside as well as downside. One of the advantages of COVID-era virtual meetings is that more people can attend: 150 participants from 30 countries attended the conference – a large assembly of committed African climate researchers. The scale of the conference was impressive as was the energy that was generated and the very real and high level of engagement and interaction, proving that online events such as this need not be sterile and dull. On the contrary, this conference was 'buzzing' from start to finish. The enthusiasm and dedication of the DAAD fellows and African Alumni of German funding institutions, experts and stakeholders from various institutions worldwide, was obvious - all of them ready to learn more about the activities of each other and to exchange research challenges and ideas.

## HOW CAN CLIMATE RISK ASSESSMENTS GUIDE ADAPTATION PLANNING?

The stage for the conference dialogue was set by the Keynote Address from Professor Dr Christoph Gornott, Working Group Leader, Adaptation in Agricultural Systems, Potsdam Institute for Climate Impact Research (PIK) – which is one of Germany's leading climate change research institutes – and chair of the department Agroecosystem Analysis and Modelling at the University of Kassel. Professor Dr Gornott's presentation was right on point, identifying the main climate threats facing the African continent and linking that risk-filled context with the key research questions that need to be addressed:

- The climate in Africa is changing fast, with huge impact on livelihoods, on economic and social conditions, and especially for sectors such as agriculture.
- Yet, there is great uncertainty about the specific trends, which makes planning and policy-making harder still.
- Crop yield forecasts can, for example, inform about potential harvest failure.
- The aim is to stabilize farmers' financial risks in the face of climate peril.
- In turn, this has serious implications for insurance: affordability, access, premiums.
- This can help develop 'Adaptation Assessments', based on multi-criteria analysis.
- Science can reduce uncertainty about climate change projections and impacts.
- The ambition is not to reduce all of the uncertainty, but to be able to respond faster to climate change.
- Because there is already high certainty in all impact studies that immediate action is needed to prevent substantial damages to the entire (African) economy.
- Adaptation is more cost effective than coping with the risks of climate change.

## Multi-criteria analysis: Adaptation assessment

Adaptation strategy	Risk response	Risk mitigation potential	Cost-effectiveness	Risk gradient	Upscaling potential	Development co-benefits	Potential maladaptive outcomes	Stakeholder interest	Institutional support requirements
Irrigation	Risk mitigation	High	Medium	No-regret	High	High	High	High	Medium
Switching crops	Risk mitigation	High	Medium	Risk-specific	High	High	Medium	High	Medium
Agroforestry	Risk mitigation	High	High	Risk-specific	Medium-high	High	Low	High	Medium
Fodder and feed improvement	Risk mitigation	High	High	No-regret	High	High	Medium	High	Medium
Insurance	Risk transfer	No risk mitigation	Risk transfer	(Weather) risk specific	Medium	Medium	Medium	Low	High

Blue = neutral; green = positive; yellow = medium; red = negative



Potsdam Institute for Climate Impact Research (PIK)

Murken,..., Gornott, et al., 2019, 2020

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(Slide from Professor Dr Christoph Gornott to the conference Murken, Cartsburg, Chemura, Didovets, Gleixner, Koch, Lehmann, Liersch, Lüttringhaus, Rivas Lopez, Noleppa, Roehrig, Schuberger, Shukla, Tomalka, Yalew, Gornott, 2020: Climate risk analysis for identifying and weighing adaptation strategies in Ethiopia's agricultural sector. A report prepared by the Potsdam Institute for Climate Impact Research for the Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH on behalf of the German Federal Ministry for Economic Cooperation and Development, 150 pp. <https://doi.org/10.2312/pik.2020.003>)

Food for thought from the conference chat:



*The multicriteria analysis is very insightful. I would like to know if you found a kind of hierarchisation of the different criteria with regards to their specific value (effectiveness) in evaluation of climate change effects.*



Dr Olivier KASHONGWE | Egerton University | Kenya

Professor Dr Gornott's core message affirmed the over-arching theme – and the imperative for African climate research – namely that policy planning and climate action investment should be based on science and an empirical assessment of the climate risks. He ended with reference to PIK's Africa-centered website: agrica.de – which is a climate risk and adaptation platform for sub-Saharan Africa.



Food for thought from the conference chat:

*Do we know, at continental scale, how successful are the different insurance schemes and what their impact is at local, national and continental level?*



Professor Dr Joerg HELMSCHROT | Southern African Science Service Centre for Climate Change and Adaptive Land Management (SASSCAL) | Namibia

## ABOUT climapAfrica's PARTNERS:

### Southern African Science Service Centre for Climate Change and Adaptive Land Management (SASSCAL)

SASSCAL is a joint initiative of Angola, Botswana, Namibia, South Africa, Zambia, and Germany in response to the challenges of global change. The current processes of global change, including demographic change, climate change and the globalisation of economic systems, are an enormous challenge for societies worldwide. Climate change is affecting the lives of millions of people in all parts of the world. Current projections on future developments indicate that there is an urgent need to develop concepts on how to adapt to these challenges in due course.

Dr Jane Olwoch, the Executive Director of SASSCAL, told the conference that "science and research offer proactive approaches to deal with the current and the expected changes. In this regard, the role of science is to be understood as a service to those societies that are most severely affected by climate change and to provide decision-makers with evidence-based results and advice. The establishment of SASSCAL adds value for the whole southern African region. The Centre is conceptualised and operationalised to complement the existing research and capacity development infrastructure and research initiatives in the region."

SASSCAL's second research phase focuses on the transition from a resource-based to a knowledge-based society. Such transformation needs to be supported by developing a demand-driven knowledge agenda and a highly-skilled labour force. The DAAD climapAfrica program that seeks to catalyse uptake and use of research outputs through a vibrant, highly connected network of postdoctoral fellows can effectively enhance SASSCAL research outputs' relevance region as a contributor to the regional knowledge economy.

SASSCAL's vision is to be a leading regional centre in integrated climate change and adaptive land management science services, and its mission is 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." Dr Olwoch stated that SASSCAL's 'value proposition' is to provide climate change data for decision-makers, to promote trans/interdisciplinary research – which is essential, given the cross-cutting character of climate change – and to do so through a regional, geographical lens, with a wide network of partner universities and research institutions. It also funds other research organisations.

Excerpt from the conference chat:

*The SASSCAL automatic weather station network has been incredibly helpful to climate scientists in working out whether or not the climate models that we use for climate prediction are able to simulate crucial elements of the climate system. Specifically, the network of weather stations is vital in figuring out if the climate models are credible. The network of weather stations is so important.*

Professor Richard WASHINGTON | University of Oxford | United Kingdom

### West African Science Service Centre on Climate Change and Adapted Land Use (WASCAL)

WASCAL is a large-scale Education, Research-focused and Climate Service Centre designed to help tackle this challenge and thereby enhance the resilience of human and environmental systems to climate change. Funded by the German Federal Ministry of Education and Research (BMBF), WASCAL is implemented in a collaborative effort by 10 West African countries (Benin, Burkina Faso, Côte d'Ivoire, The Gambia, Ghana, Mali, Niger, Nigeria, Senegal, Togo) and German partners.

WASCAL's Vision is become one of Africa's leading science-based institutions in the provision of climate services in and for West Africa, with a Mission to "provide information and knowledge at the local, national,

and regional levels to its West African member countries to cope with the adverse impacts of climate change and devise integrated mid and long-term options to build up resilient and productive socio-ecological landscapes."(Professor Dr Daouda Koné, Executive Director of WASCAL, presentation to the conference)

Like SASSCAL, WASCAL is internationally well-known and respected, with a track record of success in supporting research collaboration and partnership. Scientists at WASCAL are therefore working directly with farmers and local authorities in the region. Local surveys and mapping exercises are being combined with modern remote sensing and climate modelling methods. The centre also taps and makes use of traditional knowledge in order to find promising adaptation solutions. This information is collated by WASCAL's data management. Capacities are also being built to enable the development of independent climate forecasts and scenarios which can be used for planning adaptation measures or for representing the region's own interests in international negotiation processes such as the UNFCCC.

Earlier, Professor Dr René Haak had noted that "with the support of the Federal Ministry of Education and Research (BMBF), WASCAL enhanced the visibility of science from Africa into the international scientific networks and into long-lasting cooperation between African and German universities and research institutes." Professor Haak acknowledged that WASCAL had provided a great supporting role by setting up and coordinating new integrated regional research activities in the area of sustainable land use, water resource management, Biodiversity, renewable Energy, agriculture, human security, climate systems and economics with the latest focus on data management and Marine research.

In his presentation, the Executive Director of WASCAL, Professor Dr Daouda Koné, proudly presented its achievements, which include:

- 261 graduates
- 43% Masters; 57% PhDs.
- 224 lecturers involved in the teaching
- 336 Professors and Researchers (112 from Germany).
- 260 Research Articles published.

## POSTER SESSIONS

Thereafter, there were presentations from climapAfrica thematic working groups – a "Poster Session" presenting the main projects of each of the seven working groups. Dr Christian Schäfer, Head of Section Research and Studies within DAAD introduced this programme methodology, which is a unique feature of the climapAfrica programme. The objective is to bring together climapAfrica postdoctoral fellows and alumni of German funding initiatives in the thematic working groups, where they can combine their complementary expertise. This is not only an efficient way of accommodating the inter-disciplinary character of a complex topic like climate change, but also the close cooperation with experienced professionals in the working groups also opens up a multitude of new ideas and opportunities to the up-and-coming researchers. It helps build research skills and capacity, as well as knowledge and understanding in both Africa and Germany.

The aim of the poster sessions was to establish a close thematic link between the expert inputs of the Conference, the climapAfrica working groups, and the postdoctoral research projects. This was a very important objective, since the Conference is intended to bring the post-doctorate participants in the climapAfrica programme into direct contact with leading professionals in their fields and to thereby expand their research horizons – the post-docs are the primary target group of the Conference.

The care with which the posters were conceptualised and then prepared and published is reflected in their quality – they really are worth a read; all of them can be found at the end of this report. Each poster summarises the key challenge that the research of the working group is aimed at addressing; provides some key relevant facts and figures; and the solution that the research is directed towards. In addition, the poster describes how the climapAfrica programme is contributing towards this research agenda, and/or can continue to do so. The presentations covered a wide and diverse range of topics, including: African agriculture; resilience in food/fodder and cash crops; biodiversity and ecosystem functioning; innovative strategies for climate adaptation and mitigation in urban areas; the role of indigenous knowledge in climate change: prospects for a multiple evidence approach; mainstreaming climate information into policy formulation; and overcoming challenges in climate modelling.

## INFORMAL NETWORKING THE 'VIRTUAL WAY'

After lunch, there was some virtual networking, using Zoom small rooms and a 'speed-dating' approach whereby random groups of 3-4 participants had around 10 minutes to quickly get to know each other and make connections...much like a coffee break at a 'real' conference. The hope was to create the kind of informal opportunity that a 'normal' face to face conference provides to create links between people that can lead to new work and partnerships. The evaluation of the participants indicates that this objective was achieved and they appreciated this format very much.

## EXPERT PRESENTATIONS

The second conference day was based on eight expert presentations covering the topics of modelling, data, agriculture, biodiversity, alternative energy sources, communication, cities, and migration in West Africa. The topics were carefully selected, as was the sequence: To begin with some fundamental aspects of good climate research, namely modelling and data; then to explore three of the most important sectors – agriculture, biodiversity, and energy – then to think about some cross-cutting policy and governance issues – communication and multi-stakeholder process, cities (where all of the main system-level pressures and climate threats intersect), and demographic implications of 'climate' migration.

In the afternoon 'carousel' session, the experts spent time with three smaller groups to allow for a more detailed unpacking of the issues, and a sort of 'informal free discussion'.

### A clear narrative emerged from the expert inputs:

#### AFRICAN CLIMATE RESEARCH: THE STORYLINE FROM THE EXPERTS

**Research has never mattered more, especially about climate change and particularly for Africa.** Policymakers have daunting decisions to take, and they need the best quality research in front of them. Africa has capacity challenges and blind spots, but there is a powerful platform of outstanding research work to build on.

**Modelling climate change and its impact is the bedrock to much of the future-facing research agenda.** Cross-cutting, inter-disciplinary data is crucial, too; and recognising the gaps – knowing what you don't know – is strategically essential step.

**Agriculture is fundamental to Africa's economies: climate change presents grave threats and real opportunities...if innovation can be harnessed.** There are high diversity ecosystems across climate tension zones in Africa – the risk of harm comes not only from climate change but also from well-intended mitigation policies, such as afforestation. Beware the unintended consequences!

**The big global lever to pull for a climate-resilient, low carbon development pathway is energy:** while Africa's mitigation obligations are low (save for South Africa), the opportunity to create new, better 'green' jobs in the renewable energy sector are high.

**Cities are at the frontline of climate change** as much as rural areas, with a complex intersection of challenges spanning infrastructure, water, energy, food, urban transportation and planning – which implies a 'systems-thinking' research capacity to cope with complexity and inter-dependence.

**Local communities not only hold the key to better understanding of what is happening on the ground and to better empirical research,** but also to building consensus about how best to 'govern' the response to climate change. One of the 'truisms' about climate change that is often repeated, is that it will result in significant migration of people. But, decisions by people in climate-affected areas, such as West Africa, are not one dimensional. Given the political sensibilities related to immigration throughout the world, more research is needed to understand what motivates people and climate change is making a difference to people's decisions.

## MODELLING

### New modelling approaches for a better understanding of climate change in Africa

#### EXPERT

#### Professor Richard WASHINGTON

Professor of Climate Science  
School of Geography and the Environment  
University of Oxford, United Kingdom



#### CORE MESSAGE

Climate modelling is one of humanity's greatest accomplishments, and essential for the effective tackling of the threat posed by climate change.

Professor Washington posed and answered the fundamental, underlying question: Why do we need models? First of all, models are the prime tool for predicting future weather and climate. Second, physically consistent and globally complete 'observations' are created by models through the reanalysis process. Thirdly, to help 'unravel' cause and effect in the climate system idealized experiments such as removing the topography or setting specific sea surface temperatures.

"Climate models are one of our greatest scientific achievements", Professor Washington told the conference, and the prime route to knowing future projections of climate. Global modelling is essential but can only currently happen at resolutions are problematic for many climate processes.

It is important to know that I was actually criticising the image below. Data for every village was promised through the CORDEX programme but that promise should not have been made.

Food for thought from the conference chat:

*Yes, the uncertainties relating to the use of climate model is high. My question is how are the remaining uncertainties quantified? There are uncertainties related to the type of bias correction used, uncertainties related to the parameterisation of the hydrological models. The uncertainties could also be exacerbated in the parameterization techniques of using an ensemble of hydrological models.*

Dr Oluwafemi ADEYERI | Federal University of Technology Akure | Nigeria

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<http://thenewhumanitarian.org/feature/2011/11/02/soon-every-african-village-will-know-what-the-weather-may-bring>

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Free Newsletter
The New Humanitarian
25 years of journalism from the heart of crises

Food Feature 2 November 2011

**Soon every African village will know what the weather may bring**

(Slide from Professor Richard Washington to the conference  
[www.thenewhumanitarian.org/ar/node/251236](http://www.thenewhumanitarian.org/ar/node/251236))

## DATA

### Investigating and understanding climate extremes in a data-sparse continent like Africa

#### EXPERT

#### Professor Andreas FINK

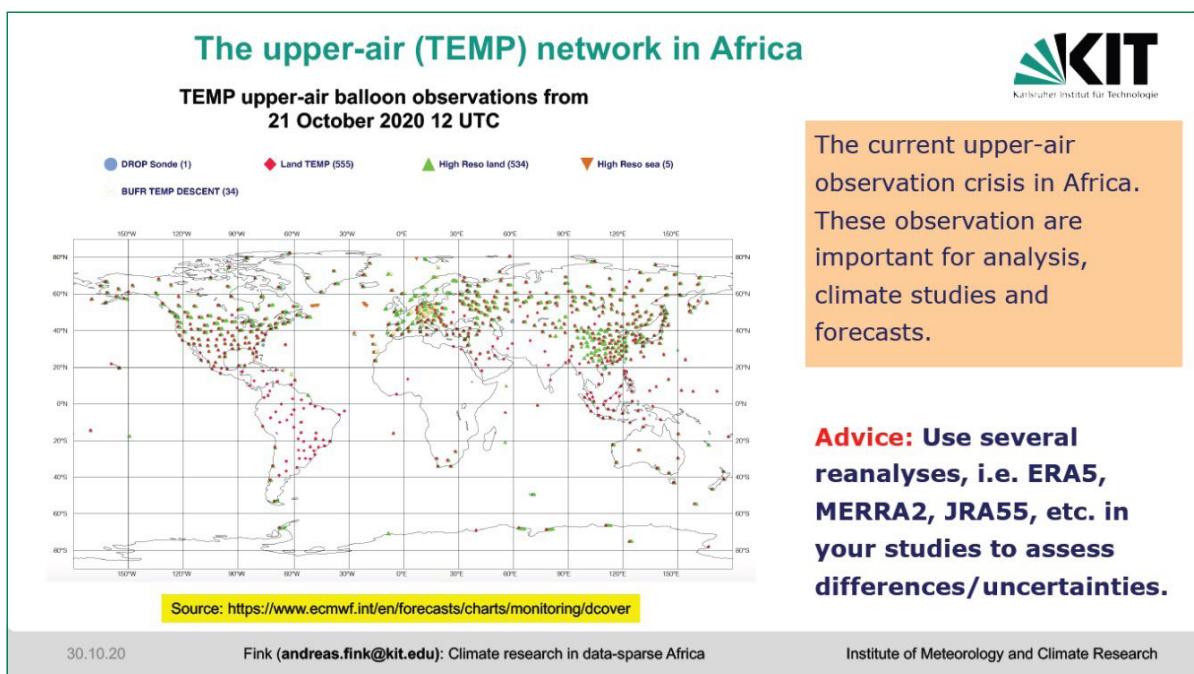
Institute of Meteorology and Climate Research  
Karlsruhe Institute of Technology (KIT), Germany



#### CORE MESSAGE

Data-gathering in relation to the key threats and challenges is essential to good research and, thereafter, good policymaking. Africa has some significant 'blind spots' in this regard, that require urgent attention:

As this slide from Professor Fink's presentation shows, Africa is lagging badly compared with other regions – it has a real data-gathering blind spot on one of the most important research questions:



(Slide from Professor Andreas Fink to the conference)

Professor Fink's starting point was that the over-riding challenge and objective for African climate research must be to identify the "optimally suitable observational data sets for climate research on the continent". His core diagnosis of the data-challenge in this context is that the most important meteorological parameters in Africa are precipitation and then evapotranspiration: climate variability, trends and extremes in Africa are often poorly quantified due to a lack of long-term, high-quality surface observations. Knowing how to obtain free surface observations and being able to assess their strengths and weaknesses for the planned application is essential to good policy-making and effective responses to climate change. If surface observations are not available, satellite or model-gridded products can be surrogate data sets, but knowing their limitations is of pivotal importance. Lastly, it is important to confront weather and climate models with real observations to examine the veracity of the simulations.

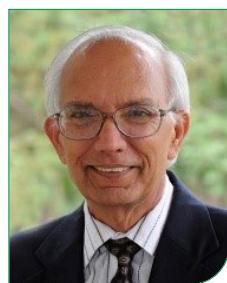
## AGRICULTURE

Innovative agricultural methods/production to cater to changing climate (e.g. soil salinization)

### EXPERT

#### Professor Rattan Lal

Director of Carbon Management and Sequestration Centre  
The Ohio State University, Columbus, OH, USA



### CORE MESSAGE

Climate change is a 'clear and present' danger to agriculture in Africa. But, get the adaptation measures right, and the continent can turn the crisis into an opportunity and finally become the 'bread basket of the world'.

Professor Lal's presentation was remarkable for covering such a wide range of complex issues in such a short (15 minute) time, capturing both the complexity and inter-dependence of climate change challenges – in particular, the intersection between drought, soil degradation, urbanisation and climate change. Professor Lal believes that with vast endowments of natural resources comprising a wide range of climates/biomes/soils and human capital, Africa has the capacity to be a 'bread basket' for the world, provided that it can adopt what he described as the Triple A (AAA) approach: Adaptation of the African Agriculture to Climate Change. This initiative has various strands, including: widespread eco-system-based adaptation; an emphasis on soil restoration and zero-net land degradation; and soil carbon sequestration through adoption of site-specific Climate Smart Agriculture (CSA). The importance of empowering farmers (especially women farmers) to adopt Best Management Practices (BMPs) is vital, as is strengthening political will and the provision of effective governance.

### FACTS AND FIGURES – AGRICULTURE

From the climapAfrica thematic working group: Climate Change and African Agriculture Working Group

Agriculture is a key economic sector in African countries, contributing approximately 15% to total Gross Domestic Product (OECD/FAO 2016; World Bank, 2019) and employing more than half of the labour force in many countries (FAO 2020). Future climate scenarios suggest mixed patterns (increases or decreases) for rainfall across the continent, but clear increases in temperature (Schleussner et al., 2018; Serdeczny et al., 2017).

### WICKED PROBLEMS EVERYWHERE YOU LOOK

From the climapAfrica thematic working group: Climate Change and African Agriculture Working Group

Climate change impacts in the agricultural sector in Africa is a 'wicked' problem that requires holistic/integrated solutions. In this respect, no one single solution will be sufficient on its own. The over-arching strategies need to encompass integrated approaches to adaptation, involving inputs from climate scientists (who understand the likely hazards), experts in crop and livestock agriculture (who understand the impacts to farm production), social scientists (who understand the impacts to farmers, their livelihoods, family structures, migration options), health experts (who understand the changes in disease distributions and impacts on mental health), and others.

## Discussion rounds with Professor Rattan Lal

### IMPORTANCE OF SOIL: YOU CAN'T WITHDRAW MORE THAN YOU PUT IN!

**SOIL** is like a bank account. In a bank account, you cannot withdraw more than you put in. You must balance the bank account very carefully. If you want to increase the output, you must increase the input, too. Soil is the same way. Anything that we take out of soil, we must replace. If you do not replace what you harvest, the organic matter is decomposed (for example soil carbon)

**RESULT:** Depletion of soil by extractive farming practices (for decades/centuries) à negative nutrient budget. If we remove nitrogen, phosphorus and organic matter from soil, we must return it.

If the soil is healthy, plants, animals and people will be healthy too! If the soil is exploited and unhealthy, plants, animals and people will suffer too.

- Don't forget: Soil is a living being (25% of all biodiversity), a handful of healthy soil may have more biodiversity than a unit area of Amazon forest.
- Managing soil has a price, not managing soil has a bigger prize!
- Therefore, we must support a policy that is pro farmers
- Soil is endangered due to industrial waste. If we don't protect the soil, it's very difficult. We must improve our soil health to mitigate the effects of climate change!
- We have all one goal in common: Protection of natural resources! Please keep in mind that the use of chemicals is like medicine: If you take one painkiller, it's fine. If you take more than 20, it will be dangerous – the same principle applies while adding chemicals (fertilizers and pesticides) to soil.

### FERTILIZER:

- Don't use fertilizer randomly and reject it directly into the soil, not on the surface!
- Avoid over fertilization - balance is important! Otherwise: Waste of nutrients (also bad for the groundwater)
- One solution can be to test the soil regarding its nutrients.
- Please use biofertilizers! Recycle as much as you can (e.g. cow dung)
- Please use chemical fertilizer or pesticides precisely and correct!!
- Water: Please don't practice flood irrigation! The organisms and plant roots cannot breathe and precious water is wasted  
→ better: drip irrigation
- ➔ Education is key!!

### Convincing farmers

The government should support farmers for ecosystem services. This would have an effect on the health of the population, improve water quality and helps to mitigate climate change. Moreover, a healthy soil would protect droughts in the summers and extreme weather events (e.g. flooding).

➔ Needs for subsidies and good practices.

## BIODIVERSITY

### How to maintain biodiversity in a changing climate

#### EXPERT

**Professor Guy MIDGLEY**

Department of Botany and Zoology  
Stellenbosch University, South Africa



#### CORE MESSAGE

The biodiversity picture is complex and multifaceted. Africa has enormous biodiversity, some of which is threatened by climate change and some of which is threatened by the response to climate change (from mitigation measures, such as afforestation) – the law of ‘unintended consequences’.

Professor Midgley set out his view of the African context: it is a vast and diverse continent, with no simple solutions, that encompasses both emerging and developing economies, and with rapid urbanisation. There are other contradictions and ambiguities. For example, in terms of technology, there are ‘leapfrog’ versus ‘legacy’ development patterns and opportunities. In general, there is commitment to multi-lateral environmental agreements, with mainly low emissions (except for South Africa), yet are vulnerable to high emissions’ pathways. There are also short-term versus long-term conflicts in resource-use trends and economic policy vulnerability around resource-use issues. Of particular importance to biodiversity is the fact that there are high diversity ecosystems across climate tension zones and disturbance-driven systems, with weaker ‘climate’ rules.

In this context, strong science and logistical support, and community integration, are essential. Professor Midgley’s presentation offered a provocative and insightful assessment of how well-intended policy can sometimes have deleterious consequences, based on a case study exploring the relationship between African biodiversity and tree-planting programmes that was co-authored by Midgley - “The Trouble with Trees: Afforestation Plans for Africa”, by William Bond of the University of Cape Town, Nicola Stevens and Guy Midgley of Stellenbosch University, and Caroline Lehmann of the University of Edinburgh and the University of the Witwatersrand. As Professor Midgley told the climapAfrica Conference, he and his fellow authors are not opposed to trees, and are supportive of reforestation programmes. But, they are opposed to tree planting over vast areas of African savannas. Their research has revealed that:

“[T]he afforestation envisaged by the global tree planting programmes is based on wrong assumptions. Far from being deforested and degraded, Africa’s savannas and grasslands existed, alongside forests, for millions of years before humans began felling forests. The maps erroneously assume that low tree cover, in climates that can support forests, are ‘deforested’ and ‘degraded’...The bizarre result is that ancient savanna landscapes, including the Serengeti and Kruger National Park, are mapped as deforested and degraded (because tree cover is reduced by elephants, antelope, and several million years of grass-fuelled fires).”

(see: <https://redd-monitor.org/2020/04/02/the-trouble-with-trees-the-african-forest-landscape-restoration-initiative-is-based-on-a-profound-misreading-of-africas-grassy-biomes/>).

Once again, the point was being made: good climate policy requires good climate research.



