The African Academy of Sciences

AESA AN INITIATIVE OF THE AAS & AUDA (AFRICAN UNION DEVELOPMENT AGENCY)

AUDA-NEPAD AFRICAN UNION DEVELOPMENT AGENCY

Setting Priorities for Climate Change and Development in Africa

8 February 2021

Contents

List of Acronyms