(Slide from Professor Guy Midgley to the conference)

Excerpt from the conference chat:

*A follow-up question: These local ways of adaptation most times have adverse effects on the long run. How do we make the more refined adaptation strategies available to these local people?*

*Bringing it down to their level, convincing them to change their practices and encourage them to adopt a better method. Secondly; how do we remedy the havoc that has been caused by the local adaptation strategies? For example, in the Lake Chad Area, some farmers resulted in the planting of Typha grass to check the incessant flooding at the upstream. But these method as reduced the flow of water to the downstream. Now, the typha grass has become difficult to control. Now evasive and resistant. This is now a big challenge over there.*

Dr Oluwafemi ADEYERI | Federal University of Technology Akure | Nigeria

*These are the dangers of using non-indigenous species to solve local issues – they often backfire – like planting Eucalyptus trees.*

Professor Dr Guy MIDGLEY | Stellenbosch University | South Africa

## ALTERNATIVE ENERGY

### Alternative energy sources for Africa/ innovative fuels

#### EXPERT

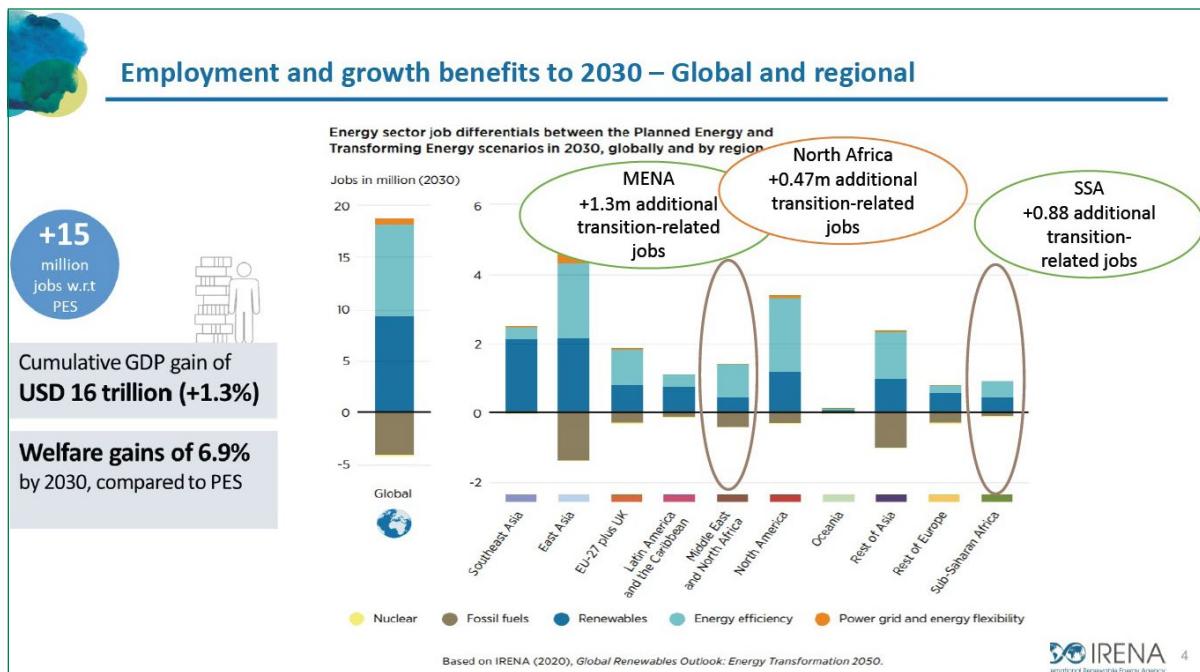
#### Dr Rabia FERROUKHI

Deputy-Director of Knowledge, Policy and Finance  
International Renewable Energy Agency (IRENA),  
United Arab Emirates



#### CORE MESSAGE

A transition towards alternative energy sources provides lots of opportunities for African countries, in terms of new, better skilled and safe jobs. But a just energy transition is complex jigsaw puzzle. To overcome a resistant political economy will be challenging. And so policy makers will need to be provided with the research-based 'evidence' to support their decision-making and to show them what can be achieved with the right investment and enabling environment.



(Slide from Dr Rabia Ferroukhi to the conference)

Globally, energy is the big lever – both for adaptation and future resilience, but especially for mitigation. As Dr Ferroukhi acknowledged, Africa does not have an historical or current carbon emissions 'problem'. But it does have both a future energy security problem and a current – and growing – employment crisis. Hence, the potential transition to 'green' energy is full of potential – to leverage the continent's natural renewable energy resources (solar and wind, and to some extent hydro), but also to create net new employment opportunities. This is the research focus of Dr Ferroukhi's research institute, the International Renewable Energy Agency (IRENA). In the post-COVID19 economic rebuilding phase, there is a unique, possibly one-off opportunity to reset economic development pathways. To execute a 'just' energy transition will have to navigate a treacherous political economy, with many fossil fuel-based vested interests to overcome. Policymakers will need to be armed with solid research that evidences the potential, and provides a credible 'roadmap' for the energy transition.



(Slide from Dr Rabia Ferroukhi to the conference)

## COMMUNICATING CLIMATE CHANGE

**Committees: a promising institution in climate change communication and adaptation?**

**EXPERT**

**Professor Dr Sabine TRÖGER**

University professor development geography  
Department of Geography  
University of Bonn, Germany



**CORE MESSAGE**

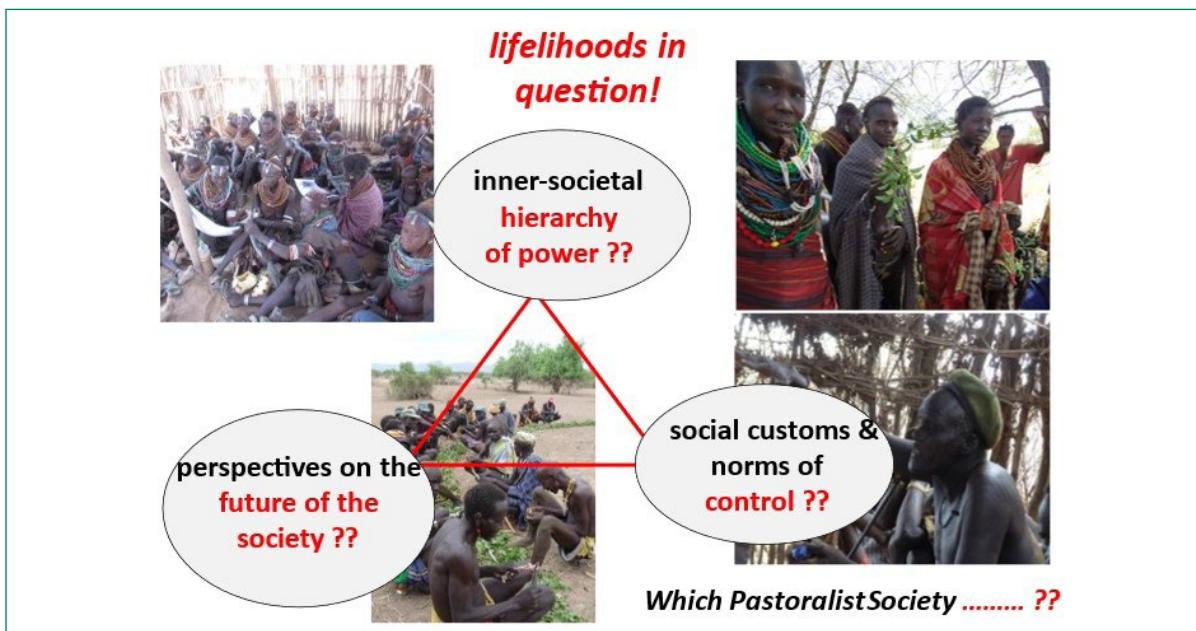
Coinciding with the demand for decentralisation together with the mainstreaming of participatory approaches in development practice, there is a shift towards policies that permit local actors and resource users to play a more active role in Natural Resource Management (NRM), which in many cases today means Climate Change Adaptation (CCA). Decentralisation describes the process by which bundles of entrustments, like regulatory and executive powers, responsibility and authority in decision-making, are transferred to local agents, which again calls for new institutions and processes of institution-building.

These processes of decentralisation often come about in the shape of 'committees'. The latter have mushroomed up in various development contexts all over Africa, compelling local actors to unanimously and fundamentally adapt to the irreversible changes in nature caused by climate change. Informed by the 'Western' ideal of democracy, the committees mirror the principal idea of equal representation and equal voice. The ideal of 'participation' has emerged as the counter-balance to the socio-political institution of 'committees', which again, following prominent discourses on participation, claims to 'give people a voice'.

Through a case study from Ethiopia/South Omo that exemplifies pastoralist livelihoods in times of climate change challenges, Professor Tröger reflected on the ambiguous effect of those 'Western' democratic ideals in their meaning for processes of climate change communication in African contexts. She argues that societies, which envisage human dignity in a less individualistic and more cooperative way, have a different way of interpreting the role of democratic institutions.

Hence, communication in processes of climate change adaptation is to be based on the recognition of a plurality of forms of democracy and socially adapted institutions of power and trust. The question to be posed is whether a more sensitive and integrative conceptualisation of societal structures, which are in place and are part of the indigenous approach to consensus-finding, would be a much more helpful and path-guiding alternative towards sustainable Climate Change Adaptation?

Very different from the other presentations, Professor Tröger's sociological, humanities lens served to remind the African climate research community that above all, climate change is a human development issue, and that issues of governance, participation, equitable access and gender rights should not be neglected when building climate research capacity and the future African climate research agenda.



(Slide from Professor Dr Sabine Tröger to the conference)

Excerpt from the conference chat:

*Indigenous knowledge is critical in many aspects of climate change including marking the onset, cessation, sowing and growing season in some localities. However, the challenge facing IK is in lack of enough documentation. More so, owing to diversity in application of the same where it exists, it is likely that it may take time to reach an agreeable consensus.*

Dr Noah KERANDI | South Eastern Kenya University | Kenya

**CITIES****Innovative strategies for mitigating the effects of climate change in metropolitan areas****EXPERT****Professor Shuaib LWASA**

Associate Professor

Department of Geography Geoinformatics And Climatic Sciences  
Makerere University, Uganda**CORE MESSAGE**

African cities are big and are growing fast. They represent the vortex and the intersection: where all the system-level pressures and forces come together creating the conditions for crisis and chaos, but also for transformational change at scale. In Africa, the call for mitigation action is often misunderstood, or eclipsed by understandable demands for adaptation finance and action, but research shows that properly framed, mitigation can yield multiple co-benefits.

Professor Lwasa has a range of research interests, which reflects the inter-disciplinarity of the primary focus of his research efforts – the African city. Professor Lwasa reminded his audience that as the IPCC special report on a 1.5-degree impact stated, all of the big four systems that require transformation have a strong link with the urban – energy, land use and eco-systems, urban infrastructure, and industry. One of his foundational points was to not only remind the audience of the importance of cities to Africa's future economic development pathway, but also the need to 'transcend city jurisdictions to deliver mitigation action at speed to reduce the impacts of global warming. This is a significant point, given that many policymakers may adopt an approach that starts with the proposition that Africa has not a 'mitigation problem' to contend with. Professor Lwasa, however, suggested to the climapAfrica conference that research suggests that the African climate research community needs to "rethink the benefits of mitigation, as well as the direct co-benefits" – a message that aligned with Dr Ferroukhi's earlier presentation on alternative energy.

Chiming, too, with Professor Midgley's earlier point about 'leapfrog' technology, Professor Lwasa suggested that his research indicates that for metropolitan areas the main driver of innovative strategy would be 'leapfrogging' through transformative urban planning that will enable cities to develop differently, with the deployment of disruptive technologies. To achieve this, however, will require skilful governance of climate action – planning, financing, implementation, and will likely require a reconfiguration of institutions to mirror the multi-disciplinary climate landscape.

### **Discussion rounds with Professor Shuaib Lwasa**

The carousel sessions with Professor Shuaib Lwasa from Makerere University's Department of Geography Geoinformatics and climatic sciences on innovative strategies for mitigating the effects of climate change in metropolitan areas allowed for a profound exchange on how adaptation and mitigation approaches can look like and their potential to be engrained in governance structures. An interesting discussion evolved around Professor Lwasa's statement that we need a reconfiguration of institutions to overcome compartmentalized urban governance structures that hamper an effective and horizontal design of climate policies. Professor Lwasa reported from its activities on workshops with stakeholders from different policy levels and how evidence-based decision-making can be communicated and implemented to the benefit of all. Importantly to the overall debate at the conference, Professor Lwasa pointed out that mitigation and adaptation are not mutually exclusive and should be seen as going in tandem. This was also reiterated during the carousel break-outs, including discussions on urban answers to recurring floods, heat stress and lack of green spaces. On this matter Professor Lwasa repeatedly underscored the importance of sustainable urban drainage solutions as well as opportunities that derive from harnessing nature in form of traditional systems i.e. in housing infrastructure to face these challenges. Asked on how urban governance structures should be managing informal neighbourhoods, Professor Lwasa made very clear that this type of structures in African cities, even though it might be different from other developments across the globe, is there to stay. Relocation measures that are often times deemed to be the appropriate answer come along with a lack of transparency that cuts deeply into the credibility and acceptance of these policies among the groups affected. Finally, Professor Lwasa called for the organization and implementation of an African-wide data base on urban mitigation programmes to record and share knowledge on how cities can contribute to climate change mitigation. He directly addressed the research community by highlighting the importance to elevate case studies on mitigation and adaptation strategies in the urban context to African level.

## MIGRATION

### Climate change and migration: A review of West African case studies

#### EXPERT

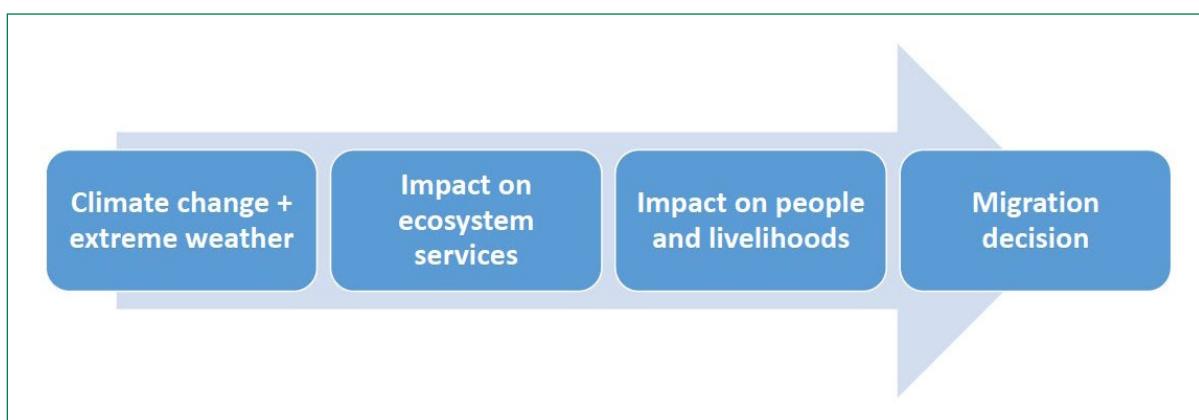
#### Professor Kees VAN DER GEEST

Academic Officer / Head of EMIC Section  
 Environment and Migration: Interactions and Choices Section  
 (EMIC) Institute for Environment and Human Security (UNU-EHS)  
 United Nations University (UNU), Germany



#### CORE MESSAGE

Climate change and extreme weather events are impacting on ecosystem services and on people's daily lives and livelihood and may lead to a decision to migrate as a form of risk management. However, research in West Africa shows that there are multiple drivers that motivate such a decision and that further research is essential to track trends and enable policymakers to anticipate the implication of changing migration patterns.



(Slide from Professor Kees van der Geest to the conference)

Drawing on a 2018 research paper<sup>1</sup> that Dr van der Geest co-authored, he explained that reviewed studies suggest that the underlying motives for migration are manifold and migration is often a voluntary decision. Migration is sometimes a form of climate risk management and adaptation to environmental stress. However, better income opportunities, and the desire for progress, prosperity and a different lifestyle – inspired by the prestige and economic opportunities of previous migrants – have been the most common motives for people to migrate in West Africa in the past 25 years. And the question for further, new research, and for debate van der Geest posited is: Is this still true?

Excerpt from the conference chat:



*The different working groups have interesting topics to be addressed. For the groups focus on climate change and climate modelling as well as the climate change and land use, I think the pollution (air, water and soil) questions should be addressed since pollution is increasing in Africa and already affecting our lives (health, water resources and land available for farming).*



Dr N'Datchoh Evelyne TOURE | Université Félix Houphouet-Boigny – UFHB | Côte d'Ivoire



*Evelyn, you are right. We have someone working on that in the climate change and meteorology group.*



Dr Oluwafemi ADEYERI | Federal University of Technology Akure | Nigeria

<sup>1</sup> Van der Land, V., C. Romankiewicz & K. van der Geest (2018). Environmental change and migration: A review of West African case studies. In McLeman, R. & F. Gemenne (eds). Routledge Handbook of Environmental Displacement and Migration. Routledge, p. 163-177.



*We must also not lose the fact that there are several other stressors on communities in addition to climate change. We must make sure that these WGs work together with other efforts that may be on-going in the same communities.*

Professor Isaac MAPAURE | University of Namibia | Namibia

## CONCLUDING OBSERVATIONS

The feedback from the participants reflects that this was a remarkable conference – because of the large number of participants, covering such a wide and diverse range of African countries and research specialisms/interests; and because of the quality and energy of the contributions, both from the expert guests and the alumni and members of the climapAfrica thematic working groups, which was striking. It brought a large number of African post-doctoral researchers together with leading experts in their respective fields, and enabled the thematic working group of the climapAfrica programme, which is a distinctive feature of the programme's methodology, to showcase their research and build new professional connection.

In this regard, the conference served the objectives of the climapAfrica programme, which is to connect high-potential African climate change scientists and researchers with African experts who are alumni of German funding initiatives in the same field. Through the seven thematic working groups, it seeks to encourage the uptake and use of research output within a vibrant, highly connected network and thereby facilitate the development of regional solutions. Sponsored by the German Federal Ministry of Education and Research (BMBF) and in cooperation with the climate competence centres Southern African Science Service Centre for Climate Change and Adaptive Land Management (SASSCAL) and West African Science Service Centre on Climate Change and Adapted Land Use (WASCAL), the programme aims to foster application-oriented research to tackle climate change in southern and western Africa.

The depth of the exchanges that took place at the conference, the level of interaction, and the positive evaluation of the conference participants, showed the benefits that a virtual gathering can yield. It will be interesting to track the interactions and cooperative work that emanates from the conference and, if possible, to compare it to previous 'normal' editions. As the whole world confronts the challenges posed by a pandemic to human interaction and collaboration, it is clear that with a positive and creative mindset, the obstacles can be overcome, just as the need for international cooperation is even greater. As numerous speakers pointed out, in the realm of climate change, the need for collaborative research could not be greater nor more important at this crucial time in human history. Policy-makers face excruciatingly tough decisions, with the clock running against them, and so the need for up-to-date, methodologically sound as well as relevant and innovative research is vital. This should inspire African climate researchers and encourage collaboration. Investments that support such research collaboration, such as the climapAfrica programme, are as wise as they are essential.



## CLIMATE CHANGE AND AFRICAN AGRICULTURE: CHALLENGES AND OPPORTUNITIES



### FOCUS AREA

Climate change impacts on the productivity of the agricultural sector through processes such as weather uncertainty, environmental changes and pest or disease distributions, land degradation, land grabbing, heat and migration. A number of solutions can be tested and scaled to reduce climate change impacts. These solutions include diversification of livelihood options, early warning systems and use of ICT to provide climate services, smart and sustainable crop and livestock management strategies/practices, alternative renewable energy sources such as solar and wind, preventive measures that reduce the chances of developing heat stress, and overarching regional adaptation governance strategy to tackle borderless climate risk.

### CHALLENGES

In Africa, climate change is negatively affecting agricultural productivity which inhibits rural development. This happens in several ways:

- Weather uncertainty: Climate change is characterised among others by increasing variability that leads to larger uncertainties about future weather (e.g. daily or seasonal rainfall, temperature, etc.) either in the short, medium or long term. These uncertainties lead to inefficient allocation of production resources with direct negative impacts on productivity.
- Environmental changes and pest or disease distributions: Climate change induced environmental changes impact all the production systems, including live-

stock, both directly (e.g., through extreme weather events, lack of grazing or water during droughts, and heat stress), as well as indirectly through changing disease distributions (e.g., altered habitat suitable for disease vectors, such as the midges that carry Bluetongue virus or African Horse Sickness). All this reduces the productivity of livestock and crops.

- Land degradation: Land is a key production asset in smallholder farming systems. Climate change-induced land degradation (e.g. desertification, wind and water erosion, deterioration in vegetation cover, soil salinization, etc.) is one of the leading factors in productivity losses.
- Land grabbing: The increasing investments in biofuels production in many developing countries as a way to address climate change leads to the conversion of croplands to commercial production of biofuel crops. This negatively impacts local food crop productivity of smallholder farms.
- Heat impacts: In Africa, agriculture relies mainly on outdoor farm workers and employs a large proportion of the workforce. Outdoor farm workers are vulnerable to the temperature rises resulting from climate change. They are at risk of heat stress that further affects health, productivity, and rural development.
- Migration: While migration has the potential to be a source of income through remittances, it also affects productivity negatively in the agricultural sector. The migrants are typically the youth and their departure from rural areas implies a reduction of labour availability.
- Food insecurity and conflict rising: As a result of climate variability/change, failure in crop and animal production is expected, which leads to rising conflict in relation to natural resources.

In sum, climate change, agriculture and rural development are closely interrelated. In Africa, climate change negatively impacts productivity through multiple processes. The situation is particularly alarming and needs urgent action in smallholder farming systems where adaptation capacities are limited.

## FACTS AND FIGURES

Agriculture is a key economic sector in African countries, contributing approximately 15% to total Gross Domestic Product (OECD/FAO 2016; World Bank, 2019) and employing more than half of the labour force in many countries (FAO 2020). Future climate scenarios suggest mixed patterns (increases or decreases) for rainfall across the continent, but clear increases in temperature (Schleussner et al., 2018; Serdeczny et al., 2017). Statistics from selected countries suggest the following:

- In Benin, rainfall is projected to show mixed-patterns depending on the agro-ecological zones and the

climate models while temperature will increase by about 2.3°C in 2050 (TCN Benin, 2019).

- In South Africa, climate will probably change as follows: in 2050, the average temperatures will rise 3°C as compared to 1986–2005, whereas, the average rainfall will be reduced by 10% (Smith et al. ,2014).
- In Ghana, average annual temperatures are estimated to increase between 0.8°C and 5.4°C for the years 2020 and 2080 respectively. Within the same period average annual rainfall total is estimated to decline by between 1.1%, and 20.5% (MESTI, 2010)
- In Zambia, the mean annual temperature is projected to increase by a further 1.2 to 3.4oC by the 2060 (MONDP et al., 2016).

These projections are associated with higher uncertainties about weather, environmental changes (e.g. more extreme events such as droughts, floods; shifting of agro-ecological zones, etc.) and high pests/diseases occurrence. These changes alter numerous processes and result in productivity losses. Many parts of Africa already experience weather conditions that challenge productivity. For example, many countries record temperatures that exceed heat stress thresholds of poultry, small and large ruminant animals, leading to reduced production and increased vulnerability to disease and death.

Climate change is also one of the drivers of soil salinization due to increases in evapotranspiration and temperature, and decreases in salt leaching from rainfall. In South Africa, for instance, salt affected soils comprise almost 32% of the country's surface area (FAO, 2015). This percentage is predicted to increase to 42% in 2050 due to the impacts of climate change (FAO, 2015).

With respect to land grabbing, the government of Ghana, for instance, pledged a 45% reduction of emission by 2030 (Republic of Ghana, 2015) and this has triggered over 950,131 ha of land grabs converted into biofuel plantations (Ahmed et al., 2017). The apparent potential of biofuels encouraged smallholders to shift



labour and land from food crop farming to engage in biofuel crops thereby affecting food crop productivity and food security (Gasparatos et al., 2015).

Although there is a need of more evidence, the projected mean annual temperature increases are acknowledged to make farmers more vulnerable to suffering from heat-related illnesses such as heat stress, heat stroke, heat exhaustion, heat cramps, heat rashes and dehydration.

Regarding migration, internal climate migration in Africa grew from 12.5 million in 2000 to 19.4 million in 2017 (UNCTAD, 2018). It is estimated that by 2050, the projected total number of potential climate migrants could be as high as 85.7 million in Africa (World Bank, 2020).

## SOLUTION

A range of solutions and measures can be tested and scaled to reduce the risk of negative climate change impacts on productivity in the agricultural sector in Africa. These include:

- Diversification of livelihood options through sustainable developments: In most African countries, the rural inhabitants heavily relied on natural resources for their living (agriculture). Thus, diversification of liveli-

hood options is crucial to broaden the opportunities under harsh conditions and to decrease the negative impacts on natural resources.

- Development of early warning systems and use of ICT to provide climate services: Early warning systems have the potential to build resilience to climate variability and climate change. The high penetration rate of ICTs in general and particularly of mobile phones in many African countries is a huge opportunity to provide climate services to smallholder farmers.
- Development and adoption of smart and sustainable crop and livestock management strategies/practices: This solution requires management choices that improve crop/livestock health and productivity. These may include smart agricultural practices; improved or adapted seeds breeds or species; adequate soil and water management strategies; techniques to enhance cooling (e.g., provision of shade, water or ventilation for livestock).
- Development and adoption of alternative renewable energy along with appropriate regulation frameworks: Adoption of alternative renewable energy sources such as solar are imperative to reducing demand and competition for land between smallholder farmers and biofuel plantations. This solu-

3



tion also involves establishing land restrictions for biofuels relative to food crop land.

- Development and adoption of preventive measures that can be undertaken to reduce the chances of developing heat stress: These include wearing loose-fitting light clothing, drinking more water, reducing movement, seeking shade, evaporative cooling, using sunscreens, installation of wells for hydration and altering schedules to allow high intensity work in cooler temperatures.
- Development of a regional adaptation governance strategy to tackle borderless climate risk and associated mobilities across SSA: This involves the need for over-arching regional adaptation governance strategy to respond to increasing climate change and associated mobilities.

Climate change impacts in the agricultural sector in Africa is a 'wicked' problem that requires holistic / integrated solutions. In this respect, no one single solution will be sufficient on its own. The over-arching strategies need to encompass integrated approaches to adaptation, involving inputs from climate scientists (who understand the likely hazards), experts in crop and livestock agriculture (who understand the impacts to farm production), social scientists (who understand the impacts to farmers, their livelihoods, family structures, migration options), health experts (who understand the changes in disease distributions and impacts on mental health), and others. Adaptation for improved resilience of African farmers must look beyond crop management alone, and requires a holistic approach that also considers animal health, management practices, species and breed selection, and genetic

selection for disease resistance. The different adaptation options need to be considered and tested, and promising options can be implemented or recommended at scale.

## HOW CAN THE CLIMAPAFRICA PROGRAM CONTRIBUTE TO ADDRESS THE CHALLENGE?

To prevent negative effects of climate change on agriculture in SSA, intra-Africa, interdisciplinary collaboration will be needed to develop workable adaptation strategies.

The DAAD climapAfrica program enables African researchers to test and generate high-quality evidence on all the above-mentioned solutions. For example, in Benin, Rosaine is conducting a study on smallholder farmers' preferences for different climate service platforms. Frederick's research explores the challenges and opportunities for transnational adaptation governance in response to increasing climate mobilities in West Africa. Michelle will be synthesizing the results of a broad range of research, to generate Africa-relevant messages about adaptation options for livestock farmers.

Most importantly, the close collaboration facilitated by DAAD climapAfrica program enables DAAD postdoctoral fellows and alumni to share knowledge, work more efficiently and effectively by means of various outreach activities based around agricultural development in Africa. In addition, this collaboration facilitates collegial relationships between these African scientists. These relationships promote problem-solving, creating a continuous cycle of knowledge generation that can expedite new and creative solutions, and lead to better team performance and overall productivity.

The thematic working groups are composed of postdoctoral fellows and African alumni of German funding initiatives with expertise in the field of climate research. [LINK to climapAfrica working group: Climate change Agriculture and Rural development](#)

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[LINK to profiles of all climapAfrica alumni experts of this working group](#)

### PHOTOS AND GRAPHICS

- 1 CA field maize intercropped with velvet beans © taken by Lydia as part of Livestock/Crop integration research financially supported by FAO |
- 2 CA field maize crop planted in rip lines © taken by Lydia as part of Livestock/Crop integration research financially supported by FAO |
- 3 Healthy crop stand in a conservation agriculture field © [http://www.fao.org/fileadmin/user\\_upload/emergencies/img/ph-zim-907-ec.jpg](http://www.fao.org/fileadmin/user_upload/emergencies/img/ph-zim-907-ec.jpg)



# FOCUS ON CLIMATE CHANGE MITIGATION STRATEGIES TO IMPROVE RESILIENCE IN FOOD/FODDER AND CASH CROPS/SPECIES (SORGHUM, COWPEA, COCOA AND ANDROPOGON GAYANUS) IN WEST AFRICA

## FOCUS AREA

Improved mitigation strategies of plants in the context of climate change. Evidence from some food/fodder and cash crops (sorghum, cowpea, cocoa and Andropogon gayanus) in West Africa

## CHALLENGES

Sorghum, cowpea and cocoa are crops grown for human consumption, animal feeding or energy production, and are also used as cash crops providing important income for farmers in West Africa. Andropogon gayanus is herbaceous species of savannah ecosystems in West Africa commonly used for livestock feeding. Moreover, the fodder species (*Moringa oleifera*, *Leucaena leucocephala*, *Newbouldia laevis*, etc.) is used as an alternative in livestock feeding and care as substitutes to conventional chemotherapeutic drugs. All these crops/species are facing climate worsening effects resulting in limited water access for agricultural production. Drought stress affects the crop/species de-

pending on the developmental stage, its severity, the duration of the stress and the species itself. Drought stress can dramatically affect yield and even causes a total failure of the crop. In sub-Saharan Africa (SSA), the effect of this stress becomes severe because of low soil fertility.

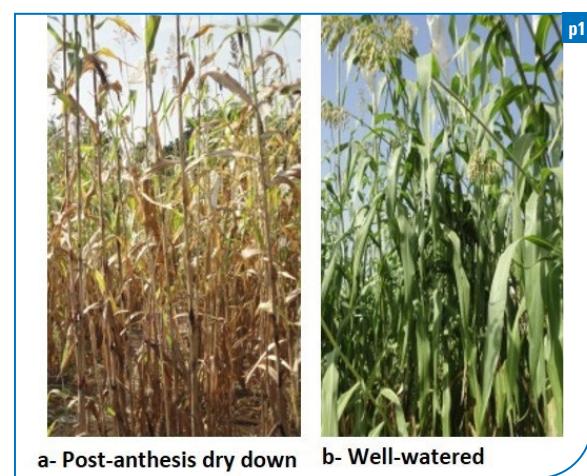
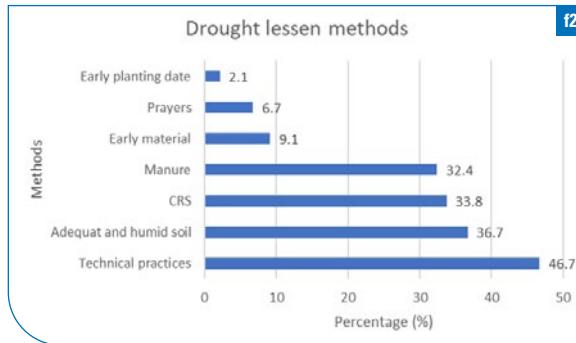
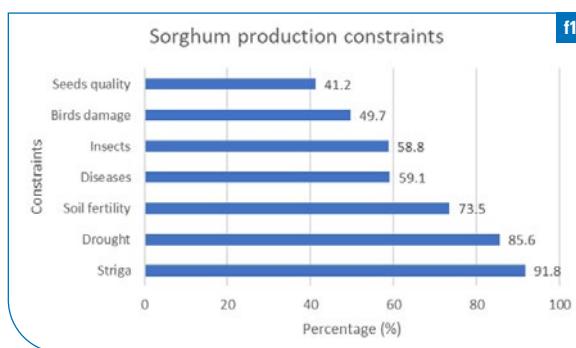
Therefore, it is crucial to identify new strategies to reduce drought effects on these crops/species in order to achieve better production in West Africa.

## FACTS AND FIGURES

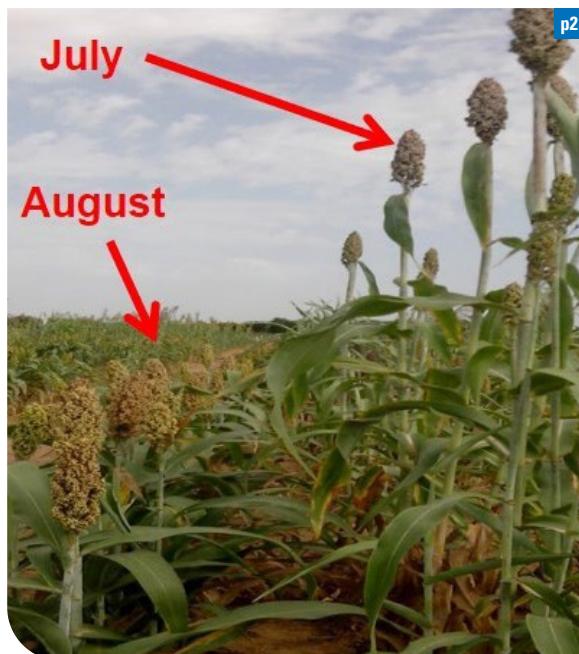
### Multipurpose sweet sorghum

In West Africa, drought is among the most severe constraints impairing sorghum cultivation. It is ranked by the farmers as the second most important constraint related to sorghum cultivation in Burkina Faso (Figure 1) (Ouedraogo et al., 2017). To combat drought, the farmers declared mostly using adequate and humid soil, technical practices (hand weeding, hoe weeding, hillling) and soil conservation and restoration practices. Few of them declared using early planting, early material and prayers (Figure 2).

In Senegal, in 2013 and 2014 we conducted field experiments testing twelve sorghum varieties with similar phenology, submitted two sowing dates (July & August) and two post flowering water treatments (irrigated, non irrigated) (Photo 1). Our results showed that late sowing date led to the reduction of sugar and grain



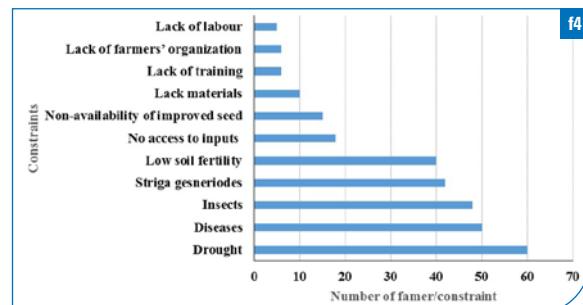
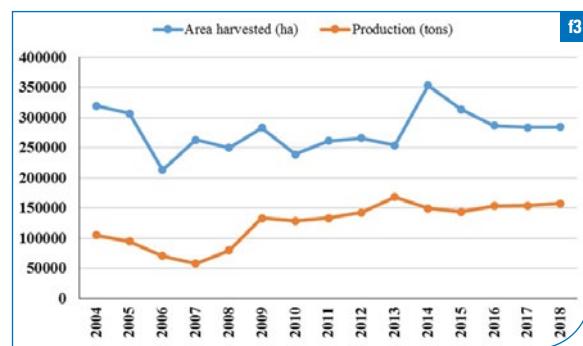
production more than post-flowering drought, whereas early sowing enhanced both types of production (Photo 2). No post-flowering competition was found between grain filling and stem sugar accumulation. However, under drought conditions, the maintenance of combined production was better for the most leaf stay-green varieties.



### Cowpea cultivation in West Africa

Based on the last 15 years' FAO data, there were some fluctuations for both cowpea production and harvested areas in Mali with decreasing of number of hectares exploited and amount of grains produced from 2013 and 2014, respectively (Figure 3).

Survey conducted within villages from two growing districts of cowpea, Ségou and Koutiala, revealed drought as a major constraint preventing farmers from getting acceptable yield from their cowpea field followed by diseases, insects, *Striga gesnerioides* and low fertility



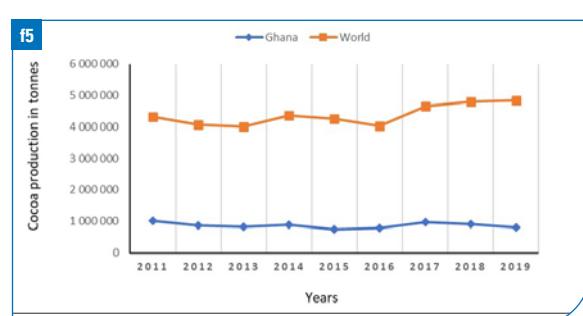
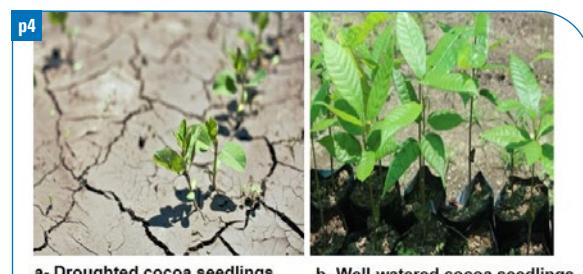
(Figure 4). The drought level emphasizes the incidence of these last factors.

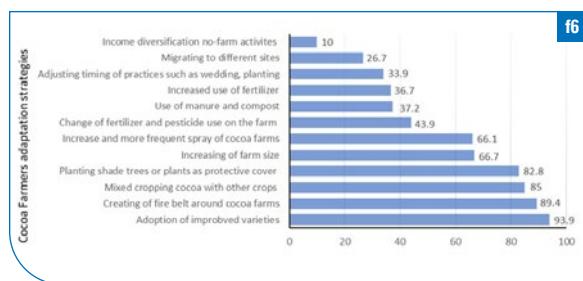
These two figures show the importance of improving cowpea adaptation to drought stress, as higher levels of drought incidence is becoming a more severe constraint to cowpea production in SSA due to climate change.

### Cocoa cultivation in West Africa

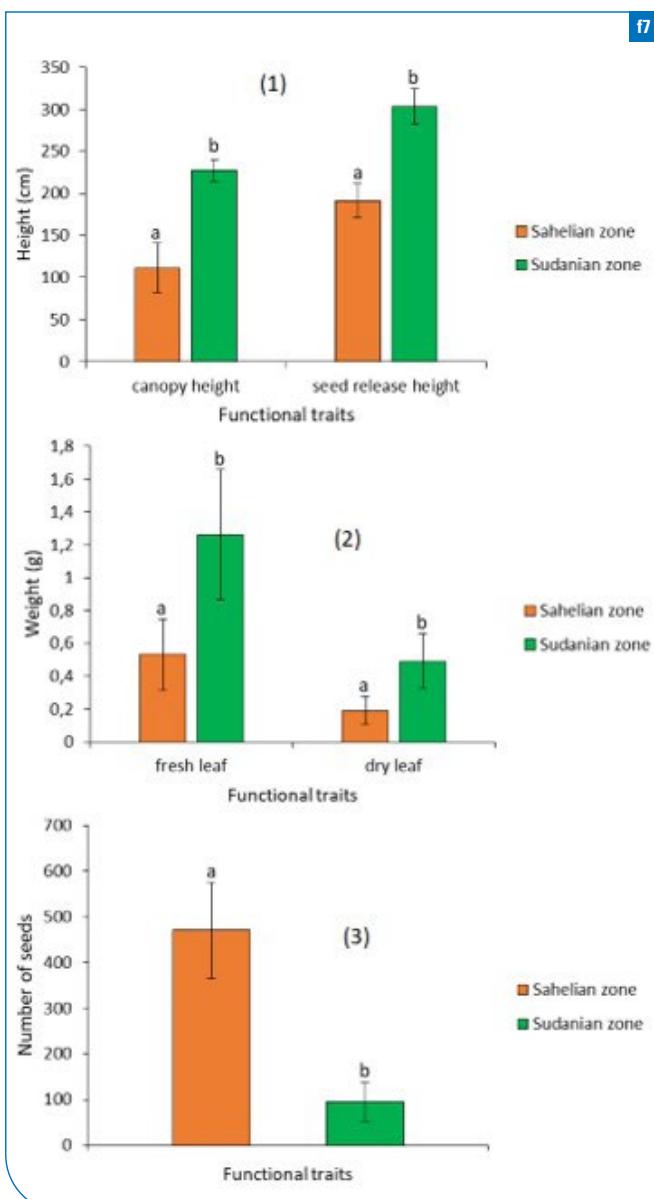
Côte-d'Ivoire and Ghana are by far the two largest producers of cocoa in the world. Ghana is the second largest producer and its production accounts for 21% of the world's cocoa beans and employs over 6 million Ghanaians (Figure 5).

Climate change is predicted to cause a drastic decrease of climatic suitability for cocoa in current growing regions of Ghana (Photo 4). Cocoa farmers have resorted to different adaptation strategies to help cope with the impact of climate variabilities. Among these strategies,





the most used are adoption of improved varieties, creating of the fire belt around cocoa farms, mixed cropping cocoa with other crops, and planting shade trees or plants as protective cover (Figure 6).



## Development of *Andropogon gayanus*

In Burkina Faso, the field data collection shows the decrease in the performance of the functional traits related to the fresh and dry weight, the canopy height and the diasporae release height in Sahelian dry conditions compared to the Soudanian zone (Figure 7). However, the species is found to produce more seeds under dry conditions in the Sahelian zone than under wet conditions in the Sudanian zone (Photo 5).

## SOLUTION

The mitigation strategies to climate change are varied and depend on the context and choice of each project:

### Multipurpose sweet sorghum

Taking into account photoperiod-sensitivity by applying early-sowing date to produce important biomass before anthesis and the use of stay-green genotypes to allow the plant to keep performing photosynthesis and fill directly the panicle using the carbon assimilates from the photosynthesis instead of remobilizing the carbohydrates from the stem.

### Cowpea

Development of new cowpea lines tolerant/resistant to drought with farmers' preferred traits in addition to the use of Zai (A) and Half-moon (B) techniques (Photo 6) for rainwater holding could increase cowpea production in SSA. Water-holding techniques associated with organic fertilizer application, such as compost, will maintain soil humidity for a long time. Growing new varieties of cowpea tolerant/resistant to drought with dual purpose - grain and fodder - will increase farmers' income and reduce the cost of their livestock feeding.

### Cocoa

Potassium (K) fertilizers application as biostimulant to enhance cocoa seedling resilience to drought. K is involved in activating a wide range of enzyme systems that regulate photosynthesis, water use efficiency and movement, nitrogen uptake, and protein-building in plants.

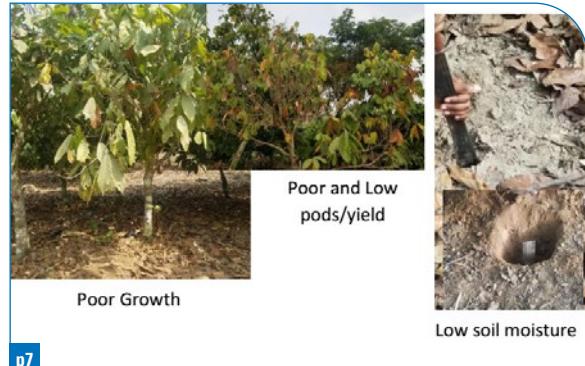
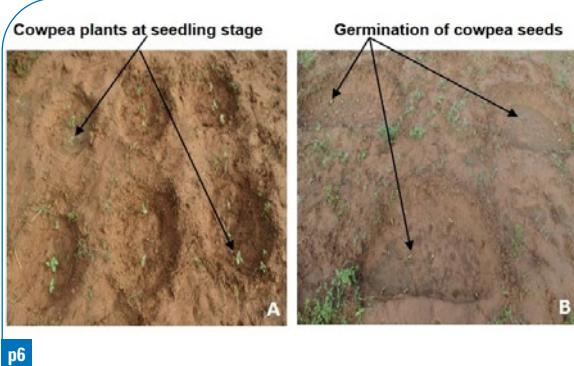
### *Andropogon gayanus*

To combat drought, the species produces more seeds, which allows it to ensure its sustainability in drier conditions. Therefore, it provides perspectives on the cultivation pathways of *Andropogon gayanus* in the semi-arid areas as a high fodder species.

### Plant phytochemical constituents: alternative in livestock production.

The delayed onset of rainy season and associated increased temperature may allow the emergence of new diseases through adaptation mechanism. In this case, most of the conventional drugs (anthelmintic and antibiotics) are constantly losing efficacy.

The use of the fodder species (*Moringa oleifera*, *Leucaena leucocephala*, *Newbouldia laevis*, etc.) in livestock



feeding provides substitutes for conventional chemotherapeutic drugs through their phytochemical constituents like flavonoids, saponin and tannin with anthelmintic, antioxidants and antidiarrheal etc.

### HOW CAN THE CLIMAPAFRICA PROGRAM CONTRIBUTE TO ADDRESS THE CHALLENGE?

The ClimapAfrica program has created an opportunity for us to meet and interact with colleagues, alumni and stakeholders on climate change related topics. In addition, the training and capacity building pro-

grammes organized by the various DAAD ClimapAfrica working groups have been beneficial to us. This diverse expertise has been beneficial in enhancing our knowledge and creating the opportunities to improve our research approach, methods and parameters that we intend measuring as indicators of resilience to climate change. In addition, we have an opportunity to disseminate our research findings and share our opinion on the DAAD ClimapAfrica program website, which can be accessed by a wider scientific community made up of researchers, policy makers and stakeholders in the climate change sector.

The thematic working groups are composed of postdoctoral fellows and African alumni of German funding initiatives with expertise in the field of climate research. [LINK to climapAfrica working group: Climate change Animal and Plant Physiology and Stress](#)

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[LINK to profiles of all climapAfrica alumni experts of this working group](#)

### PHOTOS AND GRAPHICS

f1: Constraints impairing sorghum cultivation in Burkina Faso (Ouedraogo et al., 2017) | f2: Drought adaptation methods used by the farmers for sorghum cultivation in Burkina Faso (Ouedraogo et al., 2017) | p1: Droughted vs well-watered plants of sweet sorghum grown in Senegal (Tovignan et al., 2016) | p2: Early sowing increases the multipurpose ability of sweet sorghum and contributes to reduce drought stress effects on the crop (Tovignan et al., 2016) | p3: Field of IT97K-499-35 under normal growing condition in Mali (Doumbia et al., 2018) | f3: Yearly area harvested (ha) and production (tons) of cowpea in Mali (Doumbia et al., 2020) | f4: Different constraints of cowpea production from two districts (Ségou and Kouïlou) in Mali (Doumbia et al., 2015) | p4: Droughted vs well-watered cocoa seedlings grown in Ghana (Kaba et al., 2019) | f5: Global and Ghana cocoa production and exports from 2011-2019 (Source: Bangmarigu and Qineti, 2018 and Yamoah et al., 2020) | f6: Climate change adaptation measures used by cocoa farmers in Ghana (Source: Osei, 2017) | p5: Andropogon gayanus communities showing more seed in the Sahelian area (A) than in the Sudanian area (B) of Burkina Faso (Zerbo et al., 2018) | f7: Impact of rainfall on the functional traits of *Andropogon gayanus* (Legend : Levels with different letters indicate significant difference) | p6: Zai (A) and Half-moon (B) techniques to hold rainwater for cowpea production in Mali (Doumbia et al., 2020) | p7: Effect of drought caused by climate change on cocoa growth and soil under field conditions (Kaba et al., 2019)



# ADDRESSING CLIMATE CHANGE IN AFRICA: CHALLENGES AND THE WAY FORWARD FOCUS ON BIODIVERSITY AND ECOSYSTEM FUNCTIONING



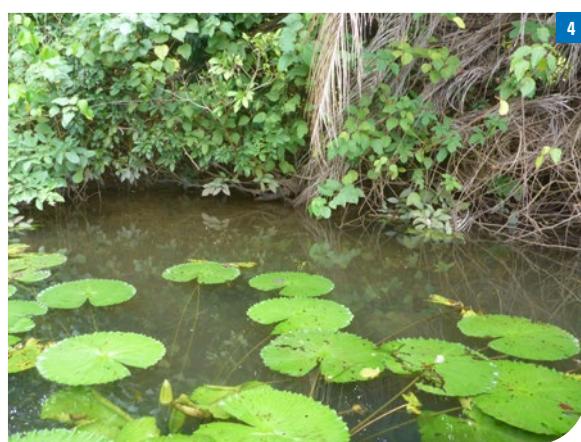
## FOCUS AREA

- (1) Understanding the effect of climate change on biodiversity and ecosystem functioning ('BEF');
- (2) Catalyzing biodiversity knowledge production that can guide policy makers and civil society to effectively participate in sustainable management;
- (3) Engaging and supporting early career scientists and students to study climate change and its effect on biodiversity and ecosystems, as the number of specialists and resources is currently limited.

To reduce or decelerate these adverse effects and ensure a functioning ecosystem, understanding biota (plants, animals, macro-/micro-organisms, humans), it is vital to be able to understand the responses to climate stressors and predicting future effects of the stressors on ecosystem management and restoration.

## CHALLENGES

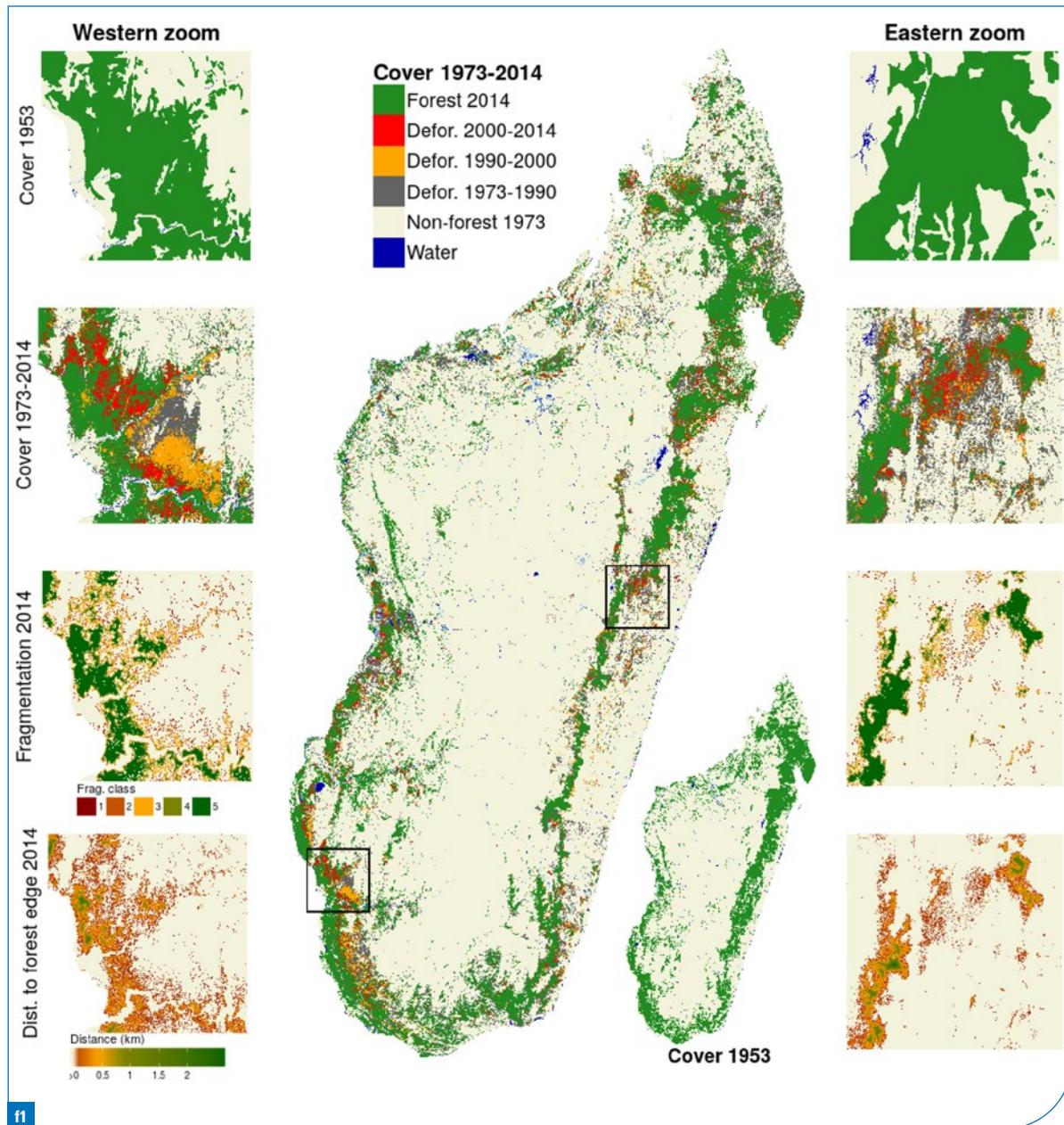
Africa's terrestrial, freshwater and marine ecosystems and their biodiversity are especially threatened. Ongoing loss of biodiversity in Africa is driven by a combination of human-induced factors (including poverty). The continent continues to experience deforestation and forest degradation at alarming rates. The negative impacts of climate change on species and ecosystems are exacerbating the effects of all these pressures.





However, in most African regions, there is a disproportionately large lack of specialists and little effort has been made to promote research to tackle climate change and its effect on BEF, this is mainly due to lack of resources and funding.

Furthermore, in many African countries, data mobilization and dissemination to catalyse knowledge production remains insufficient. Such an effort can guide policy makers and civil societies to effectively participate in sustainable management.





## FACTS AND FIGURES

### Biodiversity loss, case of Madagascar

Madagascar's land cover has undergone big changes over the past decades. Madagascar has lost 44% of its natural forest between 1953 and 2014 (Figure 1). Many of the main drivers of change affecting forests, biodiversity and environmental problems are man-made. Madagascar is a global biodiversity hotspot, with some of the highest levels of diversity and endemism on the planet. Its forests are among the most biologically rich, unique and highest conservation priorities in the world (Figure 2, 3).

The main key reasons for biodiversity loss in Madagascar are:

(1) Deforestation and habitat destruction:

- slash-and-burn agriculture for the cultivation of cash crops;
- logging for timber, this is especially a problem in the eastern rainforests of Madagascar;
- fuelwood and charcoal production.

(2) Overexploitation of living resources:

- hunting and collection of endemic species including lemurs and reptiles;
- fishing Is poorly regulated, harvesting of many endemic marine fauna is increasing at a very unstable rate (<https://www.wildmadagascar.org/conservation/threats.html>)

(3) Introduction of alien species has doomed many of Madagascar's endemic species.

## SOLUTION

We at the WG Climap Africa BEF is working toward: Promoting research related to climate change and its effect on biodiversity and ecosystems on the region (terrestrial and aquatic):

- Understand the primary climatic drivers in ecosystem type(s) and how they affect biotas.

- Understand and predict ecosystem services, species diversity and distribution pattern under climate change scenarios.
- Elucidate the direct and indirect climatic drivers and their impact on ecosystems and sociocultural behaviour and health of people.
- Promoting knowledge on biodiversity for policy development via a stakeholder dialogue workshop, providing managers and policy makers with useful tools for the management of African ecosystems.
- Promoting and/or improving synergy among researchers by facilitating information sharing on research, recent findings and advancement.

WG Clim Africa BEF must be the voice of the youth in Africa

Work and facilitate the contributions of African early career scholars in a hot and sensitive research topic linking biodiversity and climate change, thereby giving postdocs and alumni scientists a voice in global assessments of biodiversity and ecosystems in the Africa region on renounced platforms like the Intergovernmental Science Policy platform on Biodiversity and Ecosystem Assessment (IPBES), the Intergovernmental Panel on Climate Change (IPCC), the Centre for International Forestry Research (CIFOR), and the United Nations Program on Reducing Emissions from Deforestation and Forest Degradation (UN-REDD).

## HOW CAN THE CLIMAPAFRICA PROGRAM CONTRIBUTE TO ADDRESS THE CHALLENGE?

Facilitate the creation of a network of specialists, early career scholars and students based in Africa; and promote collaborative work amongst researchers in the region and specialists from around the globe. Facilitate the promotion and advertisement of each WG group members and their projects using ClimapAfrica program's platform. It is important to showcase to the international community ongoing projects led by each member.

In terms of capacity building, facilitate the mentoring of young scientists with special interest in climate science and biodiversity conservation in the region.

Facilitate the contribution of this WG to ongoing efforts and collaborative work tackling biodiversity loss in Africa, for instance "The Strategic Plan for Biodiversity 2011-2020 and its Aichi Biodiversity Targets"

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The thematic working groups are composed of postdoctoral fellows and African alumni of German funding initiatives with expertise in the field of climate research. **[LINK to climapAfrica working group: Climate change Biodiversity, Ecosystems and Forests](#)**

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**[LINK to profiles of all climapAfrica postdocs fellows of this working group](#)**

**[LINK to profiles of all climapAfrica alumni experts of this working group:](#)**

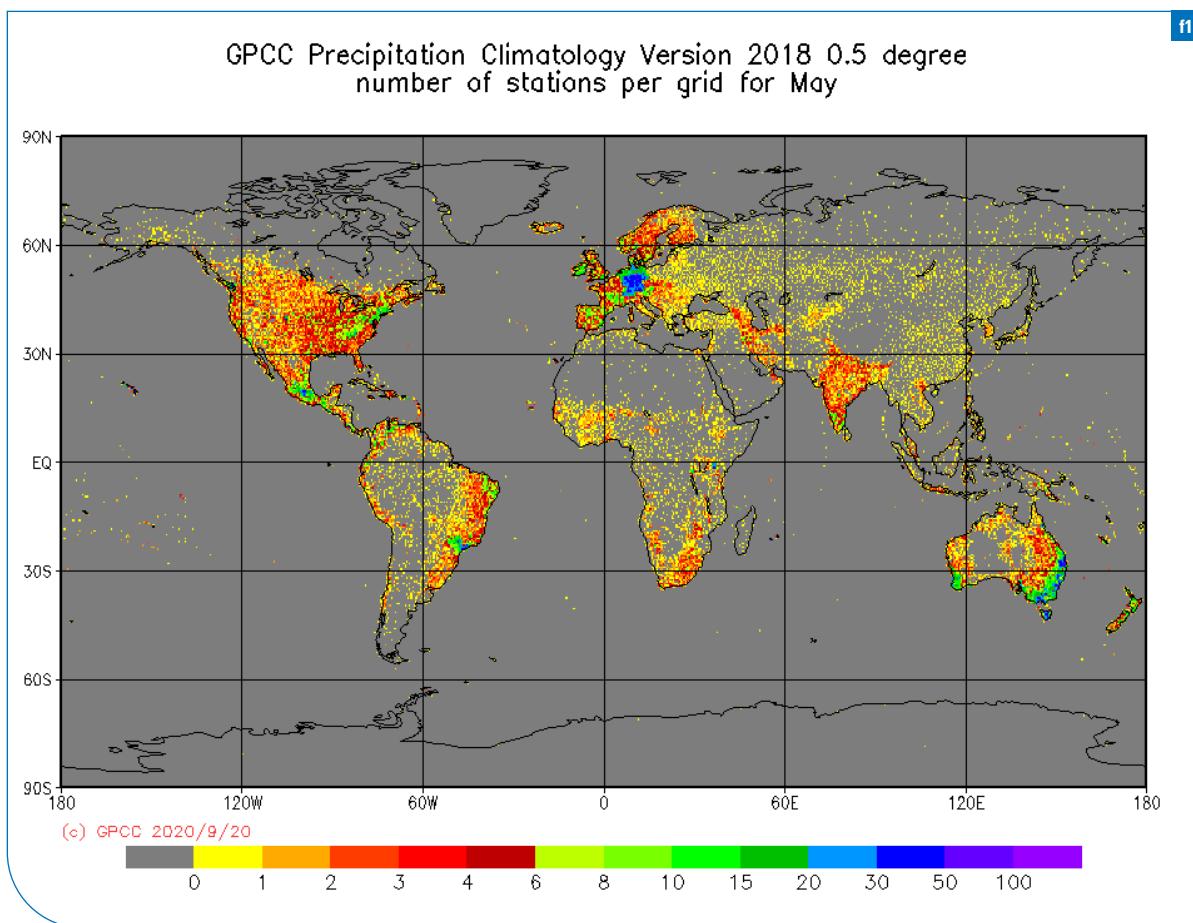
The alumni of this working group are currently being determined.

#### PHOTOS AND GRAPHICS

p1: Village at the edge of Marojejy National Park, North-eastern Madagascar ©Jurgen Kluge | p2: Tsingy formation in Ankarana National Park, Northern Madagascar ©Lova Marline | p3: Population of Baobab (*Adansonia grandiflora*) near Morondava, western Madagascar ©Lova Marline | p4: Volta Lake, Akosombo Gorge Area, southeastern Ghana ©Lailah Gifty Akita | p5: Woodlands in Bicuar National Park, Huíla province SW Angola ©Francisco Gonçalves | p6: Forest cover change from 1953 to 2014 in Madagascar. Main figure: Forest cover changes from 1973 to 2014; bottom-right inset: forest cover in 1953; left part: zoom in the western dry and right part: zoom in eastern moist (Source: Vieilledent et al. 2018) | p7: Aerial view of woodlands in Bicuar National Park, SW Angola ©Francisco Gonçalves



# RESOLVING CHALLENGES ASSOCIATED WITH CLIMATE CHANGE MODELLING IN AFRICA



## FOCUS AREA

For the practical planning of local issues such as rain-fed agriculture, water resources availability and flood management, African countries need information at a local scale. Recent approaches for obtaining high spatial resolution information are downscaling techniques:

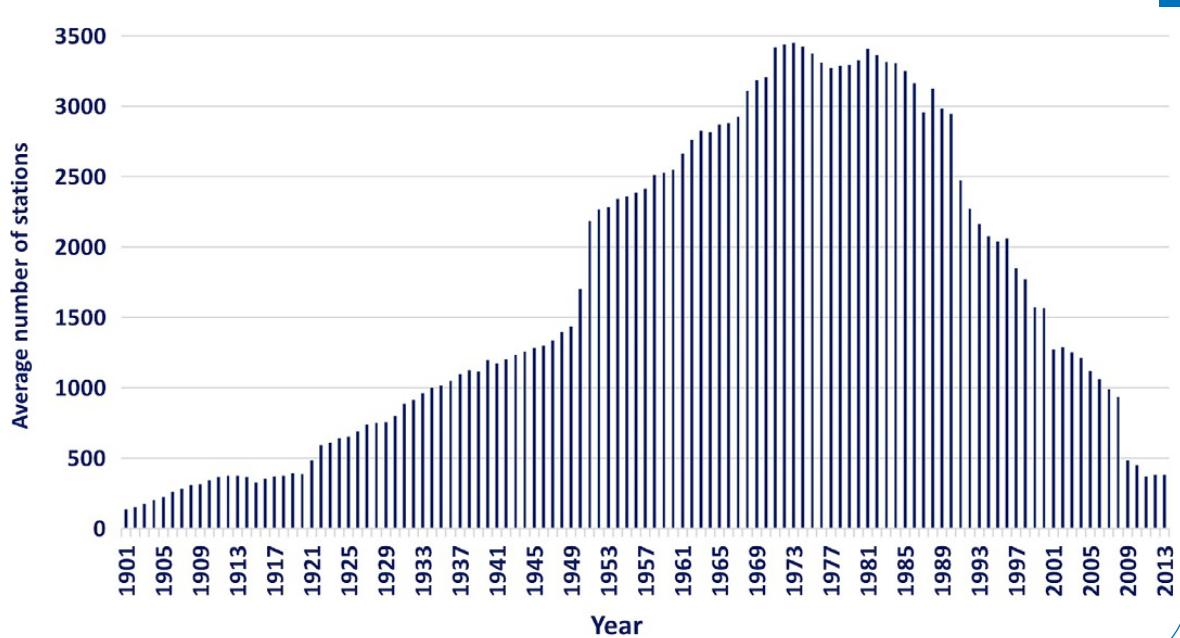
- Statistical downscaling methods, which consist in making an empirical observation-based link between large-scale variables, also called predictors, and local variables called predictants;
- Dynamical downscaling methods, which are based on the use of regional climate model (RCMs). In fact, this method consists in using the outputs of a global climate model (GCM) as boundary conditions to drive the RCM.

## CHALLENGES

The GCMs are the most widely used instruments so far for studying the impact of climate change in several regions of the world. Generally, these models adequately

simulate climate parameters in the present at a global scale. Despite the fact that during the second half of the 20th century, GCMs have proven their ability to reproduce general rainfall trends, they may still have significant limitations in simulating the processes that modulate climate at the regional scale. One of the main limitations of GCMs is the relatively coarse horizontal resolution (~100-300 Km), which affects their ability to predict climate variability in detail and consequently provide limited information about the impacts of climate change at a regional scale. Because of their high resolution (~10-50 Km), regional models offer a solution to this problem by allowing a better capture of local atmospheric phenomena, which plays a role in reducing uncertainties in the prediction of future climate. If we take the case of the simulation of heat stress in Central Africa, it is evident that, contrary to the GCM results, those of the RCM allow for the observation of more details by allowing for the appreciation of all the different categories of stress that may exist in the region, as well as their spatial extent.

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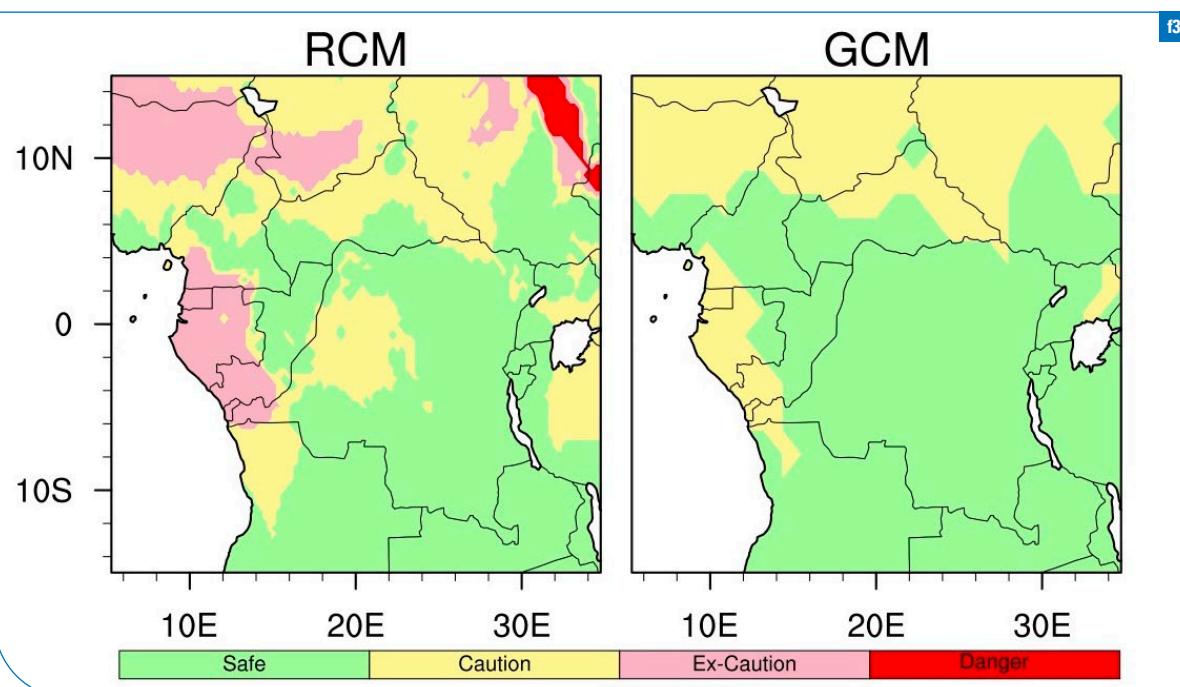


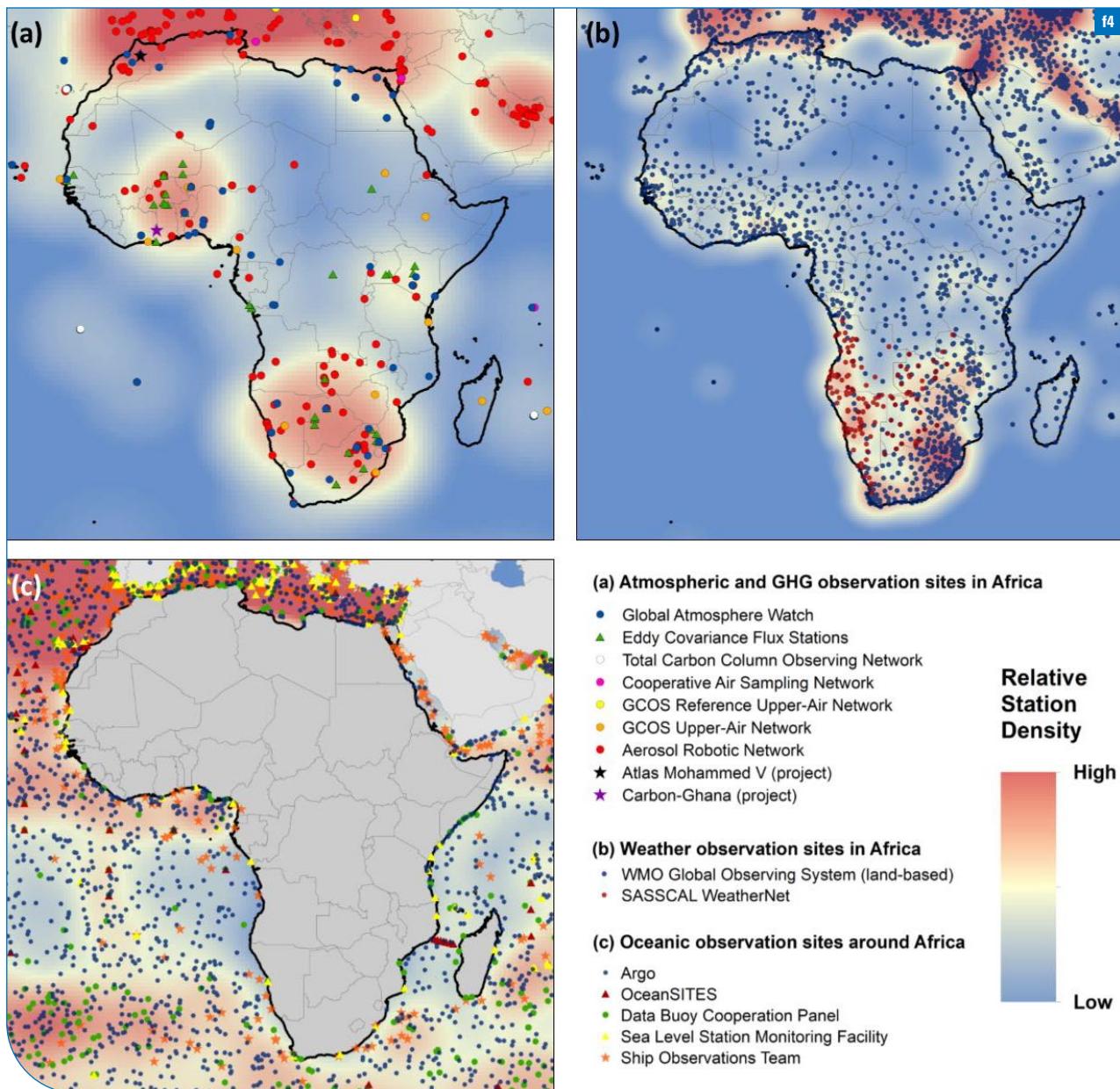
## FACTS AND FIGURES

The African continent has a very low density of rain gauge stations, and long-time-series for recent years are often limited and poorly available. Thus, the scarcity of quality data is one of the main limiting factors when attempting to assess climatic conditions and changes across the African continent. The primary source of most climate data in Africa is through a network of weather stations, which are scattered disproportionately across the landscape. As of October 2018, of 162 active earth observation missions for non-commercial and non-military use in the database of earth observation satellites only 103 could provide potentially relevant environmental data for the African continent and the surrounding oceans (Beck et al, 2019). Moreover, most stations are concentrated in or near major cities

or easily accessible locations, disregarding regions with rough or inhospitable terrain - e.g. mountains and deserts. Additionally, this observational network can be poorly maintained and rarely serviced, mostly due to limited investment in the respective country's climate infrastructure (Dinku 2019). The historical data gathered from this network covers only a few decades, in good cases, and are typically riddled with missing information, incorrect capture, and incomplete conversion between the metric and imperial system. Alternative options to the observation network include satellite data or such proxies. The storage of this data is usually undertaken by the relevant government branch or even by private groups, which introduces accessibility challenges, either through legal restrictions, lack of knowledge of the pertinent branch that hosts the data

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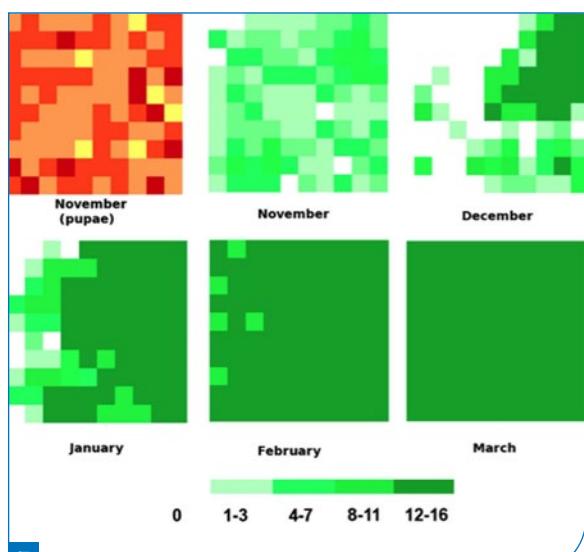
repository, and/or high access costs (Dinku 2019). Thus, sharing of data beyond the initial user is rather limited. Furthermore, due to low financial investment, the availability of the latest products and tools is minimal, leading to a lack of dissemination of skills.

## SOLUTION

Many practices can be used to deal with the challenges associated with obtaining data for climate change modelling:

- First, the density of the stations in developing countries, specially sub-Saharan African (SSA) countries has to be increased, so that observational historical climate data can be more accurate. This would ease modelling works such as assessment of heat stress, modelling of diseases, economic modelling, crop modelling, etc., in such a way as to account for small geographic units. For instance, crop modelling requires daily weather data such as minimum temperature, maximum temperature, solar radiation, and rainfall.

- Second, there could be an improvement in the understanding of physical processes.
- Third, data assimilation methods could be improved.



- Fourth, the spatial resolution of the regional climate models can be increased to yield data for finer geographic units. This would be achieved through heavy investment in climate modelling. The representation of the most energetic processes is made possible through high spatial resolution. Modelling requires future climate data with respect to different climate scenarios. Thus, high resolution climate data are of paramount importance to capture the specificities of the various geographic units. However, increase in spatial resolution in climate models is not to be at the expense of superior simulations.

## HOW CAN THE CLIMAPAFRICA PROGRAM CONTRIBUTE TO ADDRESS THE CHALLENGE?

climapAfrica program can contribute to solving this challenge in the following ways:

- climapAfrica program can help sponsor and organize stimulating workshops that focus on identifying the specific sources, where specific kinds of data for climate change modelling can be found.
- climapAfrica program can also assist in inviting top scientists from German higher institutions, with specialization in different types of climate modelling research areas, to deliver online seminars and workshops to all the climapAfrica Work Groups (WGs). Such workshops

Dataset	Spatial extent	Temporal extent	Data input	Spatial resolution	Temporal resolution
GPI	40°N - 40°S	1986 - present	TIR	2.5°	Monthly
GPCP	Global	1917 - present	TIR, PMW, gauge	2.5°	Pentad, monthly
NOAA-CPC ARC	40°N - 40°S 20°W - 55°E	1983 - present	TIR, gauge	0.1°	Daily
CHIRPS	50°N - 50°S	1981 - near present	TIR, gauge	0.05°	Pentad
TAMSAT	Africa	1983 - present	TIR, gauge	0.0375°	Dekadal

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and seminars will focus on how to identify specific sources of hidden but publicly-available sources of scarce climate change modelling data, share knowledge about how to implement methods to extract such kind of data, share learning on the necessary software to analyse such data, and advise on how to interpret the results generated or produced by such software.

- climapAfrica program can also encourage different WorkGroups (WGs) to collaborate on ethical data sharing and interdisciplinary and cross-disciplinary research collaborations.
- climapAfrica program can also promote exchange programs among different WGs in order to encourage innovative climate change modelling approaches and data usage.

The thematic working groups are composed of postdoctoral fellows and African alumni of German funding initiatives with expertise in the field of climate research. [LINK to climapAfrica working group: Climate change and Modelling](#)

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[LINK to profiles of all climapAfrica alumni experts of this working group](#)

## PHOTOS AND GRAPHICS

f1: Number of stations per 0.5° grid box for May 2020 worldwide used in Global Precipitation Climatology Project (GPCC). Map is generated using GPCC's Visualizer, <https://kunden.dwd.de/GPCC/Visualizer> | f2: Time series of average number of stations used in the GPCC full-data product over Africa (15°W–45°E and 30°S–30°N): Source: Dinku, 2019 | f3: Spatial distribution of heat stress categories over Central Africa for the 1986–2005 period | f4: Observational sites of selected net-works and their relative density for (a) ground-based atmospheric and greenhouse gas, (b) ground-based meteorological and (c) oceanic observation on and around the African continent. Note that the operational status of each station has not been taken into account since this information was not available for all networks (Beck, et al 2019) | f5: Model Simulation run results for Anopheles female adult mosquito dynamics over a 10X10 grid from the onset to the peak of the wet season. First box represents initial pupal distribution among properties. Source: Oluwagbemi et al., 2013 (Legend for f5: Predictions from AnoSpEx Model about mosquito population, distribution and dynamics over a 10X10 grid; the model was driven by weather station-collection data (temperature(minimum, maximum, average), relative humidity, saturation deficit, etc)), based in the Johns Hopkins Malaria Research Institute (JHMRI) malaria research field station and training center Macha, Zambia)



# TOWARDS INDIGENOUS KNOWLEDGE INTEGRATION IN CLIMATE CHANGE: PROSPECTS FROM A MULTIPLE EVIDENCE APPROACH



## FOCUS AREA

Within the climate change research community, there is now growing acknowledgement of indigenous knowledge (IK) in climate impact assessment, mitigation and adaptation. An important lesson emerging from this recognition is the need to integrate IK in mainstream climate science. However, as this agenda unfolds, the nature, level and process of integration is still shrouded in controversy. While some authorities favour a citizen science approach (e.g., Conrad & Hilcay 2011; Dickinson et al. 2012; Reyes-Garcia et al. 2020), others push for more radical emancipatory and decolonial methodologies that see IK as legitimate in its own right (Odora-Hoppers 2002; Mertens 2003; Chanza & de Wit 2013). Given the peculiarity of climate change as a field of enquiry and the complexities of IK from the diverse environments in which the knowledge is understood and applied, there is need for an approach that makes IK more acceptable on the scientific front while remaining judicious in the eyes of the holders of this knowledge. We propose the use of the multiple evidence approach (MEA) as a way to strengthen the recognition of IK in climate change science. Referred to as 'visibilist' approach (Reyes-Garcia et al. 2016; Smith et al. 2017), this paradigm argues that climate change is visible to local indigenous populations and can be tracked based on their personal experiences with climatic phenomena. Aside from guiding the meaningful participation of indigenous people in climate change research, this approach ensures that the knowledge held by people witnessing climate change can be utilised to enhance understanding of climate change from impact



identification, mitigation and adaptation to the design of effective and adoptable climate change projects.

## CHALLENGES

Africa is one of the regions already experiencing, and projected to experience, serious climate change impacts largely owing to underlying non-climatic drivers of vulnerability (IPCC, 2014). Among the entrenched drivers of exposure to the negative effects of climate change, is the knowledge and institutional deficiencies in giving appropriate climate information services. This problem largely emanates from data imprecision and gaps, which are often based on coarse-grained resolutions from a few isolated stations, some of which still use obsolete equipment. In some remote areas in Africa, climate infor-

mation rarely gets to the intended recipients. Ironically, most of these places not adequately covered by existing climate studies and conventional climate information services are inhabited by several groups of indigenous people who have rich knowledge about their local climates from their many years of constant interactions with the environment. These communities perceive their indigenous climate knowledge as reliable and more practical, and tend to disregard or trivialise the information they get from outsiders. On the contrary, technical personnel from government and development partners use the knowledge they acquire from formal institutions, which they regard as scientific and valid. As a result, climate change interventions driven by outsiders may face some resistance. Unless workable approaches that break this impasse are understood, the praxis of climate mitigation and adaption will remain a challenge. Apparently, methodological approaches of working with indigenous people are still being contested and some are not robust enough to ensure meaningful participation and contribution of the knowledge holders themselves.

## SOLUTION

There are promising and empirical practical approaches for the use of IK in the broad field of climate change science. These include early integration in education systems and citizen science and multiple evidence approach. The former is the means towards realising the multiple evidence approach (MEA), while the latter is an example of knowledge hybridization in practice. MEA is given closer attention here:

a. IK integration in the education system. The integration should be done early enough in the education system to ensure that IK is given similar weight in informing the knowledge of climate science. Within this approach, the methods of IK enquiry that observe the sensitivity and uniqueness of this knowledge form ought to be developed and taught to ensure adequate recognition of IK. Huntington (2000) proposes that such methods could include collaborative field projects, semi-directive interviews, stakeholder networks and facilitated workshops. Chanza and de Wit (2013)



## FACTS AND FIGURES

There are several empirical examples of proven knowledge hybrid areas from the co-creation of knowledge to its application in the field of climate change. These cover the broad areas of climate impact assessment studies, mitigation and adaptation (see Table 1).

discourage a hasty and ad hoc approach in indigenous science inquiry, warning that such practices would result in IK being viewed as unscientific and therefore, easily dismissed; the knowledge may remain largely partially understood, and may fail to give any practical directions to policy implementation; and generators of the knowledge could remain underrated.

f1



b. Citizen science. The concept is defined by Conrad and Hilchey (2011) as a process whereby citizens are involved in science as researchers. When applied to the field of climate change, citizen science suggests that local populations experiencing and observing climatic phenomena should collaborate with climate scientists to study impacts of climate change and design response strategies and projects that are appropriate in their local contexts. The concept has been understood as a public good that is generated through increasingly collaborative tools and resources, while supporting public participation in science and Earth stewardship. The key aspects of citizen science relevant in climate science are shown in Figure 1.

c. The multiple evidence approach (MEA). MEA assumes that perceptions and observations of local communities experiencing climate change are legiti-

Field of application	Description of IK practices	Potential for integration	Study Area/Source
<b>Impact identification</b>	Local weather conditions and signs Animals, birds and insect behaviour/signs Astrological constellations/signs Signs from the local environment Signs from flora	Improved impact studies	Kenya (Speranza et al 2010) Zimbabwe (Chanza 2014) Uganda (Orlove et al 2010)
<b>Adaptation</b>			
<i>Use of traditional grains</i>	Traditional grains (sorghum, millet) are drought tolerant and accessible	Enhanced climate change resilience Enhanced adaptive capacity	Togo ( Adoukonou-Sagbadja et al 2006) Zimbabwe (Chanza 2015)
<i>Adjustments in farming practices</i>	Planting drought resistant crops and seed s, planting early maturing crops, and stopping to sell their stored grains	Enhanced climate change resilience Enhanced adaptive capacity	Kenya (Speranza et al 2010) Zambia (Mubaya 2010) Zimbabwe (Chanza 2015)
<i>Use of traditional livestock varieties</i>	Indigenous breeds of animals (goats, sheep, cattle, chickens) that can withstand high temperatures and have wider geographic range	Enhanced resilience Enhanced adaptive capacity	East Africa (Radeny et al 2019)
<i>Indigenous food collection &amp; processing</i>	Fruits from trees which grow naturally in the forests or wilderness (e.g., the African shea, <i>Vitellaria paradoxa</i> in Burkina Faso & Gambia, <i>Aadansonia digitata</i> in Zimbabwe & Malawi, <i>Uapaca kirkiana</i> and <i>Ziziphus mauritiana</i> in Zimbabwe, <i>Sclerocarya birrea</i> in South Africa, <i>Tamarindus indica</i> in Kenya, Malawi, Uganda & Senegal)	Enhanced resilience Enhanced adaptive capacity	Nigeria (Akaijaku et al 2014, Van der Stege et al 2011) Uganda (Ebifa-Othieno et al 2017) Zimbabwe ( Nyanga et al 2008) South Africa (Wynberg et al 2003)
<i>Use of ash for grain storage</i>	Ash as a grain preservative chemical has a widespread usage among some indigenous African communities. E.g., maize cob ash contains certain natural salts which become toxic for growth and habitation of weevils	Enhanced resilience Enhanced adaptive capacity	Zimbabwe (Gadzirayi et al 2006, Mutandwa & Gadzirayi 2007, Chirimuuta & Mapolisa 2011, Matsa & Mukoni 2013), Malawi (Kamwendo & Kamwendo 2011) Kenya (Waithaka 2011) Sudan (Ibnouf 2012)
<b>Mitigation</b>	Ecosystem protection & management Tree planting Reducing deforestation Forest protection Avoiding air pollution Conservation farming	Ecosystem based adaptation UN-REDD+ Climate smart agriculture	Sahel (Senegal, Gambia Mauritania, Mali, Burkina Faso, Niger, Chad, Sudan) (Nyong et al 2007) Zimbabwe (Mandondo 1997, Chanza & de Wit 2016)

t1

mately scientific and should be used to enhance understanding of climate change, and to subsequently guide climatic interventions. The prospects of this approach span the broad range of climate change science - from understanding climate change indicators to the formulation of mitigation and adaptation strategies that are acceptable and adoptable at local levels.

We see some phenomenal interest in MEA largely owing to the following reasons:

- Growing recognition that climate change is too complex and can be better understood by drawing from other knowledge forms such as IK. E.g., Comparing local indicators with existing knowledge in the climate science domain can strengthen and enrich climate impact assessment studies.
- Local knowledge of climate change impacts can improve our understanding of the localized responses of the physical and biological systems to climate change. For example, this can give useful pointers on how local socio-ecological systems influence ecosystem-based adaptation (EBA).
- The growing agenda in climate change governance where decisions to devise climatic interventions should involve communities who are affected by the outcomes.
- Public involvement in participatory climate assessment (e.g., through citizen science) holds the potential to increase local agency and success of climatic projects.

## HOW CAN THE CLIMAPAFRICA PROGRAM CONTRIBUTE TO ADDRESS THE CHALLENGE?

There are a variety of ways in which the ClimapAfrica Programme is contributing to the use of indigenous knowledge in climate change science. Firstly, the formation of the working group on climate change and Indigenous Knowledge has enabled the postdoctoral fellows and the DAAD alumni, working on areas related to climate change and indigenous knowledge to share experiences, skills, knowledge and resources to advance this area. Secondly, the programme provides a platform where members of the working group on climate change and indigenous knowledge interact with other working groups, to learn from each other. Thirdly, ClimapAfrica programme is also supporting conferences and summer schools where working group members interact with practitioners, researchers, policy makers and other stakeholders across the globe to engage them on issues around indigenous knowledge and climate change as well as policy advocacy issues. Fourthly, the programme is also expected to link the members of the working group with experts and resourceful people or institutions across the globe that can support the work of the working group technically. The collaboration of policy makers, practitioners, and researchers is expected to provide a platform where issues of indigenous knowledge for climate services will be shared, including policy implications, as well as what communities can do to promote climate change mitigation and adaptation. The collaboration will enable policy makers and practitioners to look at policy and practice from the indigenous people's perspective.

The thematic working groups are composed of postdoctoral fellows and African alumni of German funding initiatives with expertise in the field of climate research. [LINK to climapAfrica working group: Climate change and Indigenous Knowledge](#)

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[LINK to profiles of all climapAfrica alumni experts of this working group](#)

### PHOTOS AND GRAPHICS

p1: Drought tolerant traditional crops (sorghum, above and pearl millet, below) ©ICRISAT - Zimbabwe (Source: [http://www.icrisat.org/what-we-do/crops/PigeonPea/Archives/ippbsa\\_pm.htm](http://www.icrisat.org/what-we-do/crops/PigeonPea/Archives/ippbsa_pm.htm)), Participatory plant breeding in Southern Africa, Namibia | p2: Participatory climate impact assessment in Mangwe, Zimbabwe (Photo taken by Nelson Chanza, 2018) | p3: Indigenous breeds of goats (Kalahari red, left and Indigenous Veld, right) (Source: <https://www.goatfarming.in/kalahari-red-goat-breed-information>; <https://www.namibian.com.na/153320/archive-read/Indigenous-veld-goat>), The Kalahari red name comes from the Kalahari Desert which spans the boundaries of South Africa, Botswana and Namibia. As such this breed is adapted to hot climates and is resistant to parasites and diseases. The Indigenous Veld is bred for functional efficiency; they are antelope-like with longer legs, so they move with ease and can walk long distances, to either graze or browse on a variety of plants. | f1: Key aspects of citizen science relevant in IK integration | t1: Examples of IKS integration in climate change



# INNOVATIVE STRATEGIES FOR CLIMATE MITIGATION AND ADAPTATION IN URBAN AREAS IN AFRICA



## CHALLENGES

Climate change is impacting the world at large through both fast and slow onset events. Extreme events such as sea-level rise, floods, and urban heat-stress are impacting urban areas severely (Khan, 2012; The Planning and Climate Change Coalition, 2012; Cobbinah et al., 2017, 2019). The effect of climate change in metropolitan areas covers environmental, social, economic and spatial impacts. The following challenges exacerbate these impacts:

- Rapid Urbanisation to meet the needs of the growing African population. This urbanization trend is expected to continue in the coming decades. Although Africa is presently the least urbanized continent, estimates show that its urban dwellers are expected to double by 2030 (UN-Habitat, 2008). Urbanization affects the natural functions of the ecosystem.
- Informal development and Infrastructure deficit: In Sub-Saharan Africa, around 55.9% of urban dwellers live in areas regarded as slums and informal settlements - the highest proportion globally. High density, poor sanitation conditions, lack of basic infrastructure and combination of other socio-economic and environmental factors found in these areas increase their vulnerability to climate impacts.
- Data scarcity for integrated planning and response to climate change. Information from Household surveys is often lacking or inadequate in many Africa cities. Censuses involve figures that are often disputed and lacking in relevant nuance and detail to cater for socio-spatial heterogeneity in cities.
- Weak local and national governments, and political crises, preclude appropriate governance for urban climate challenges.

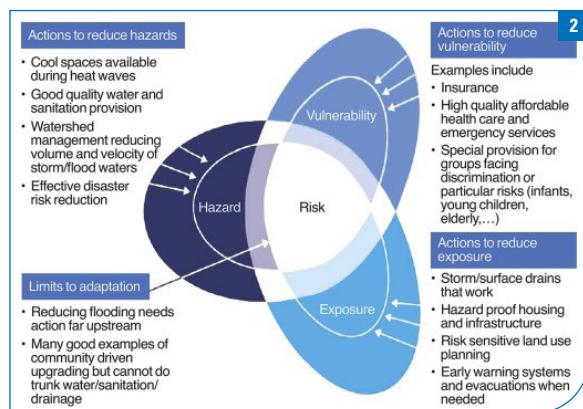
## FACTS AND FIGURES

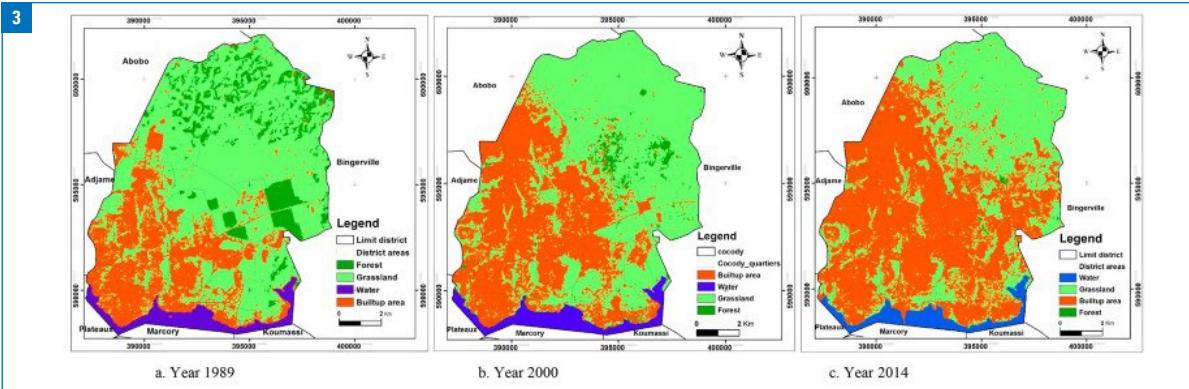
- With its 20 million people, Lagos, Nigeria is exposed to frequent and intense rainfall, storm surges, coastal flooding and predicted 1.5 m sea level rise (SLR). This poses serious risks to infrastructure, housing, lives and livelihoods of over 5 million people in coastal communities.

- Cities are becoming warmer. Dar es Salaam's Mean annual temperatures have increased by 1°C since the 1960s, leading to more hot days and hot nights. In Lagos, mean annual temperature rise of 0.04°C until 2046 is predicted, leading to an increase in the number of days of extreme heat.
- Changing land use patterns have involved reduction in vegetation cover and increase in built up areas (See figure). More covered and built up areas reduce natural drainage (Increasing impermeability), which during heavy rains can lead to more severe urban floods. In Côte d'Ivoire flooding has caused displacement of 16% of impacted population and created the dislocation of family units.
- Prevalence of built-up areas and lack of green space leads to higher urban temperatures (the urban heat island effect). Heat Stress impacts health, labour productivity and leisure activities in cities.

## SOLUTION

- Nature-based solutions such as Mangrove Restoration in coastal communities
- Vertical Greening Systems in dense neighbourhoods
- Green infrastructure such as wetland rehabilitation, green roof, living walls. These do not only lead to increased resilience of the urban area, but have numerous co-benefits, such as improved air quality, better health, improved biodiversity and enhanced overall quality of life for citizens.
- Strategies to tackle floods include flood risk transfer through insurance; implementation of structural flood control measures; enforcing law and regulation related to natural disaster, and the establishment of risk perception and warning systems (IPCC, 2014; Nikolaou et al., 2014).
- Green building development: greening the existing housing stock including within slums and informal settlements.





Land use/cover of the district of Cocody for the years 1989, 2000 and 2014.

- ICT-enabled data generation: Hydrodynamic modelling as well as community action-planning to map flood vulnerability level. Remote sensing and drone technology can support monitoring of urban landscapes. In Congo,

with support of the World Bank data-based technologies through drones and GIS were deployed for 'highly detailed' neighborhood risks, geo-locating potential outbreaks and conveying critical information to at-risk populations.



## HOW CAN THE CLIMAPAFRICA PROGRAM CONTRIBUTE TO ADDRESS THE CHALLENGE?

ClimapAfrica creates a forum for exchange of ideas across disciplines/research areas, cultures, and nationalities, which will expand opportunities for scientists, increase global scientific capacity, and contribute to improving the state of the world. The Working Group on 'Climate Change and Land Use' contributes through:

- Collaboration within the working group to facilitate inter-disciplinary approach and understanding for research activities and to develop climate change research capacity in Africa and for Africa;
- Increasing the professional network and spread of connections for research activities;
- Promoting capacity building for members and interested stakeholders through Working Group activities;
- Providing a platform for co-production of knowledge by collaboration of African researchers and non-academic stakeholders.

The thematic working groups are composed of postdoctoral fellows and African alumni of German funding initiatives with expertise in the field of climate research. [LINK to climapAfrica working group: Climate change and Land use](#)

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[LINK to profiles of all climapAfrica alumni experts of this working group](#)

### PHOTOS AND GRAPHICS

1 Damage to waterfront houses through sea level rise and sea incursion. Source: Olumuyiwa Adegun, 2019 | 2 Addressing Hazards, Risks, and Vulnerable Populations in Informal Settlements. Source: Satterthwaite et al (2020) | 3 Land use change in a commune of Abidjan. Source: (Kablan et al., 2018) | 4 People Blocked by flooding in Abidjan. Source: Kablan, 2020



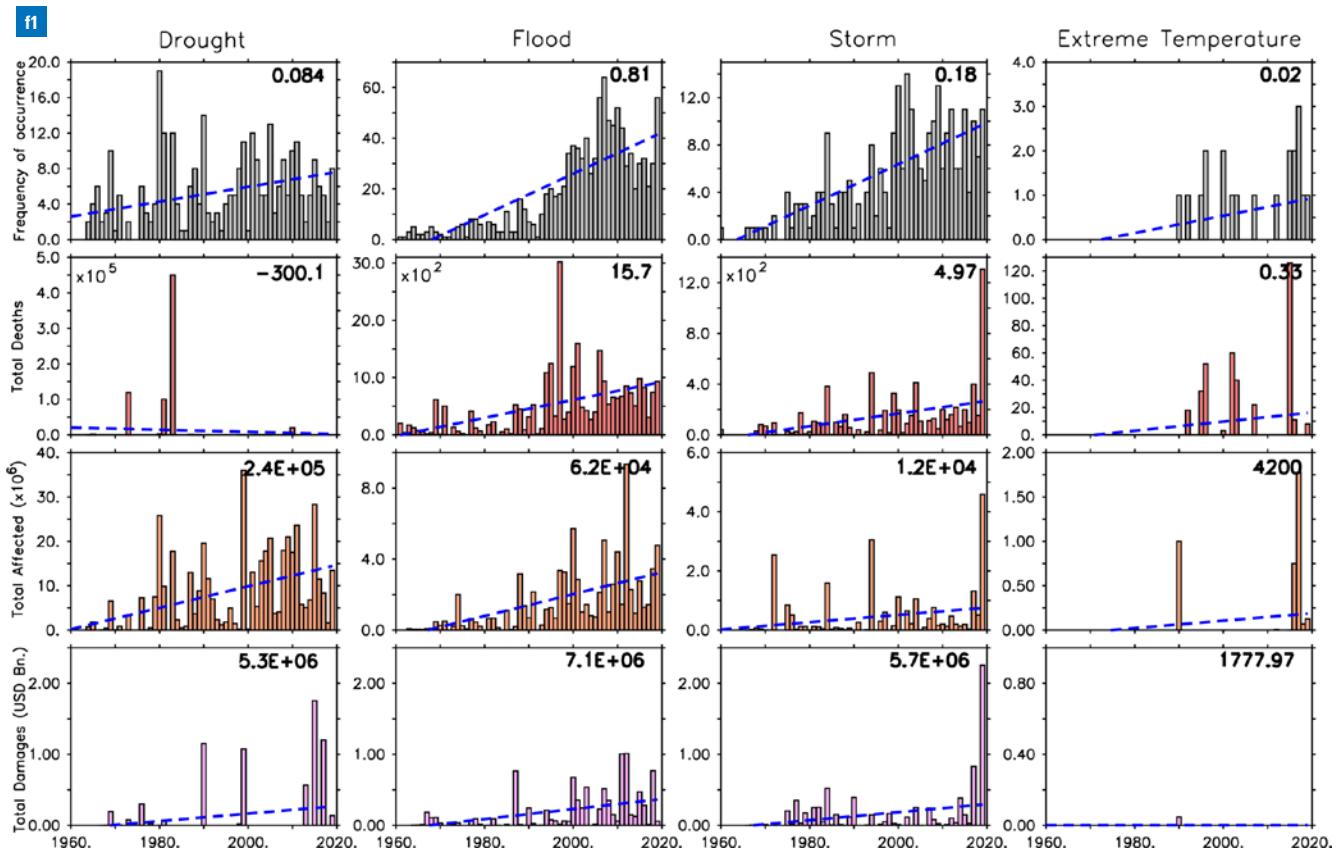
# MAINSTREAMING CLIMATE INFORMATION INTO POLICY FORMULATION IN AFRICA

## FOCUS AREA

Climate information is essential for policy, decision-making, and climate action to promote global development agendas like the Paris Agreement, Sendai Framework of Disaster Risk Reduction, Sustainable Development Goals (SDGs), and New Urban Agenda. Over 45% Africa is dominated by arid or semi-arid climate with high rainfall variability and frequent episodes of weather/climate extremes 1-2. Yet, the use of climate information in policy formulation is still embryonic in most African countries. There is a general increasing trend in weather/climate extremes across Africa 3-8. These observed increases would in the future continue with more frequent and severe extremes as the climate system is forced with increasing concentration of anthropogenic greenhouse gases. There is, therefore, a need to integrate climate information into decision-making processes and policy formulation of most African countries, because their economy mostly relies on climate-dependent sectors. For example, agriculture contributes an average of 15% (ranging from 3% to 50%) to the GDP of sub-Saharan Africa, engaging more than half of the continent's labour force 9. Also, the agricultural sector in sub-Saharan

Africa is mostly rain-fed, making it a highly vulnerable sector to climate change and climate variability. This portends severe implications for human health and security over the continent. These, coupled with the low adaptive capabilities of communities living in sub-Saharan Africa, will increase their exposure to climate-related disasters, which often lead to humanitarian crises, jeopardising decades of socio-economic progress and increasing the risk for food and water insecurity 10.

Hydrometeorological information can provide early warnings and alerts to help mitigate the impact of weather/climate hazards on communities. Accurate prediction of hydrometeorological extremes and relevant knowledge generated from climate data would, therefore, contribute to building communities that are resilient to climate risk, losses, and damages arising from such disasters. Although there exist several climate information platforms provided by the research community, these are strongly science-driven and mostly useful to scientists rather than to the non-climate experts who are the main actors designing and formulating climate policies and strategies. Also, the available information



is often inadequate for the purpose of providing substantive support to policy and decision-making in most parts of Africa.

Providing policymakers with adequate climate information is, therefore, imperative to building more resilient communities in Africa in the face of climate change. This would, subsequently, influence policies and help maintain best practices over the continent. Unfortunately, policy formulation and decision-making processes have, often, failed to incorporate climate information into their procedures. This is partly due to the communication gap existing between climate researchers, project developers, and policymakers. Thus, the need for concerted efforts to make hydrometeorological information available and accessible in a format that creates knowledge and enhances understanding of the intended users. Such a process will, therefore, help to identify suitable approaches to integrate climate information into climate policies and projects.

The aim here is to give an overview of factors contributing to such gaps in the formulation of policy and sustainable development strategies in Africa with a major focus on the use of hydrometeorological information in the decision-making process.

## CHALLENGES

Africa is among the most vulnerable regions of the world to climate change impacts because of its low adaptive capacity. To effectively address this high-level vulnerability of the continent to climate change impacts, it is essential to mainstream climate information into development planning. This would contribute to improving the limited capacity of Africa to assess climate risk and subsequently mainstream adaptation into development plans.

Given the cross-cutting nature of climate change impacts it is essential that climate change-related policies or strategies are formulated as part of broader policies for sustainable development.

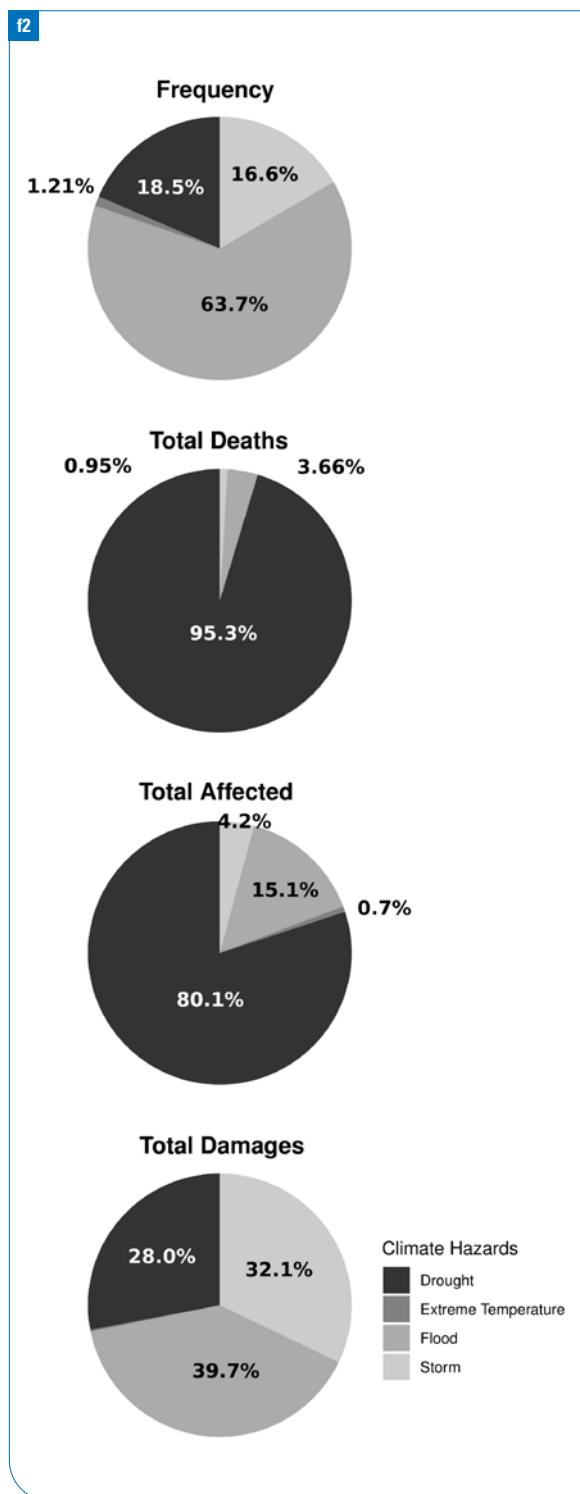
Increasingly, countries have realized the need to 'mainstream' climate information into national development planning and sectoral strategies and policies to address risks emanating from climate extremes and slow onset events. To better contribute to climate disaster risk reduction and management, hydro-meteorological information has to be integrated into decision-making processes at local, national, regional scales and in a range of different sectors, including agriculture, health, forestry, fisheries, transport, tourism, water resources management and energy.

## FACTS AND FIGURES

Brief overview of current conditions (see figure 1-4)

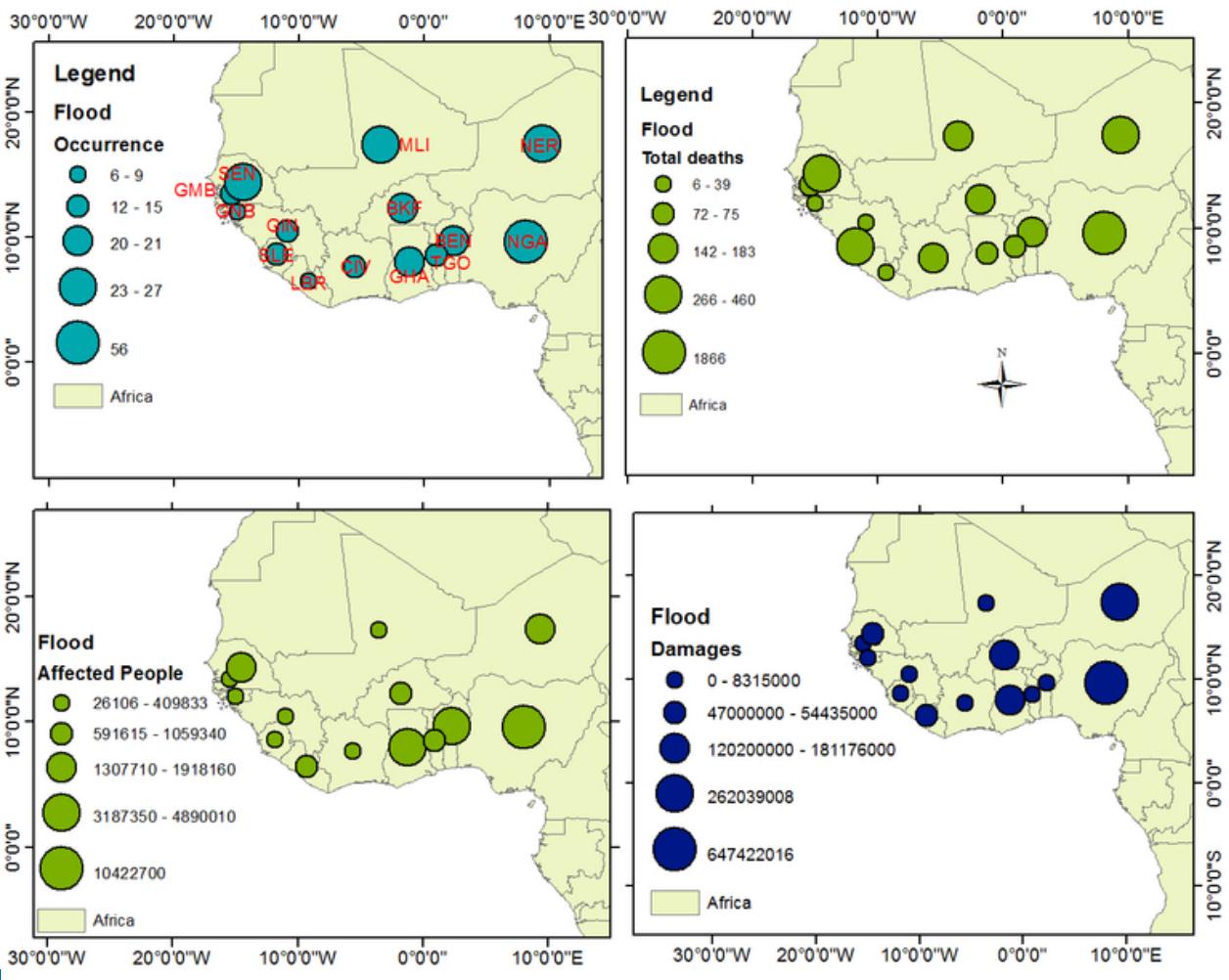
## SOLUTION

Climate services should enable decision-makers and user communities to assess, and prevent or prepare for,

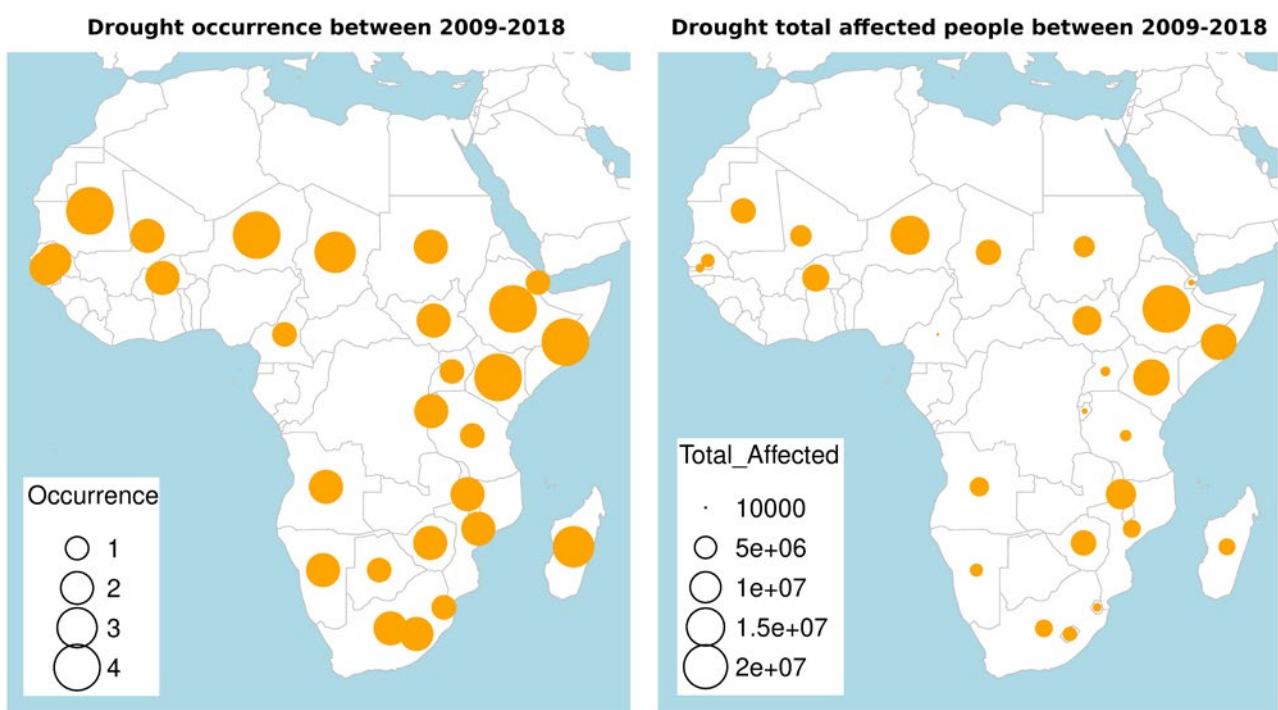


potential impactful weather, climate and hydrological events. It should consist of the following compounds:

- Relevant Product: identifying, generating, and making available a set of user-relevant and user-friendly products concerning information about the impact of climate variability and change on society.
- Skill support: providing assistance in interpreting those products and, in collaboration with relevant stakeholders, helping to identify a sensible set of decision options.
- Feedback loop: constant communication between climate information users and providers for improved product delivery and support.



f3



f4

## HOW CAN THE CLIMAPAFRICA PROGRAM CONTRIBUTE TO ADDRESS THE CHALLENGE?

ClimapAfrica program aims to promote application-oriented research to tackle climate change in Africa through:

- Capacity building to analyse, produce, interpret, and disseminate user-relevant climate information.
- Dialogues to encourage the incorporation of climate information into national/regional development planning or in disaster reduction strategies.

- Establishing and strengthening networks of multi-disciplinary climate scientists that will enhance the access and sharing of climate information amongst African countries.
- Assist decision-makers to make informed decisions such as determining specific needs of sectors and users.
- Research on new tools and methods required for improving the quality of climate information to meet user's diversity.

The thematic working groups are composed of postdoctoral fellows and African alumni of German funding initiatives with expertise in the field of climate research. [LINK to climapAfrica working group: Climate change and Meteorology](#)

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[LINK to profiles of all climapAfrica postdocs fellows of this working group](#)

[LINK to profiles of all climapAfrica alumni experts of this working group](#)

### PHOTOS AND GRAPHICS

f1: Time-series of the reported number of climate-related natural disasters in Africa during the period 1960-2019 and associated impacts (total deaths, total affected, and total damages). The disasters considered are (from left- to right-hand column) drought, flood, storm, and extreme temperature (warm and cold extremes). The dash blue line is the trend line and the bold number in the top right-hand corner is the value of the trend slope. Data are from 'EM-DAT, CRED / UCLouvain, Brussels, Belgium - [www.emdat.be](http://www.emdat.be) (D. Guha-Sapir)' | f2: Contribution of each climate-related disaster to all disasters reported during the period 1960-2019. Data are from 'EM-DAT, CRED / UCLouvain, Brussels, Belgium - [www.emdat.be](http://www.emdat.be) (D. Guha-Sapir)' | f3: Country-based statistics of floods in West Africa during 1966-2017 11. (Source of Figure 3: Badou, F. D., Hounkpe, J., Yira, Y., Ibrahim, M. & Bossa, A. Y. (2019) Increasing Devastating Flood Events in West Africa: Who is to Blame? In: Regional Climate Change Series: Floods (B. Y. J. Adegoke, M. B. Sylla, A. Y. Bossa, K. Ogunjobi & J. Adounkpe, eds.), 84–90. Accra, Ghana. doi:10.33183/2019.rccs.p84) | f4: <https://www.daad.de/en/the-daad/what-we-do/sustainable-development/funding-programmes/climapfrica/wg/4/alumni-expert-members-cc-and-metereology/>



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Niels Böhm joined the DAAD as a Senior Desk Officer in the Strategy Department (Section Research and Studies) in 2019. Among other projects, he is responsible for international research cooperation in the climapAfrica programme, where he coordinates the working groups, knowledge management platforms, and external communication measures.

Mr Böhm has brought several years of experience in strategic communication, international relations, and climate change to his current position. He previously worked in both the public and private sector at the national and international level, including at Deutsche Telekom AG, the German government, and the OECD.

He holds a B.A. in international relations (TU Dresden) and a master's degree in public policy (Hertie School of Governance and UCLA).

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Jana Bömer joined the DAAD shortly after the launch of the scholarship programme of the Network of Excellence on Land Governance in Africa (NELGA) in 2016. Since March 2017 she has been the senior desk officer for the programme and responsible for master's and PhD scholarships at the partner universities. She also manages the NELGA research fellowships and staff exchange programme, as well as the project funding. Ms Bömer graduated from the University of Münster (Germany) with a B.A. in political science and law, and also earned an M.A. in European Governance from Osnabrück University and Aarhus University (Denmark). During her studies, she has worked with the German Federal Parliament, the Friedrich-Ebert Foundation, and the Department of International Affairs and Global Sustainability of the city of Bonn.

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Now based at the University of Cape Town (UCT), where he is Associate Professor in Public Law, Richard Calland has for more than twenty-five years been working in the fields of democratic governance and sustainable development in South Africa and beyond. An experienced Moderator and Facilitator, Calland is also a Fellow of the University of Cambridge Institute for Sustainability Leadership (CISL) and since 2005 has been a member of faculty on numerous customized sustainability leadership programmes for partners such as Anglo American PLC, the World Bank, the Asian Development Bank, Tata, PWC, Network Rail, Namdeb and Nedbank. In 2012, Prof Calland created the African Climate Finance Hub, an advisory and research organisation that works principally in Sub Saharan Africa for a range of local and international development organisations, focusing both on the supply and demand side of climate finance in order to identify the key transformational levers, combining expertise in finance, law, and governance. One of his passions is the intersection of education and sustainability, to which end he is the co-founder of the Sustainability Education ([sused.org](http://sused.org)) initiative, which is working with school and other partners around the world to create opportunities for critical reflection by school leaders on questions of what, where and how they teach. He was the co-lead, with Amar Bhattacharya of the Brookings Institute, of a technical task team of experts appointed by the UN Secretary-General to prepare a report on the state of climate finance ahead of his climate summit in September 2019 (and has recently been re-appointed to update the report in the light of the impact of the COVID19 pandemic). Calland is also leading a team of consultants advising the Green Climate Fund as it reviews its Information Disclosure Policy.

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Gudrun Chazotte is Head of Section Scholarship Programmes Africa at the DAAD. The climapAfrica programme is located in her section. She holds a master's degree in history and has published several articles. Ms Chazotte joined the DAAD in 1996 and has spent many years coordinating international higher-education cooperation projects and developing new DAAD programme lines, especially on linkages between business and higher education institutes. She is proficient in German, English, French, and Spanish and has organised several conferences on business/university linkages and topics related to quality assurance in Latin America and Africa. Since 2013, her regional focus has been on Africa.

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Dr Rabia Ferroukhi joined IRENA in 2011. She is currently the director of the Knowledge, Policy and Finance Centre, where she oversees the agency's work in its three main fields. This includes efforts to produce up-to-date and authoritative renewable energy data and information, analyse and identify best practices in renewable energy policies and finance, and advise and support countries in tailoring their policy and investment analysis to the deployment of renewables in the field.

Dr Ferroukhi has brought over 20 years of experience in the fields of energy, development, and the environment to her current role. She previously worked in both the public and private sectors, including with governments in the Middle East and North Africa, energy companies in the Mediterranean region and the GCC, and various international institutions.

Dr Ferroukhi holds a master's degree in applied economics and a Ph.D in economics from the American University in Washington, DC (USA).

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Andreas Fink is a professor of meteorology at the Karlsruhe Institute of Technology. His expertise lies in tropical meteorology and climatology, with a regional focus on Africa. He is currently analysing atmospheric processes using observational data and models in order to better understand weather variability and extremes. In the latter case, his focus is on extreme rainfall events. Dr Fink's other recent work concentrated on what currently limits the predictability of rainfall at time scales of one to 10 days and ways to improve this using modern statistical methods. Previously, he was involved in several field campaigns (e.g. AMMA, DAccIWA) and in charge of operating rain gauge networks and meteorological balloon campaigns. He has also done studies on rainfall variability and trends using surface and satellite rainfall data.

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Christoph Gornott is an agricultural scientist and the leader of the working group Adaptation in Agricultural Systems at the Potsdam Institute for Climate Impact Research (PIK). He conducts interdisciplinary research that aims to improve food security and resilience in tropical agricultural systems. His research covers climate impacts on agriculture and strategies the agricultural sector can follow to respond to changing climatic conditions, with a particular focus on crop yield forecasting, climate adaptation evaluation and the development of insurance solutions for sub-Saharan Africa. At PIK, Dr Gornott is leading more than 20 research projects and working closely with a diverse set of institutions that are active in international development cooperation and other relevant areas.

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**Prof Dr René  
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René Haak joined the German Federal Ministry of Education and Research (BMBF) in 2005. He is now the Head of the Division Global Change and Climate Research. He was previously the Head of the Business and Economics Section and Deputy Director at the German Institute for Japanese Studies (DIJ, Tokyo), where he worked between 1999 and 2005. Between 2011 and 2014, Dr Haak was the head of the science and technology section at the German Embassy in Beijing. He has given lectures at the Brandenburg University of Applied Sciences (Germany), European University Viadrina (Germany), Hosei University (Japan), Nishogagusha University Chiba (Japan), Tsinghua University (China), and the University of Hawaii at Manoa (USA). He has a Ph.D in engineering from Technische Universität Berlin (Germany).

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Simone Kolz joined the DAAD in 2018. Shortly after the launch of the scholarship programme "Climate Change Research Alumni and Postdocs in Africa" (climapAfrica), she became a senior desk officer in July 2019. She is now responsible for the scholarships and the organisation of the selection committees in which the next scientists and practitioners of the programme are chosen. In addition, she manages the conferences and training related to policy advice. Ms Kolz previously worked at the German international development agency GIZ in the global programme "Climate Risk Management (Loss and Damage)". She graduated from Trier University (Germany) with a B.A. in applied geography in 2014 and from Université du Luxembourg with an M.A. in geography and spatial planning in 2016.

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Prof Dr Daouda  
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Daouda Kone, a full professor at Université Félix Houphouët-Boigny (Ivory Coast), was appointed the new director of capacity building at WASCAL in January 2020. He is an agrophysiologist who works on environmental issues such as understanding how plants can physiologically develop adaptation strategies against stress (e.g. droughts) and how to develop alternative solutions to environmental pollution caused by synthetic pesticides. Dr Kone's academic interests relate to building capacity in response to environmental issues like these. His expertise also lies in helping communities identify their needs and address them through capacity building programmes in master's and Ph.D programmes (as well as short courses). In terms of research, he and his colleagues are working to develop adaptation technologies and tools.

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Frederike Krist joined the DAAD Section ST32 (Scholarship Programmes Africa) in 2019. She is a Team Leader for its joint scholarship programmes with sub-Saharan Africa. The DAAD cooperates with several countries in the field of postgraduate training on the basis of individually negotiated cooperation agreements. The joint scholarships are awarded to qualified junior scientists and university staff for Ph.D studies in Germany.

Ms Krist graduated from Trier University with a B.A. in German (language and literature) and political science in 2018. From 2016 to 2017, she studied at Sciences Po Bordeaux (France).

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Prof Rattan  
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Rattan Lal is a distinguished university professor and the director of the Carbon Management and Sequestration Center at Ohio State University, as well as IICA's Chair in Soil Science and a Goodwill Ambassador.

Previously, Dr Lal was the president of the Soil Science Society of America (2006-2008) and of the International Union of Soil Sciences (2017-2018). He researches soil carbon sequestration for food and climate security, conservation agriculture, and soil health. Having authored almost 1,000 journal articles and mentored 360 researchers, Dr Lal has an h-index of 157 and around 112,000 citations. He is a laureate of the 2018 GCHERA World Agriculture Prize, the 2018 Glinka World Soil Prize, the 2019 Japan Prize, the 2019 US Awasthi IFFCO Award, the 2020 World Food Prize, and the 2020 Arrell Food Prize.

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Shuaib Lwasa is an associate professor in the Department of Geography, Geoinformatics, and Climatic Sciences at Makerere University. He has spent over 18 years teaching at university and working on interdisciplinary research projects. His recent work relates to climate change mitigation, the adaptation of cities to climate change, urban environmental management, spatial planning, disaster risk reduction, and urban sustainability with links to livelihood systems and disaster vulnerability. Mr Lwasa is a coordinating lead author of the IPCC WG III Chapter 8 ("Urban Systems and Human Settlements") and the lead author of the IPCC Special Report on Land and Climate Change.

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Guy Midgley is a distinguished professor in the Department of Botany & Zoology at Stellenbosch University, where he teaches global change ecology. His science career spans three decades and has included leading roles in the 4th, 5th, and 6th IPCC Assessment Reports, as well as IPBES Global Reports. In addition to having authored over 170 publications and been identified by Thomson Reuters as a highly cited researcher in 2014, Dr Midgley recently received the South African Royal Society Marloth Medal for contributions to science and policy and the Humboldt Foundation Research Award for lifetime contributions to science. He researches global change and biodiversity while also focusing on ecosystem-based adaptation and production landscapes. His specific topics of interest include plant ecophysiology, biogeography, population demography, system ecology (including disturbance), and global ecology.

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Dr Olwoch is a climate change impact specialist with a background in biology and vector ecology. She holds a PhD from the University of Pretoria, a MSc from the Medical University of Southern Africa, a BSc from Makerere University as well as a MBA from the Netherlands Business School. A South African of Rwandan decent, her previous employment was with the South African National Space Agency (SANSA) in the position of Managing Director: Earth Observation. Amongst others, she was instrumental in facilitating regional and international collaboration with other space agencies and earth observation institutions in data access, sharing and application development.

Prior to joining SANSA, she was the coordinator of Environmental Science undergraduate degree programme and the manager of the postgraduate degree programme in Environment and Society at the University of Pretoria. She has over 20 years' experience in training in higher institutions of learning and 15 years' experience in research on the impact of climate change on natural and societal systems including their adaptation with particular attention on climate change and vector-borne diseases.

She has proven research and training experience and skills demonstrated by several publications in peer reviewed national and international journals. She has supervised to completion over 30 Honours, Masters and PhD students. She holds a prestigious Laureate Award from TuksAlumni, the highest award an alumnus of the University of Pretoria can receive from fellow alumni. Dr. Olwoch currently serves as a South African member on SASSCAL's Scientific Advisory Committee.

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**Dr Christian  
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Christian Schäfer joined the DAAD in 2001. Since then, he has headed several sections, always with a strong focus on research. He currently heads the Section Research and Studies in the Strategy Department. Before joining the DAAD, Dr Schäfer worked as a researcher at the University of Bayreuth following his biology studies at the University of Frankfurt. In addition to earning his Ph.D (Dr. rer. nat.) in biology at the Technical University of Darmstadt, he completed a postdoctoral stay at the Carnegie Institution for Science and the Department of Plant Biology of Stanford University (USA), as well as a postdoctoral lecture qualification in botany at the University of Bayreuth. The focus of his research was on stress adaptation in plants.

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Berit Stoppa works for the German Academic Exchange Service as a senior desk officer in the Section Development Cooperation: Partnership Programmes, Alumni Projects, and Higher Education Management. She studied German and English linguistics and has extensive experience in teaching German and English linguistics. She has also furthered her education in higher education management and is currently conducting research on sociology and higher education studies.

After working as the director of the DAAD Information Centre in Accra (Ghana); a lecturer at the University of Education, Winneba; and a DAAD lecturer at Université d'Abomey-Calavi (Benin), Ms Stoppa joined the DAAD itself in January 2020. There, she has coordinated various projects related to quality assurance and collaborations with African partner institutions.

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Prof Dr Sabine  
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Sabine Tröger has been a professor of social geography at the University of Bonn since 2002. Her fields of interest and competence also cover sociology and political science. For 18 years, Dr Tröger's work has focused largely on southern and eastern Africa. She obtained her postdoctoral lecture qualification, for example, with a thesis on food crisis research in Tanzania. For the past decade, she has also contributed to research on climate change adaptation in Ethiopia with a particular focus on pastoral communities in the Lower Omo Valley. Meanwhile, Dr Tröger links representations of food crises and climate change adaptation to a larger vision of societal transformation, which is her overarching concern in both Africa and the world at large. In these fields, she has supervised and supported generations of M.A. and Ph.D students from Africa and Germany.

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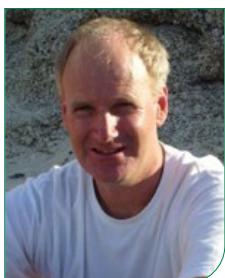
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Kees van der Geest (Ph.D) is senior researcher and head of the "Environment and Migration: Interactions and Choices" (EMIC) Section at the United Nations University's Institute for Environment and Human Security (UNU-EHS).

As a human geographer, Dr van der Geest studies the impacts of climate change, human mobility, environmental change, adaptation, livelihood resilience, and rural development. Key features of his work include a people-centred perspective and a mixed-method approach that combines quantitative and qualitative research tools. His work has contributed substantially to expanding the empirical evidence base on migration-environment linkages and impacts of climate change beyond adaptation ("loss and damage").

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**Prof Richard  
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Richard Washington is a climate scientist who works on understanding the African climate system. He is Professor of Climate Science at the School of Geography and the Environment and Fellow of Keble College, Oxford. His specializes in African climate science and runs the African Climate research group.

His pan-African interests include research on observations of the climate system through field experiments such as BoDEX, Fennec, DO4Models, and CLARIFY; and large programmes like UMFULA, IMPALA, and REACH, which involve both contemporary and future climate dynamics. Dr Washington leads a team of researchers on African climate at the University of Oxford. Dr Washington's research is concerned with the African climate systems, including climate change, the mechanisms leading to floods and drought and the way these characteristics of climate are represented in climate models. He has also worked extensively on aerosols, particularly so on dust storms in the central Sahara and in southern Africa. He has run major observational campaigns involving both ground observations and instrumented aircraft in North and southern Africa. He is primarily funded by the Natural Environment Research Council (NERC).

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Luca Wettlaufer is part of the DAAD Research and Studies unit, where he leads a project linking international scientists with the German research community in the field of artificial intelligence. He holds master's degrees from the University of Turin (Italy) and Université de Paris (France), where he studied socio-economic practices and innovation in the joint management of public goods. Before joining the DAAD in Bonn, Mr Wettlaufer worked for the editorial office of the scientific journals *Wirtschaftsdienst* and *Intereconomics* at the Leibniz Information Centre for Economics in Hamburg, and as a project manager for the Goethe-Institut Turin.

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Olumuyiwa Adegun is a lecturer in the Department of Architecture (School of Environmental Technology) at the Federal University of Technology Akure (Nigeria). He trained as an architect and holds a Ph.D with a specialisation in human settlement studies from the University of the Witwatersrand (South Africa). In his work, Dr Adegun focuses on environmental sustainability issues in informal low-income neighbourhoods and housing in cities within sub-Saharan Africa. In his climapAfrica research project, he is exploring climate adaption pathways (with bias towards nature-based solutions) in low-income neighbourhoods in urban and rural contexts within Nigeria.

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Oluwafemi Adeyeri joined the Climate Change Research Alumni and Postdocs in Africa Scholarship Programme after obtaining his doctoral degree from the University of Abomey-Calavi (Benin) with full sponsorship from the German Federal Ministry of Education and Research (BMBF). His research plan calls for continued investigations into the impact of climate change on the environment for present and future scenarios, as well as its effective management. Dr Adeyeri's research interests include hydrological and climate modelling; statistical downscaling and bias correction of climate models; atmospheric satellite meteorology; extreme climate and hydrology studies; remote sensing and geographical information systems in urban climate and environmental studies; and the impact of regional climate variability on water resources.

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Abubakari Ahmed is a lecturer in the Department of Planning at the University for Development Studies (Ghana). He received a B.Sc in development planning from the Kwame Nkrumah University of Science and Technology (KNUST, Ghana) in 2011, an M.Sc in environmental government from United Nations University in 2014, and a Ph.D in sustainability science from the University of Tokyo in 2018. Dr Ahmed's research interests focus on sustainability assessments (i.e. economic, social, and environmental impact assessments) of renewable energies and industrial crops such as palm oil, sugarcane, rubber, and jatropha in connection with climate adaptation and mitigation in Ghana.

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Lailah Gifty Akita is a marine science lecturer in the Department of Marine and Fisheries Sciences at the University of Ghana. Her scientific interests lie in benthic ecology, palaeoecology, and environmental climate reconstructions. Dr Akita's professional expertise, meanwhile, is in ecology, ecosystem dynamics, and sedimentary science, and she performs research in the field of aquatic ecology. In doing so, she seeks to understand the relationship of organisms with their depositional environment in the past and through ecosystem changes. This involves studying the biological indicators of climate change. Dr Akita believes there is a need to explore how organism composition, abundance, and diversity change with variations in environmental variables such as temperature, water level, and salinity.

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Ihuoma Anyanwu is an environmental scientist who has worked on soil and aquatic environments for over eight years. She is interested in pollution monitoring, contaminant-biota interactions, risk assessment, contaminant bioavailability, bioremediation, the management of microplastic waste, and climate change. Dr Anyanwu is also a senior lecturer in the Faculty of Science at AE Federal University Ndufu-Alike. Prior coming to AE-FUNAI, she worked as a demonstrator at Lancaster University (UK) and as a visiting scientist at the Technical University of Munich (Germany) as part of the TWAS-DFG programme. In climapAfrica, her research will seek to understand how climate change affects aquatic ecosystems (especially in Nigeria) and impacts the socio-cultural behaviours, psychology, and health of people, particularly in the Niger Delta.

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Shaibu Baanni Azumah is a researcher and M&E specialist with Solidaridad in Ghana. Prior to joining Solidaridad, he worked with IFDC in various capacities on the Feed the Future USAID Agriculture Technology Transfer project in the north of Ghana. Dr Azumah does research on climate change, agricultural technology transfer and adoption, and gender and is interested in collaborative research and impact evaluations of development projects in Africa. As a postdoctoral fellow in the climapAfrica programme, he is currently researching the nexus between migration and climate change in Ghana. Dr Azumah has a Ph.D and an MPhil in agricultural economics and a B.Sc in agricultural technology from the University for Development Studies (Ghana). He also holds an executive MBA from KNUST (Ghana).

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Enoch Bessah joined the Department of Agricultural and Biosystems Engineering at the Kwame Nkrumah University of Science and Technology (KNUST) as a lecturer in August 2020. His research interests are climate change impact vulnerability and adaptation, soil and land-use science and engineering, water resource management, and ecosystem services. In the climapAfrica postdoc programme, he is working in the area of climate change and land use. After graduating from KNUST with a B.Sc in agricultural engineering in 2011, Dr Bessah went on to obtain a master's degree in climate change and adapted land use from the Federal University of Technology Minna (Nigeria) in 2014 and a Ph.D in environmental management from Pan African University and the University of Ibadan (Nigeria) in 2019.

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Lydia M. Chabala is a lecturer/researcher at the University of Zambia. This year, she started a postdoctoral stint at the University of Namibia with the support of the German Academic Exchange Service (DAAD). She holds a Ph.D in soil science from the University of Zambia. Dr Chabala's research interests lie in sustainable land and natural resource management, remote sensing, and soil ecosystem services in changing climates. Her current work relates to digital soil assessment, interactions between land use and climate change, and soil water quality assessment in different catchments. She is currently serving as one of the soil experts on the Intergovernmental Technical Panel on Soils (ITPS), which is part of the Global Soil Partnership.

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**Dr Nelson  
CHANZA**

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Nelson Chanza is a senior lecturer in the Department of Geography at the Bindura University of Science Education (Zimbabwe). He is also a research fellow in the Department of Town and Regional Planning at the University of Johannesburg and holds a Ph.D in environmental geography from Nelson Mandela University (both South Africa). Dr Chanza's main expertise is in the area of indigenous knowledge applications in climate science and disaster management. His current research hypothesises that local indigenous observations and experiences can complement existing knowledge of climate change, particularly in regions not adequately covered by climate impact assessment studies. He seeks to contribute to the discourse on sustainability science by examining the interface between climate change and society.

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DAPILAH**

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Frederick Dapilah is currently a lecturer at the Simon Diedong University of Business and Integrated Development Studies (Ghana). He earned a B.A. in development studies and an M.Phil in geography from the University for Development Studies and the University of Ghana, respectively. He then obtained his doctorate in human geography at the Humboldt-Universität zu Berlin (Germany). Dr Dapilah's research focuses broadly on human-environment relations and, in particular, on dimensions of adaptive capacity and resilience in the context of climate change and disaster risk. In the climapAfrica programme, his research is concerned with understanding how borderless climate risk is shaping climate mobility and what transnational adaptation governance options are possible in West Africa.

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**Dr Kangbéri  
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Kangbéri Dimobe obtained his baccalaureate in mathematics and natural sciences in 2002 and added an M.Sc in botany with the highest distinction in 2007. In 2010, he earned another M.Sc, this time in the field of applied plant biology. After being awarded a full, four-year Ph.D scholarship by WASCAL in October 2012, he completed his doctorate in December 2017. Dr Dimobe has now been a lecturer at the University of Déodougou since January 2019. He previously worked for WASCAL as an associate researcher and has 11 years' experience in international research projects. Dr Dimobe's research interests span the fields of climate change, ecology, biogeography, and forest assessment. Besides being involved in the climapAfrica programme, he has been awarded the African-German Network of Excellence in Science Grant for Junior Researchers in 2020.

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**Dr Ibrahima Zan  
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Ibrahima Zan Doumbia has an M.Sc. in agronomy (plant breeding) and a Ph.D in plant breeding. His thesis was related to improving cowpea resistance to the pest Megalurothrips sjostedti. Previously, Dr Doumbia served as a technician at the Molecular Biology Laboratory (University of Bamako, Mali), where he developed and implemented new technologies to reduce the effects of climate variability on crop production within the climate-smart agriculture programme. He now works within a fruit and legume programme, which suits his interests in cowpeas and bambara groundnuts, roots (cassava), tubers (sweet potatoes), and vegetables (tomatoes and okra). Meanwhile, Dr Doumbia's fields of research include breeding crops for resilience to climate change. He also teaches part-time at the university level.

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**Dr Thierry Christian  
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Thierry C. Fotso-Nguemo currently works as a researcher at the Climate Change Research Laboratory (CCRL), which is part of the National Institute of Cartography at Yaoundé (Cameroon). In September 2018, he completed his Ph.D in atmospheric sciences at the University of Yaoundé I. His research mainly focuses on climate modelling, climate variability, and climate change, as well as on extreme weather events over central Africa. In the framework of the climapAfrica programme, Dr Fotso-Nguemo intends to assess how heat stress changes caused by global warming are impacting the health and daily productivity of populations living in his area of interest.

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**Dr Imoleayo Ezekiel  
GBODE**

Leibniz Institute for Tropospheric Research

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Imoleayo Ezekiel Gbode is a postdoctoral researcher in the climapAfrica programme and a guest at WASCAL (FUT Akure, Nigeria). He is a meteorologist and climate scientist who is currently researching aerosol-radiation and aerosol-cloud effects on the West African Monsoon (WAM) system in a changing climate (ACCLIMATE). This research is being conducted in close collaboration with the TROPOS Modelling Department in Leipzig, Germany. The aim is to investigate the impact of aerosols on the WAM system via aerosol radiation and cloud interactions in the current climate and for possible future climate and aerosol scenarios. Dr Gbode is keen to provide quality research output that will serve as evidence-based climate information in shaping policies and guiding decision-making processes in climate-sensitive sectors of the monsoon region.

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**Prof Dr Francisco  
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Francisco Maiato P. Gonçalves joined the Herbarium of Lubango at ISCED (<https://isced-huila.ed.ao/>) in 2010. Since then, he has participated in various national and regional scientific projects. Apart from research, Dr Gonçalves has academic duties which include the teaching and scientific coordination of a master's course in ecology and natural resource management. He is also coordinating a scientific project at Bicuar National Park, where he is conducting his postdoc research in the framework of the climapAfrica programme. Dr Gonçalves obtained his degree in biology from the Faculty of Sciences at Agostinho Neto University (Angola) in 2009. He went on to earn a doctorate from Universität Hamburg (Germany) in 2019.

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**Dr Reginald Tang  
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Forestry Research Institute of Ghana, Council for Scientific and Industrial Research - CSIR

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Reginald T. Guuroh has been a research scientist at the CSIR-Forestry Research Institute of Ghana (CSIR-FORIG) since November 2016. He is a graduate of the University of Bonn (Germany), where he obtained his Ph.D in plant ecology. He also obtained M.Sc degrees in tropical forestry and management from TU Dresden (Germany) and environmental forestry from Bangor University (UK), respectively. Dr Guuroh's research focuses on investigating the impacts of multiple environmental drivers on plant diversity, as well as on how ecosystems function and provide benefits to society. In the climapAfrica programme, his research will seek to understand how climate and land use jointly affect the distribution of woody medicinal plants in Ghana.

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**Dr Zied  
HAJ-AMOR**

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Zed Haj-Amor's research work focuses on soil and water management under climate change, specifically in regions of Africa. At present, he is concentrating on soil salinisation and climate change issues. His current research interests include soil and water management, climate change modelling, and geographic information systems (GIS). With regard to climate change in particular, Dr Haj-Amor is most curious about modelling for better soil and water management, soil salinisation, agricultural water management, and sustainable agriculture in general.

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**Dr Josefina  
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Josefina Hamutoko has a Ph.D in hydrogeology from the University of Namibia (UNAM), an M.Sc in environmental and resource management from BTU Cottbus-Senftenberg (Germany) and a B.Sc (hons.) in geology from UNAM. In 2016, she was named "Young Scientist of the Year" by the Namibian National Commission on Research Science and Technology (NCRST). Her long-term career aspiration is to develop a framework for quantifying shallow aquifers in drylands, their interactions with deeper aquifers in a changing climate, and human activities for sustainable management. In the climapAfrica programme, Dr Hamutoko's research work will seek to improve the state of knowledge on wetland hydrology utilisation and management by carrying out a wetland inventory and assessment of the Cuvelai Basin in Namibia.

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**Dr Jean  
HOUNKPE**

National Water Institute, University of Abomey Calavi

Benin

Jean Hounkpe is a postdoctoral researcher and part-time lecturer at the National Water Institute of the University of Abomey Calavi (Benin). He has a background in hydrology, climate change, and water resources with a focus on flood risk assessment. He is currently working on measures to adapt to the increasing flood risk in changing climates based on non-stationary seasonal flood forecasting at a regional scale. The main objective of his research project is to investigate the link between flood characteristics and climate factors/catchment states in order to achieve better flood risk management. Prior to joining the National Water Institute, Dr Hounkpe was a consultant on disaster risk reduction at the Competence Center of WASCAL ([www.wascal.org](http://www.wascal.org)) in Ouagadougou, Burkina Faso.

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**Dr Godfrey  
HOVE**

University of Stellenbosch

South Africa / Zimbabwe

Godfrey Hove is an environmental and economic historian who is currently engaged as a climapAfrica postdoctoral fellow at Stellenbosch University (South Africa / Zimbabwe). His research interests lie in the environmental and agrarian history of southern Africa, particularly with regard to how humans have interacted with the land, flora, and fauna while negotiating their survival in ever-changing socio-environmental circumstances. More specifically, his works emphasise the nexus of climate change, food security, state policy, local initiatives, and rural livelihoods. Dr Hove graduated with a Ph.D in history from Stellenbosch University in 2015 and from the University of Zimbabwe with an M.A. in African economic history in 2010.

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**Dr James Seutra  
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Kwame Nkrumah University of Science and Technology

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James S. Kaba is a lecturer and researcher at the Kwame Nkrumah University of Science and Technology (KNUST). He joined the DAAD climapAfrica programme in 2019. His climapAfrica research project at KNUST aims to improve the drought tolerance and survival rate of cocoa seedlings with potassium fertiliser and AMF. Dr Kaba obtained his Ph.D in mountain environment management and agriculture from Libera Università di Bozen (Italy) in 2017. He previously obtained his B.Sc and M.Phil degrees in agricultural technology and crop science from the University for Development Studies and the University of Ghana (Legon), respectively. His research interests lie in crop/soil science, plant nutrition, climate change, and integrating science with farmers' knowledge.

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**Dr Malan Ketcha Armand  
KABLAN**

Centre Suisse de Recherches Scientifiques

Côte d'Ivoire

Malan Kablan is a hydrologist by training and an expert in environmental and human security. His research interests include climate change and human security, disaster risk reduction, and resilience and vulnerability assessments. His master's and Ph.D research focused on the vulnerability of urban populations to climate change. Dr Kablan is currently a lecturer and researcher at Université Félix Houphouët-Boigny in the field of environmental and human security. A fellow of the DAAD/climapAfrica programme since February 2020, he is working on improving the urban flood early-warning system in Cocody, Abidjan. His research project is being hosted by the Centre Suisse de Recherches Scientifiques (CSRS), which makes him a postdoc student of the same research institution.

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Dr Kelly  
**KIRSTEN**

University of Cape Town

South Africa

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Kelly Kirsten holds a Ph.D in environmental science with a specialisation in palaeolimnology. She is currently a researcher in the Department of Geological Sciences at the University of Cape Town. Her research expertise lies in understanding lake systems and how they operate as a repository of environmental and climatic change during the Quaternary, with a focus on how these changes impact human development (including in the past, present, and future). Dr Kirsten has worked all over South Africa, providing valuable insights into lake functionality and hydrological development while producing an extensive publication record. She aspires to create novel ways to interpret palaeodata so as to provide a better understanding of the natural world.

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Dr Samuel  
**KUMAHOR**

University of Ghana

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Samuel K. Kumahor is a lecturer in the Department of Soil Science at the University of Ghana. Prior to this, he worked as a postdoctoral fellow at the University of Ottawa (Canada) after completing his Ph.D dissertation at the Helmholtz-Centre for Environmental Research (UFZ, Germany). Dr Kumahor's research now focuses on multiphase flow and contaminant transport in environmental systems. His main interests include investigations into the mobility of nanomaterials in environmental systems, radioactive waste management, and gas fluxes in agroecological systems. Within the framework of climapAfrica, his research will seek to understand key processes that govern greenhouse gas fluxes from lowland rice production systems in Ghana.

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**Dr Boris  
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Boris Odilon Kounagbè Lokonon is a climapAfrica postdoctoral fellow in the Department of Economics and Management Sciences at the University of Lomé. He earned a Ph.D in climate change economics as part of the West African Science Service Center on Climate Change and Adapted Land Use (WASCAL) programme at the University Cheikh Anta Diop (UCAD, Senegal). Dr Lokonon is also a lecturer and researcher at the University of Parakou (Benin). His research interests include climate change, agricultural production, agricultural policy, and economic modelling.

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MARLINE**

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Lova Marline's long-standing interest as a taxonomist has been in bryophytes, an ecologically important but poorly studied group of plants in tropical ecosystems. She is originally from Madagascar, where she completed her undergraduate and master's studies with a background in botany and ecology. She earned her Ph.D in the bryophytes of Madagascar at the University of Cape Town (South Africa). Dr Marline is broadly interested in the ecological and evolutionary processes that determine community assembly and patterns of biodiversity at local landscape and biogeographic scales. She uses tropical mountain massifs as a model to study bryophyte diversity, investigate potential ecological processes that underlie bryophyte community assembly, and link bryophytes' functional traits to ecosystem processes.

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**Dr Michelle  
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Michelle North is a veterinarian with a strong interest in ecosystem health, "One Health" ecotoxicology, and multi-/interdisciplinary problem solving. After completing her veterinary studies at the University of Pretoria (South Africa), she went on to obtain a doctorate in the effects of urban air pollution on wild birds from the University of Calgary (Canada). Dr North is currently a postdoctoral researcher at the University of KwaZulu-Natal, where she is investigating the adaptation of African livestock agriculture to climate change and providing academic support to the Durban office of the IPCC Working Group II TSU.

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NYAMBE**

University of Zambia

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Anayawa Nyambe is a medical scientist with a background in public health. She is currently affiliated with the University of Zambia's School of Public Health and has been volunteering in the COVID-19 response at the Zambia National Public Health Institute. Her doctorate involved an in-depth study on the factors affecting the uptake of cervical cancer prevention measures. In the climapAfrica programme, Dr Nyambe's research will focus on providing strategies and guidelines for the prevention of heat stress during outdoor work by investigating how extreme heat exposure is perceived and exploring the extent to which Zambian farmers have been affected by the rise in global temperatures.

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Dr Romaric Christel

**ODOULAMI**

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Romaric C. Odoulami is passionate about climate research and how it can contribute to enhancing human development outcomes in a changing climate. He is developing his research on climate-related themes relevant to African communities to provide policy-makers with robust scientific evidence that can influence policy formulation and practice in Africa. Dr Odoulami has worked on the underlying mechanisms that drove the "Day Zero" drought in Cape Town, as well as on human influence on its likelihood and severity using attribution science. He is also working on quantifying changes in risk for agricultural insurance. In addition, his research seeks to understand how stratospheric aerosol injection might influence extremes in Africa. He holds a Ph.D in meteorology and climate science with a background in agronomy.

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Dr Ayub

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Technical University of Kenya

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Ayub M. O. Oduor is a lecturer in the Department of Applied Biology at the Technical University of Kenya. He obtained a Ph.D in genetics and evolution at the University of Granada (Spain). He previously did postdoctoral research at the University of Konstanz (Germany) with funding from the Alexander von Humboldt Foundation, as well as at the Chinese Academy of Sciences in Beijing. His research focuses on the ecology of invasive plant species. In the climapAfrica programme, his research will seek to model risks of invasion by alien ornamental flora under current and forecast climatic conditions in Benin. Information from this study could inform prioritisation in managing alien species that pose the greatest risks of invasion.

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**Dr Gloria  
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Gloria Okafor is an interdisciplinary research scientist with background skills in the fields of hydrology and agrometeorology. Over time, her interests have evolved towards solving environmental issues related to climate variability and change. To this end, she has developed technical skills in programming languages (e.g. Python), post-processing tools for the analysis of various datasets in climate and hydrological modelling (i.e. R CDO), and the use of remote sensing observations for hydrological applications. Dr Okafor's interests are in river basin development and management, flood prediction, and the planning and operation of water resource systems. Her current research focuses on investigating hydrological and climatic extremes and quantifying their impacts on ecosystems.

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Stellenbosch University

**South Africa**

Olugbenga Oluwagbemi earned a B.Sc in computer science at the University of Ilorin and an M.Sc in computer science at the University of Ibadan (Nigeria). After completing his corresponding research at Johns Hopkins University (USA) on a Fulbright scholarship, he obtained a Ph.D in computer science from Covenant University (Nigeria). Dr Oluwagbemi also completed two years of postdoctoral training at Stellenbosch University (South Africa) and was a visiting research fellow at the University of Oxford (UK). He is currently a senior faculty member at Sol Plaatje University (South Africa) and a research associate at Stellenbosch University. His fields of research are in computer-aided diagnosis, computational modelling, bioinformatics, health informatics, artificial intelligence, and machine learning.

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**Dr Ganiyu  
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Ganiyu Titilope Oyerinde is a postdoctoral fellow in the doctoral research programme on climate change and water resources at the University of Abomey-Calavi. He finished his Ph.D with distinction at the same university in 2016. His postdoctoral research focuses on providing solutions to different sources of uncertainty in hydrometeorological modelling in the Niger Basin and West Africa. Dr Oyerinde's research will improve the lives of citizens in 10 Niger Basin countries and beyond. His research interests are in hydrological modelling, hydroclimatology, geographical information systems (GIS), remote sensing, computer programming, big data analysis, and agrometeorology. He hopes to be the researcher who will solve the nagging challenges in hydroclimatology in West Africa.

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**Dr Souleymane  
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University Science Technical and Technologies De Bamako - USTT-B

Mali

Souleymane Sanogo, a researcher and lecturer at USTT-B, is currently a postdoctoral research fellow in the DAAD climapAfrica programme in the working group "Climate Change and Meteorology". He is working on extreme precipitation events and methods of inducing them meteorologically. Dr Sanogo wrote his Ph.D thesis in 2015 under the WASCAL programme at the Federal University of Technology Akure (Nigeria). During his doctoral research, he completed two research stays at the Institute of Geophysics and Meteorology (University of Cologne, Germany). He previously graduated from the University of Bamako with a bachelor's degree in applied physics in 2016 and with an M.Sc in energetics in 2009. In 2018 and 2019, he contributed to the RARSUS-SEMALI project.

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**Dr David  
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David Ssekamatte is currently a consultant and lecturer in the field of monitoring and evaluation (M&E) at the Uganda Management Institute. He has more than 12 years' experience in programme management; monitoring, evaluation, research, and learning (MERL); and management consulting in the education and health sectors. At present, Dr Ssekamatte is working on a postdoctoral research project at Nelson Mandela University (South Africa), where he is focusing on the integration of African indigenous knowledge into climate change education at universities in Uganda and South Africa with funding from the DAAD. He is also a NAFSA Senior Fellow (2020-2021) on climate change and sustainability issues in international education. Dr Ssekamatte holds a Ph.D in education and social sciences from the Carl von Ossietzky University of Oldenburg (Germany) and an M.A. in economics from the University of Lucknow (India).

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**Dr Thierry  
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Thierry Tovignan is a crop physiologist who works as an assistant researcher in the Department of Genetics and Biotechnology at the University of Abomey-Calavi. He is interested in assessing crop genetic diversity based on morphological and molecular criteria and improving crops to deal with biotic and abiotic stresses, particularly in tropical semi-arid environments. Dr Tovignan is currently working on the multipurpose (food/feed/fuel) sweet sorghum and striving to understand how traits of interest (photoperiod sensitivity, drought tolerance) function. He is also researching cropping practices (sowing dates, organic fertilisation) that contribute to higher yields and quality in climate-smart sorghum varieties.

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**Dr Rosaine N.  
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Rosaine N. Yegbemey is currently an assistant professor in the Department of Rural Economy and Sociology at the University of Parakou. Before taking on his current position, he worked for the National Agricultural Research System of Benin, the Africa Rice Center, the World Bank's Gender Innovation Lab, and the International Initiative for Impact Evaluation (3ie). He has about 10 years of experience in designing, conducting, and managing studies and evaluation research. Dr Yegbemey holds a Ph.D in agricultural economics and rural development from the University of Giessen (Germany). He is an alumnus of the International Climate Protection programme of the Alexander von Humboldt Foundation. Since April 2020, he has also been a postdoc fellow of the DAAD climapAfrica programme.

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**Dr Azeez  
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Federal University of Agriculture Abeokuta

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Azeez Yusuf is a professional natural scientist and a lecturer at the Federal University of Agriculture, Abeokuta. His research focuses on sustainable livestock production to curb food insecurity, alternative feeding of ruminant animals in the face of recent climatic changes, mitigation of methane production in ruminants through the administration of plants, and other related subjects. Dr Yusuf has served as a postdoctoral fellow at North-West University (Mafikeng, South Africa) and recently obtained an international diploma in animal feed from PTC AERES (the Netherlands). He aspires to contribute to sustainable food production and safety through research.

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Dr Issouf  
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Issouf Zerbo is a permanent lecturer and researcher at the Polytechnic University Center of Tenkodogo. He holds a Ph.D in the functional diversity and responses of savannah vegetation to climate change and land use. As a climapAfrica postdoc, he is carrying out his activities at the University of Abomey-Calavi (Benin). Dr Zerbo's research focuses on the impact of climates, land use, and overexploitation on the conservation of *Bombax costatum*, a threatened useful woody species from Burkina Faso (West Africa). His other interests include climate change, plant biology and ecology, systematic botany, biodiversity, phytosociology, functional ecology, agro-sylvo-pastoralism, ethnobotany, and biostatistics.

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**Prof Dr Nahla  
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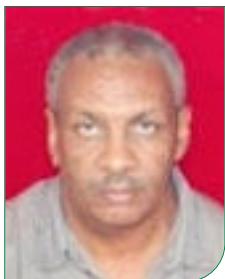
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Nahla S. Abdel-Azim is a professor of phytochemistry. She has experience in the isolation and purification of active constituents from medicinal plants using environmentally friendly techniques such as microwave-assisted extraction (MAE) and ultrasonic-assisted extraction (UAE). Prof Abdel-Azim graduated from Cairo University (Egypt) and studied at the University of Freiburg (Germany) on a DAAD scholarship from 1993 to 1995. She is now working on the conservation and sustainable use of wild medicinal plants. She is also one of the main researchers in the project "Egyptian Encyclopedia of Wild Medicinal Plants".

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Hayder Abdelgader's academic background includes a B.Sc in agriculture and an M.Sc in crop protection (both Sudan), as well as a Ph.D crop protection (Germany). His fields of academic interest and professional expertise lie in agricultural research and crop protection.

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Hamada Abdelrahman is an associate professor of soil chemistry and fertility at Cairo University. He has a Ph.D in agricultural chemistry from the University of Bari (Italy), where his work investigated the changes in soil organic carbon during the transition from conventional to organic farming. Dr Abdelrahman has been a Fulbright Visiting Scholar, a DAAD post-doctoral researcher, and a Farnesina post-doctoral scholarship awardee. He has visited and worked at the USDA-ARS FZI (Germany), the University of Bari, and Aarhus University (Denmark). His academic interests and expertise include soil organic matter and land use, carbon sequestration and climatic changes, soil fertility management, organic farming, waste recycling and composting, and growing media and nursery production.

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Mohamed Abdrabou is a professor of plant ecology in the Botany Department and the dean of the Faculty of Science at Suez Canal University. He also founded the Egyptian Society for Environmental Sciences and has been an Alexander von Humboldt fellow since 2008.

Dr Abdrabou's main focus is molecular ecology – specifically, the application of molecular genetic markers to study aspects of plant ecology and the conservation of endangered and/or endemic plant species in arid environments. Since 1997, he has contributed as a PI, co-PI, or co-investigator to a number of practical conservation projects dealing with endemic and/or threatened species. The aims of these projects have included the assessment of natural resources and the conservation, sustainable use, and rehabilitation of critical and keystone species and ecosystems.

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**Neway  
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Neway Abera is a university instructor by profession. His academic interests focus on climate-proof urban planning and design, as well as outdoor thermal comfort. He is currently enrolled in the third year of a Ph.D programme in urban and regional planning at the Ethiopian Institute of Architecture, Building Construction, and City Development (Addis Ababa University, Ethiopia). The working title of his Ph.D dissertation is "Impacts of Neighborhood Morphology Patterns on Urban Heat Island Intensity in Addis Ababa, Ethiopia". This research centres on urban climates, specifically by investigating the effects of urban heat islands and related mitigation mechanisms based on Landsat images, meteorological data, and different types of urban planning simulation models.

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Koffi Massesso Adji and has over three years of experience in research and climate policy analysis. He is a recent Ph.D graduate in climate change economics from the University of Cheikh Anta Diop (Senegal). His doctoral research topic deals with green entrepreneurship. Here, Dr Adji was interested in analysing and identifying the main factors that drive entrepreneurs' willingness to engage in green business according to a certain number of variables, such as environmental risk, social pressure, regulatory pressure, and financial assistance. His study revealed that policy regulations have a significant impact on individuals' choices. People are more willing to engage in innovative, sustainable, and even risky activities if they can receive support from the public sector.

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Cyriaque Agboton is an agricultural engineer who trained in the Faculty of Agronomic Sciences at the University of Abomey-Calavi (Benin). He also holds a master's degree in environmental management and a Ph.D in agricultural sciences with a specialisation in plant genetic resources and crop protection. Having worked as a research associate at IITA for many years, he is now a scientific researcher/consultant. Dr Agboton's professional expertise is related to basic and applied agricultural research, biological control, integrated pests, endophytism management studies, the impacts of climate change, and environmental impact studies. His fields of research include endophytism studies, agricultural commodity production and protection, and studies on how climate variability affects agriculture.

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Corinne Akadjé Epse Kabo is part of the first cohort of the climapAfrica project. She belongs to the working group on climate change and animal and plant physiology and stress. She completed her thesis at the Abidjan Oceanological Research Center on the dynamics of barracuda stock (*Sphyraena guachancho*). Today, Dr Akadje Epse Kabo is an assistant in the Department of Animal Biology at the Université de Man. Its research projects are oriented towards the valuation, conservation, and monitoring of anthropogenic impacts on continental fish species in rivers in western areas of the Ivory Coast. Dr Akadje Epse Kabo sees climapAfrica as an opportunity to exchange expertise and support all of her ongoing projects in the magnificent mountainous region of Man.

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Folorunso Akinseye obtained a Ph.D in meteorology and climate science in 2015 on a full scholarship from the German Federal Ministry of Education and Research (BMBF) as part of the WASCAL Graduate Research Program on West African Climate Systems. He is an experienced agroclimatologist and crop modeller who has spent around eight years in teaching and agricultural research (including participatory research for technology dissemination). He has expertise in the use of different decision support tools for yield projection based on different climate scenarios that have been calibrated and evaluated over different locations across the semi-arid tropical regions of West Africa.

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Hamada Elsayed Ali is a lecturer of plant ecology in the Department of Botany at Suez Canal University (Egypt). In 2015, he earned a Ph.D in functional plant ecology and environmental sciences from the University of Bayreuth (Germany). Before that, he completed an M.Sc degree in ecology at Suez Canal University. From 2010 to 2011, Dr Ali studied on a prestigious International Climate Protection Fellowship from the Alexander von Humboldt Foundation in Germany. He is currently working on several projects to study the effects of climate change, invasive species, and land use on terrestrial ecosystems. Dr Ali also teaches under- and postgraduate courses on ecology, environmental sciences, global change, and the R programming language.

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Abayineh Amare has been an assistant professor at Jimma University since 2018. That same year, he obtained a Ph.D in environmental and developmental studies from Addis Ababa University. Dr Amare has conducted extensive research in the areas of climate change, induced vulnerability, resilience to climate change, adaptation options, food security, index-based livestock insurance, and natural disaster management. He has also received numerous awards, including from the Africa Climate Leadership Program (AfriCLP), the Africa Climate Change Fellowship Program (ACCFP), and the DAAD In-Country Scholarship programme. In his research, Dr Amare prioritises improving his understanding of climate-smart agricultural practices and local/indigenous knowledge as a means of managing climate risks.

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Dinnah Ayebazibwe joined the DAAD in 2015 on an In-Country/In-Region Scholarship. She then graduated from the Mbarara University of Science and Technology (Uganda) with an M.Sc in biology, natural resource management, and conservation in 2018. Her master's thesis compared the carbon sequestration of tea plantations and natural forests of eucalyptus and pine in Kyamuhunga (southwest Uganda). She also holds a bachelor's degree in education (biology and chemistry) from the Mbarara University of Science and Technology (2014).

Ms Ayebazibwe currently works as an assistant lecturer in the Faculty of Education at Kabale University. She is also the executive director of the Blessed Hands Foundation, a community-based organisation that aims to empower youths and women with better life skills in making decisions and eradicating poverty, as well as with strategies for mitigating and adapting to global climate variability.

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**Prof Dr Raphael Olanrewaju  
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Raphael Olanrewaju Babatunde obtained a Ph.D in agricultural economics from the University of Hohenheim (Germany). After joining the University of Ilorin in 1999 as a junior research fellow, he became an associate professor in 2016. His research focuses on development economics, nutrition and health economics, the economics of poverty and food security, climate change adaptation and resilience, and impact assessments. Dr Babatunde is the team leader of the Development Economics Research Group and the lead consultant at the Centre for Sustainable Agricultural Empowerment of Ilorin. He is also an M&E expert and a consultant for ECOWAS, AUC, IFPRI, and FAO. Finally, Dr Babatunde is a member of the Nigerian Young Academy (NYA) and the African Growth and Development Policy Modelling Consortium (AGRODEP).

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Abdoulaye Ballo is an enthusiastic and ambitious expert in the West African climate system, as well as in climate change and energy in general. His research interests focus on regional climate modelling, meteorology, climate science, and renewable energy. Dr Ballo is experienced in research and analysis and currently works with various types of atmospheric models (e.g. mesoscale regional climate models and global climate models). He has evaluated numerous models and uses them to study atmospheric systems that induce rainfall and droughts in West Africa. He also applies the global climate model to predict seasonal climates.

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Moncef Bouaziz completed an engineering degree in water and soil management in 2005 and went on to earn a master's degree in environmental engineering and management. After spending some time working in the private sector, he began pursuing a Ph.D within the Remote Sensing Group at TU Bergakademie Freiberg (Germany) in 2008. The focus of his doctoral thesis was the monitoring of land degradation from space. After obtaining his Ph.D, Dr Bouaziz received a grant from the Alexander von Humboldt Foundation to continue his research as a postdoc at the Dresden University of Technology (Germany). Between 2012 and 2015, he worked in the same university's Faculty of Environmental Sciences as a research associate. Since 2015, Dr Bouaziz has been an assistant professor at the University of Sfax and an ambassador scientist of the Alexander von Humboldt Foundation in Tunisia.

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Samuel Bunani is an assistant professor in the Department of Chemistry at the University of Burundi. Since June 2019, he has been working as a Georg Foster postdoctoral research fellow in the Water Chemistry and Water Technology Department at the Karlsruhe Institute of Technology (KIT, Germany). He is mostly interested in water purification processes based on membrane separation technology (NF, RO, ED, BMED, and EDI). His research covers wastewater management and the recovery of valuable elements from water resources. Dr Bunani graduated from the University of Burundi with a B.A. in chemistry in 2008 and from Ege University (Turkey) with an M.Sc and a Ph.D in analytical chemistry in 2013 and 2017, respectively.

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**Dr Madu Ali  
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Madu Ali Bwala is a university teacher and social science researcher who has supervised several undergraduate and postgraduate projects in the field of agricultural and development economics. His qualifications include a Ph.D in agricultural economics from Justus Liebig University Giessen (Germany) and B.Sc and M.Sc degrees in agricultural economics from the University of Maiduguri (Nigeria). Dr Bwala has attended several workshops and training courses, such as on the Competitive African Rice yield survey (Minna, Nigeria), the Comparative Research Network (Yaoundé, Cameroon), reversing degradation through innovation (Bonn, Germany), geometric arithmetic modelling systems (Hamburg, Germany), and the theory and applications of risk analysis and risk management in agriculture (Berlin, Germany).

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**Dr Claudious  
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Claudious Chikozho is a social scientist with more than 20 years of experience in the African research and development sector. Over the years, he has carried out substantial research on water resource governance, poverty alleviation, and inequalities in Africa. He also has substantial experience in leading project teams and communities of practice across different countries. Dr Chikozho has been leading the research division at the APHRC since 2018. In the past, he has worked as a research director at the Human Sciences Research Council in South Africa and as a science uptake coordinator at the International Water Management Institute in Ghana. He graduated with a Ph.D in social studies from the University of Zimbabwe in 2008.

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**Moumouni  
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Moumouni Compaore joined the Swiss NGO E-CHANGER in April 2020 as the national “cooper-actor” in charge of the development of the partner organisation Le Balai Citoyen. He is supporting this organisation in restructuring and in formulating its thematic policies (on gender, the environment, land, and security). Previously, he was in charge of engineering at Arts Terra/IRD (Population-Environment-Development Laboratory).

Mr Compaore graduated from Thomas Sankara University (Burkina Faso) and from Université de Limoges (France) with a master's degree in international and comparative environmental law. For his master thesis, he worked on the subject of electronic and electrical waste in international environmental law. He also graduated from Université Aube Nouvelle (Burkina Faso) with a master's degree in project management.

Mr Compaore previously worked as a visiting researcher (for Burkina Faso) at École Régionale Supérieure de la Magistrature (ERSUMA, a specialised institution of OHADA) in the framework of a research project on the economic scope of the OHADA Uniform Acts. At present, he is also the coordinator of the Konrad Adenauer Foundation's alumni network in Burkina Faso.

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Amadou Coulibaly has a Ph.D in meteorology and climate science. In addition to teaching courses on meteorology, agrometeorology, and climatology, he works as an IT and management officer for the WASCAL Doctoral Programme on Climate Change and Agriculture at IPR/IFRA (Mali). Dr Coulibaly's research focuses primarily on coastal weather fluctuations, especially with regard to how winds on land and at sea affect coastal weather.

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Since 2018, Jean Danumah has been a lecturer and researcher at CURAT, which is part of Université Félix Houphouët-Boigny. He obtained a Ph.D in climate change and land use at WASCAL (Kwame Nkrumah University of Science and Technology, Ghana) in 2010. Dr Danumah also holds a DEA degree in Earth science (with a specialisation in hydrogeology) and a master's degree in the same field (with a specialisation in geology) from the University of Cocody (Ivory Coast). His research focuses on natural disasters and land use monitoring, modelling, and forecasting in urban and peri-urban areas. Natural disasters (especially floods) have become a major problem throughout the world, and particularly in West Africa. In urban and peri-urban areas, the threat of flooding is due to urbanisation. Dr Danumah's professional expertise lies in floods, climate change, and dynamic urban monitoring and forecasting.

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Mohamed Elgali is an associate professor of agricultural economics at the University of Gezira. He teaches within the postgraduate programme of the university's Department of Agricultural Economics. He has also worked for a number of other divisions at this institution.

Dr Elgali has been involved in many research projects at the Ministry of Higher Education in Sudan. His own research focuses on climate change and its impact on food security and agriculture in general. In addition to serving on the academic international relations committee at the University of Gezira, he is a member of several international and regional networks and has published many articles on climate change, food security, and agricultural policy.

Dr Elgali graduated from Ain Shams University (Egypt) with a B.Sc in agriculture in 1991 and from the University of Gezira with an M.Sc in agricultural economics in 1997. In 2003, he received a DAAD scholarship within a Ph.D sandwich programme to finalise his Ph.D research at Justus Liebig University Giessen (Germany).

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Fousseni Folega teaches in the Department of Botany at the University of Lome, where he belongs to the Geomatics and Ecosystems Modelling Research Team in the Laboratory of Botany and Plant Ecology. His research tasks focus on biodiversity assessment and forest and biomass dynamics by using Earth observation data to monitor agrosystems and ecosystems in the context of climate change.

Dr Folega holds a doctorate in forest ecology (2012) and a postdoctoral certificate (2014) from the Beijing Forestry University (China). With the support of TWAS-DFG, he worked at the Center for Remote Sensing of Land Surfaces (ZFL, University of Bonn, Germany) as a visiting scientist from 2011 to 2016. From July to November 2018, he was a visiting scholar in the Faculty of Agriculture at Kyoto University (Japan) with funding from the Matsumae International Foundation.

To enhance his capacity building efforts, Dr Folega has also attended several international conferences and workshops (including IUFRO, SERVIR, FAO, UNDP, WRI, TWAS-DFG, and TWAS-IPA/CAS).

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**Dr Mary  
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Mary Idowu obtained bachelor's and master's degrees in soil science in 1993 and 2000, respectively, as well as a Ph.D in soil fertility and plant nutrition in 2005 from Obafemi Awolowo University. Since then, she has mentored 10 postgraduate candidates. She is now the acting head of the Department of Soil Science and Land Resource Management. In 2000, Dr Idowu received a DAAD scholarship to participate as a facilitator in the Area Water project at the International Women's University (Germany). She has received 10 other awards, has 25 publications, and has attended over 40 meetings. Her research focuses on promoting efficient nutrient usage and using potassium feldspar waste and wastewater biochar as cheap sources of nutrients. She is currently working on improving urban food systems.

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Chinasa Ikelu has over 10 years of cumulative work experience in the public and private sector. In the former field, he has worked in large groups to assist students with their mathematical skills. In the latter, he has worked as a research assistant at the African School of Economics (ASE). He is currently a German Academic Exchange Service (DAAD) fellow at the Institut de Mathematiques et de Sciences Physiques (IMSP). Dr Ikelu holds a master's degree in mathematics, economics, and statistics from ASE; a postgraduate diploma in mathematical models in economics and finance from Université Paris 1 Panthéon-Sorbonne (France); a bachelor's degree in statistics and economics from the University of Nigeria; and a certificate in policies for growth from the World Bank.

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Tariku Olana Jawo graduated with an M.Sc in tropical forestry and management from the Dresden University of Technology (Germany). From December 2012 to September 2019, he worked as a lecturer at Hawassa University's Wondo Genet College of Forestry and Natural Resources. He was also promoted to the position of assistant professor in April 2019. Currently, Mr Jawo is a Ph.D student at the Czech University of Life Sciences (CZU) Prague, where his Ph.D project is being jointly supervised by professors from CZU and Hawassa University. The project is entitled "Potentials of Coffee-Based Agroforestry System in Enhancing the Adaptive Capacity of Local People for Climate Change and Variability: The Case of Sidama Zone, Southern Ethiopia."

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Adeyemi Jeje is currently working as a scientific officer with the Lagos State Ministry of the Environment and Water Resources. He is responsible for policy formulation and promoting environmental sustainability in the state. He has worked in various capacities at the ministry as a desk officer on climate change.

Mr Jeje graduated from the University of Agriculture, Abeokuta (Nigeria) with an M.Sc in environmental management and has carried out research on climate-related disasters in coastal communities.

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George Karuku holds a Ph.D in soil science, an M.Sc in soil science, and a B.Sc in agriculture from the University of Nairobi. He is a senior lecturer in the same university's Department of Land Resource Management and Agriculture Technology (LARMAT), where he specialises in soil technology. This entails performing modelling for irrigation applications, scheduling the soil water balance of root zones, and increasing efficiency in crops' water consumption in order to enhance food security. Dr Karuku has done extensive research on climate change modelling and action research in the field, which he has combined with his supervision of Ph.D and M.Sc students. His areas of expertise include irrigation and water management, agronomy and soil science, and climate change mitigation models.

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Dr Olivier  
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Olivier Kashongwe is a researcher and lecturer in the Department of Animal Sciences at Egerton University. So far, his research has focused on practices that affect the production and quality of milk in smallholder dairy and pastoral systems with an eye toward reducing post-harvest losses. His current research interests include the sustainability of smallholder systems and the integration of economic, ecological, and social aspects. Dr Kashongwe is participating in the climapAfrica programme as an alumni expert from German funding initiatives because he believes that increased collaboration among researchers (especially in Africa), coupled with capacity building on climate-sensitive research, could contribute to Africa's sustainable development.

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Dr Noah  
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Noah Misati Kerandi is a DAAD alumnus and a member of the climapAfrica Climate Change and Meteorology working group. He now works as a lecturer in the Department of Geology and Meteorology at South Eastern Kenya University. He is also the chairman of the department, where he coordinates all activities involving geological and meteorological sciences. In addition, Dr Kerandi is a member of the Kenya Meteorological Society. He obtained a bachelor's degree from the University of Nairobi in 2002, a master's degree in technology from the Federal University of Technology Akure (Nigeria) in 2007, and a Ph.D from the Institute of Geography at the University of Augsburg (Germany) in 2017.

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**Dr Joseph  
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Joseph Kugbe, a soil scientist at the University for Development Studies, holds a Ph.D from the University of Bonn (Germany). His research involves climate change adaptation and mitigation. In the field of adaptation, he focuses on soil conservation measures, the use of early-maturing crop varieties, and timing in cropping systems. He has brought tremendous knowledge into climate-change-resilient farming systems in the production of cereals, legumes, and vegetables. With regard to mitigation, Dr Kugbe has helped to reduce nutrient losses and greenhouse gas emissions through satellite remote sensing and field experiments. His estimations have been recognised by numerous scientific organisations, including IPCC, where he presents his findings. He is currently working on emissions associated with plant nutrients and fertiliser regimes.

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**Dr Isaac  
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Isaac Larbi is a researcher in the Department of Civil Engineering at Koforidua Technical University. Through his research and teaching efforts, he has obtained good knowledge and experience in water resources, environmental science, and engineering. His research focuses on climate change and climate extremes, climate modelling and model applications, watershed hydrology and water-related ecosystem services, remote sensing and GIS applications in water resources, hydrological modelling of surface and groundwater, and agrometeorology.

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Ibrahim Macharia is a senior lecturer at Kenyatta University who holds a Ph.D in agricultural economics from Leibniz University Hannover (Germany). He has over 15 years of applied professional experience in both qualitative and quantitative socio-economic impacts and need assessments related to climate-smart agricultural technologies at various international organisations. In addition, Dr Macharia has expertise in teaching, administrative support, and student supervision at the university level.

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Precious Makwele is an alumna of HTW Berlin (Germany), where she earned a master's degree in international and development economics. She is currently working as a chief policy analyst in the Republic of Namibia.

Ms Makwele has 14 years of experience in public service in areas ranging from taxation to investment promotion and policy analysis. She is currently part of the climapAfrica programme in the Climate Change, Agriculture, and Rural Development working group.

In the future, Ms Makwele hopes to earn a Ph.D in the field of climate change and sustainable development. Her main objective in joining the climapAfrica programme was to learn further scientific and technical skills before embarking on her doctoral studies.

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Gladys Mosomtai is a passionate user of Earth observation as a means of solving global environmental challenges, especially in Africa. Her research interests include landscape ecology, epidemiology, climate modelling, and data science. Currently, she is a Ph.D fellow at the International Centre of Insect Physiology and Ecology and the University of KwaZulu-Natal (South Africa). She is conducting her research on using Earth observation datasets to understand factors that influence coffee pest populations at the landscape and plot levels while integrating the use of machine learning algorithms. Ms Mosomtai has co-authored several scientific publications in peer-reviewed journals and received a L'Oréal-UNESCO For Women in Science Sub-Saharan Africa Fellowship in 2018. She hopes to inspire more women to join the STEM fields.

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Chipo Plaxedes Mubaya, who holds a Ph.D in development studies, is currently the international collaboration manager and an associate professor at the Chinhoyi University of Technology. She supervises M.Phil, Ph.D, and postdoc candidates in addition to her work in the university's International Collaborations Office. Dr Mubaya's research centres on rural and urban development, especially in connection with climate change adaptation, natural resources, and decision-making processes related to climate change at the local level.

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Onan Mulumba is an academic agricultural librarian and a project co-manager for AHEAD at Makerere University. Previously, he served as a representative of Research4Life users on the Executive Council won the Research4Life Unsung Heroes award in 2013. He also participated in the implementation of TEEAL-AGORA project activities in Uganda under ITOCA and Digital Access to Research: Prospects of the Technology Bank Project. Mr Mulumba is a researcher in agricultural information services and a trainer of information literacy and reference management. He holds a bachelor's degree in biological sciences and a master's degree in Information science and looks forward to pursuing a Ph.D. His research interests include climate change, information literacy, and digital humanities.

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Peter Onyango Odhiambo holds an M.Sc in botany (2005) and a B.Sc in biological sciences (1995) from the Jomo Kenyatta University of Agriculture and Technology. He was a DAAD scholar and visiting scientist at DSMZ in 2007 and is now a member of the working group on plant and animal physiology in the climapAfrica programme. Mr Odhiambo was nominated for the Tony Elumelu Entrepreneurship Programme in 2015. In addition, he initiated a research and development programme on the extraction and utilisation of Thevetia peruviana seed oil. The aim was to transform *T. peruviana* from an ornamental shrub into a cash crop for vegetable oil and seed protein production in Kenya, Africa, and the world at large. He also founded Yellow Oleander Enterprises in Kenya.

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Olujumoke Ogunrayi earned her master's degree in meteorology at FUTA (Nigeria) and a postgraduate diploma certificate in environmental management at TU Dresden (Germany). She is one of the states' desk officers on climate change in Nigeria. As a climate change director, she initiates and drives climate change activities. Ms Ogunrayi has professional expertise in the public policy aspects of weather and climate-related information, environmental education, climate variability and change, and related applications in human activities, ecosystem services, and human development. Her fields of research include interactions of the environment and society, including land use and anthropogenic transformations of land cover, climate change, marine science and conservation, environmental governance science, and policy interactions.

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Chukwuebuka Christopher Okolo is an agricultural soil scientist with a Ph.D in soil science from Mekelle University. He is passionate about achieving an in-depth understanding of soil organic carbon and its role in boosting agricultural productivity in the face of climate change. Within the context of the climapAfrica research project, his research interests centre on the accurate quantification of soil organic carbon and the measurement of CO<sub>2</sub> emissions under contrasting land use systems and soil types. Dr Okolo aims to provide framework information that will support our understanding of carbon capture distribution and transfer, which are vital in supporting ecosystem services.

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Vincent Orekan is a DAAD alumnus from Benin, West Africa. He graduated in geography from the University of Abomey-Calavi. In 2007, he began working towards a Ph.D at the Geography Institute of the University of Bonn (Germany) with support from the DAAD and the IMPETUS GLOWA project. For his doctorate, he collected remote sensing and socioeconomic data to model (simulate) land use and land cover changes in the Upper Oueme Catchment of Benin at a local scale (villages) by adapting the CLUE-s Model. Currently, Dr Orekan is the head of geomatics, remote sensing, and GIS at IGATE and a lecturer in the Faculty of Human and Social Sciences. He is also an external supervisor of master's and Ph.D students for WASCAL and AFRIGIST (formerly RECTAS).

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Beatrice D. Simo-Kengne is a professor and senior research fellow for the Public and Environmental Economics Research Centre (PEERC), which is part of the School of Economics at the University of Johannesburg. She holds a master's degree and a Ph.D in economics and has more than 30 publications in the field of development economics and risk management. They cover the areas of housing stock, health, energy, agriculture, growth environments, performance evaluation, portfolio management, monetary policy, and importing/exporting. Dr Simo-Kengne is an alumna of the World Academy of Sciences, an affiliate of the African Academy of Sciences, a member of the Economic Society of South Africa, and a current mentor for the 2020 climapAfrica programme of the German Academic Exchange Service.

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Mr Wafula holds an M.Sc in renewable energy from the University of Oldenburg (Germany, 1993). For his master thesis, he looked into the sizing and designing of solar home systems for rural Kenyan communities. Prior to pursuing his master's degree, Mr Wafula was seconded to a biogas dissemination program involving the Ministry of Energy in Kenya and the German international cooperation agency GIZ. He is currently pursuing his Ph.D studies at the Institute for Climate Change and Adaptation at the University of Nairobi.

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Julia Bastong joined the DFG as a programme consultant in the International Affairs Division's Asia Team in 2013. Since 2016, she has been working in the Africa Team, where she assists all measures designed to facilitate research cooperation between German and African researchers. This involves working with various African networks, such as the African and Malagasy Council for Higher Education (CAMES) and the Next Einstein Forum (NEF). Ms Bastong is also supporting the establishment of a framework for joint funding and organising scientific events that connect German and African researchers. She graduated from the HTWG Konstanz - University of Applied Sciences with a B.A. in international management and Asian studies in 2010.

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Lara Berens joined the German Research Foundation (DFG) in April 2019. She is a project assistant for international cooperation with Africa and the Middle East in the division of International Affairs. She is mainly responsible for cooperations with eastern and southern African countries. In this context, her tasks include working closely with the Science Granting Councils Initiative (SGCI) in sub-Saharan Africa.

Ms Berens graduated from the University of Bonn with an M.A. in cultural anthropology in 2018. For her master thesis, she collected research data in Nairobi, Kenya. During her studies, she also worked with the Uganda National Commission for UNESCO in Kampala and the Goethe Institute in Dar es Salaam (Tanzania).

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Silke Bertram works as a programme director at the Volkswagen Foundation, Germany's largest private research funder. She has a background in geography and geosciences and holds an M.Sc from the University of Uppsala (Sweden), as well as a Ph.D in landscape evolution in Namibia from the University of Würzburg (Germany). She previously held positions as a co-ordinator for study affairs in the Department of Geosciences at the University of Bremen and as an officer for science policy research funding and EU affairs at the Ministry for Science and Culture of Lower Saxony (both Germany). At the Volkswagen Foundation, Dr Bertram is a contact person for scientists in the fields of geography, geosciences, and environmental sciences and oversees two international funding programmes.

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Markus Disse is a civil engineer who earned his doctorate in hydrology at TH Karlsruhe under Prof. Dr.-Ing. Plate. For several years, he led the Departments of River Morphology and Water Management & Statistics at the German Federal Institute of Hydrology in Koblenz. Since 2013, he has been a full professor of the Chair of Hydrology and River Basin Management at TU Munich. The research topics of the chair include water and land management (with a focus on Central Asia and East Africa), IWRM, floods, and remote sensing. At the ClimapAfrica Conference, he will be represented by Dr Alexander Gerner, who is an expert in both floods and dryland hydrology. They are partners of the WASCAL project FuriFlood, which is scheduled to start in 2021.

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Jan Christian Habel is an evolutionary biologist, ecologist, conservation biologist, and entomologist. He studied environmental sciences at the Leuphana University Lüneburg (Germany) and did his PhD and postdoctoral research qualification at Trier University in the fields of population genetics and biogeography. He is currently leading the working group "Evolutionary Zoology" at the Department of Biosciences of the University of Salzburg. He has also conducted intensive research on forest ecosystems of eastern Africa and led various transdisciplinary research programmes in sub-Saharan Africa with funding from the DAAD.

The University of Salzburg is located at the foot of the Alps in northern Austria. It was founded in the year 1622 and is now attended by a total of 15,000 students. The university is well known for its profound expertise in the fields of history, theology, music (Mozarteum), and bio- and geosciences.

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Torsten Haberzettl has been working in the Physical Geography Department of the University of Greifswald since 2018. He did his Ph.D on paleoenvironmental investigations in Bremen in 2006. Since then, he has held postdoctoral positions at the Universities of Göttingen, Jena, and Quebec (Canada). During the past 10 years, he has supervised DAAD scholars who have expressed interest in environmental changes and sediments and have visited his institutions for several months. Dr Haberzettl's main interests lie in paleoenvironmental changes in southern Africa, where he has been carrying out several international projects on various lakes. He recently started an environmental assessment programme in the harbour of Richards Bay, where he also carried out the DAAD-funded international summer school Train-Me (<https://geo.uni-greifswald.de/trainme/>).

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Jörg Helmschrot has been the SASSCAL Director for Science & Technology / Capacity Development since 2016, which makes him responsible for the implementation of SASSCAL's research and human capacity development programmes. In his previous positions as scientific coordinator at UHH and FSU Jena (Germany), he coordinated water and climate research, the implementation of a regional weather monitoring network, and the SASSCAL OADC. Dr Helmschrot holds a diploma in geography (1999) and a Ph.D in geoinformatics (2006) from FSU Jena. He did his postdoc at the University of Washington (USA, 2010-11) and has held a professorship (eo) at Stellenbosch University (South Africa) since 2016. He has more than 20 years of experience in water-related research in southern Africa, Turkey, the United States, Tibet, and Australia, all of which has been published in more than 100 scientific papers.

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As division head of strategic planning, Michael Hörig supervises the work of five sections at the DAAD headquarters in Bonn: Higher Education Policy, Monitoring & Evaluation, Development Cooperation, German Studies and Studies & Research. Previously, he led the Development

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Before joining the DAAD, Mr Hörig worked as a programme manager at the European University Association (EUA) in Brussels, Belgium. He coordinated various European projects and contributed to policy development for the European Higher Education Area (EHEA).

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Fèmi E. Hounnou started as a collaborator in the Faculty of Agronomic Sciences at the University of Abomey-Calavi in 2015. One year later, he became a research assistant in the Laboratory of Rural Economics and Farming Management. Since 2018, he has been a head of statistics at the Centre de Recherche, d'Expertise et de Formation Afrique Durable.

Dr Hounnou graduated from the University of Abomey-Calavi with a B.A. and an M.Sc in agricultural economics in 2012 and 2016, respectively. While earning his Ph.D from the same university (2020), he collaborated with professors from Humboldt-Universität zu Berlin (Germany) and the University of Lomé (Togo).

His research focuses on economic modelling to explore and quantify the impact of climate change and agriculture policies, the economic efficiency of farms and natural resources, and other phenomena.

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Christian Hülshörster graduated from the University of Münster with a degree in German studies, social sciences, and Catholic theology. He then worked as a lecturer in the United States, Great Britain, and Thailand. From 1998 to 2001, he was a DAAD lecturer and the head of the DAAD Information Centre in Bangkok. He then returned to Germany to take up a post in Bonn as head of the DAAD section responsible for international university marketing. From 2005 to 2010, Dr Hülshörster was head of the DAAD regional office in Cairo (Egypt) before taking on his current role as Head of Division 44 (North Africa, Middle East, Gulf States) in August 2010.

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Wilfred Kadewa is the executive dean of the Ndata School of Climate and Earth Sciences at the Malawi University of Science and Technology. He is an environmental and resource management specialist with over 19 years of professional experience. During his career, he has been involved in vulnerability assessments, water resource management, environmental and social impact assessments, soil remediation technologies, and GHG inventory and accounting. Dr Kadewa holds a Ph.D in applied environmental sciences from Cranfield University (UK, 2010) and an M.Sc in environmental science from the University of Malawi (2001). He has managed projects ranging from climate-smart agriculture, eco-sanitation, GHG accounting in agriculture, and climate modelling.

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Michaela Carmen Kristan, a native German, studied international economic affairs, French, and Spanish in the United States. After her studies, she stayed in the US for 24 years, spending 14 years in the German Foreign Service (including 12 years as a policy advisor for public affairs at the German Consulate General in Atlanta and two years as a climate and energy advisor at the German Embassy in Washington, DC). She also worked for the NGOs Microfinance Opportunities and the League of Women Voters. After her return to Germany in 2016, Ms Kristan worked for one year for the Federal Agency for Nature Conservation. She has now been with the German Research Foundation for three years, where she is on the Africa Team and handles the TWAS Programme.

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Constanze Leemhuis joined DLR-PT in 2018 and now works within the Department of Environment and Sustainability as a scientific officer in the Africa team. This team supports the administrative and scientific coordination of the climate competence centres WASCAL and SASSCAL – including the WASCAL/SASSCAL research and graduate school programmes and the DAAD alumni programme climapAfrica – on behalf of the BMBF. Dr Leemhuis previously worked as a senior researcher in the Department of Geography at the University of Bonn for the BMBF-funded project “GlobE (Research for Global Food Supply): Wetlands in East Africa”. She holds a Ph.D in hydrology and landscape ecology from Georg-August-Universität Göttingen.

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Stefan Liersch is a senior scientist who has worked at PIK since 2009. He has gained a wealth of experience in various interdisciplinary research projects related to Africa, where he has conducted climate change impact and vulnerability studies at the regional and local scale. Dr Liersch is an expert in eco-hydrological modelling, model development, and scenario design who works at the interface of global, regional, and local scales to generate tailor-made information for stakeholders and decision-makers. In the framework of the JPI Climate ERA4CS initiative, he coordinates the CIREG project on climate information to support integrated renewable electricity generation in West Africa. Dr Liersch graduated from the University of Potsdam with a diploma in geoecology.

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Eike Luedeling leads the Department of Horticultural Sciences at the University of Bonn. Before this appointment, he worked for World Agroforestry as a climate change scientist (2010-2013) and a senior scientist in decision analysis (2013-2018). He previously served as a postdoctoral scholar at the University of California, Davis (USA) for two years. Dr Luedeling holds a Ph.D in agricultural sciences from the University of Kassel (2007) and M.Sc degrees in international agricultural development (UC Davis, 2005) and international ecological agriculture (Kassel, 2004). The main lines of research pursued in his current group are the dormancy of temperate fruit trees (including climate change impacts and adaptation), agroforestry (in tropical and temperate climates), and the application of decision analysis methods in agricultural research.

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Mr Merk graduated with a B.Sc and an M.Sc in environmental engineering from TU Munich in 2014 and 2017, respectively. His topics of focus were water resource management and flood risk management. In 2018, he joined the research team at the university's Chair of Hydrology to support the ProNaHo project, which investigated the potential of ecosystem-based flood mitigation measures in Bavaria.

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Jonas Metzger studied social science at Justus-Liebig-University Gießen. Since 2011, he has worked on various research projects in the university's Department of Sociology in the team under Prof. Reimer Gronemeyer, including on rural development and small-scale agriculture in eastern and southern Africa and aging societies in Europe. Over the course of his projects, Dr Metzger has conducted extensive field research in Malawi, Namibia, Tanzania, and Turkey.

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Mariane Michels joined the DAAD in 2019 as a project administrator shortly after the launch of the scholarship programme "Climate Change Research Alumni and Postdocs in Africa" (climapAfrica). She is now responsible for the formal examination and preparation of applications, as well as for the administrative organisation of the climapAfrica meetings that select the programme's next scientists and practitioners. In addition, she is tasked with attending to all the administrative needs of scholarship holders and providing them with financial supervision for the duration of their fellowships.

Ms Michels previously worked as an official in charge of the management section at a local children and youth welfare service.

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Noreen Mutoro began her Ph.D at the University of Salzburg in 2019. Her research focuses on conservation of the cheetah (*Acinonyx jubatus*) in human-dominated landscapes through combinations of methods based in ecology, geoinformation, and social sciences. Before her starting her Ph.D, Ms Mutoro worked as a research assistant with Action for Cheetahs in Kenya. She graduated from the University of Nairobi with a B.Sc in wildlife management and conservation, as well as an M.Sc in conservation biology. Her M.Sc project was on the dietary selection of a small cheetah population living outside protected areas in southeastern Kenya. Ms Mutoro's academic interests mainly include non-invasive survey methods in carnivore ecology studies involving conservation dogs, species distribution modelling, GIS, and remote sensing.

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Jutta Nüdling joined the German Federal Ministry of Education and Research (BMBF) in 2014. She is an administrative officer in Division 723 (Global Change and Climate Research), where she is in charge of the competence centres WASCAL and SASSCAL.

Before joining Division 723 in 2018, Mrs Nüdling worked for Major Project Controlling in the Z73 Division of the BMBF. She had previously worked for more than 20 years in the controlling department of Deutsche Telekom AG in Bonn.

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Issaka Ouedraogo graduated in biochemistry/applied microbiology in 2007 and in environmental health in 2012. From 2008 to 2015, he taught biology and mathematics at a secondary school. After that, he joined the Ministry of Environment in 2014, where he was in charge of mainstreaming climate change and other topics (biodiversity, gender, land degradation, etc) into planning and project design. Since 2018, Mr Ouedraogo has been serving as the National Designated Authority of his country's Green Climate Fund. In working closely with different stakeholders (public and private entities, civil societies, and municipalities) to mobilise climate funding, he has a profound interest in climate finance mobilisation in the context of fragility and conflict in the Sahel region as a potential Ph.D thesis topic.

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Moumini Savadogo is a scientist and project/programme manager in environmental and sustainable development in Africa who has 15 years of experience at senior management levels. He holds a Ph.D in animal sciences and sustainable land use in crop/livestock systems from Wageningen University (the Netherlands). He also has expertise in programme development and management (including in fundraising, implementation, procurement, monitoring and evaluation, budget management, human resource management, and reporting), as well as in negotiations. Before being appointed the executive director of WASCAL, Dr Savadogo worked as head of the Burkina Faso office of the International Union for Conservation of Nature (IUCN) within the West and Central Africa Programme (PACO). He also worked as scientist for the National Institute of Environment and Agricultural Research (Burkina Faso).

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Brice Sinsin is a forester by background and a specialist in plant ecology, rangeland, and wildlife conservation. Previously, he served as vice chair of WCPA/IUCN for Central and West Africa, a member of the governing board of ICRAF and WASCAL, and a rector of the University of Abomey-Calavi. Dr Sinsin is now the director of the Laboratory of Applied Ecology at UAC and a member of WASCAL's scientific advisory committee. His research focuses on ecosystem management, pastoralism, and wildlife conservation both within and outside of protected areas.

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Kevin Stephanus joined SASSCAL in 2018 and is now responsible for the management and coordination of the Human Capacity Development Program. Mr Stephanus previously worked for the United Nations Development Program in Namibia as the regional training officer for the Benguela Current Commission. Prior to that, he worked at the University of Namibia as a lecturer of natural resource and fishery management. Mr Stephanus graduated from the University of Namibia with a bachelor's degree in economics and management sciences in 1998 and from the Norwegian College of Fishery Science (University of Tromsø) with an M.Sc in fishery management in 2000.

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Ms Wetzel previously worked as a personal assistant to the group chairman of the Green Party in Baden-Württemberg and as a project assistant at the Arnold Bergstraesser Institute within a DAAD-funded project in northern Iraq. She graduated from the University of Freiburg in 2009 with an M.A. in sociology and Middle Eastern studies.

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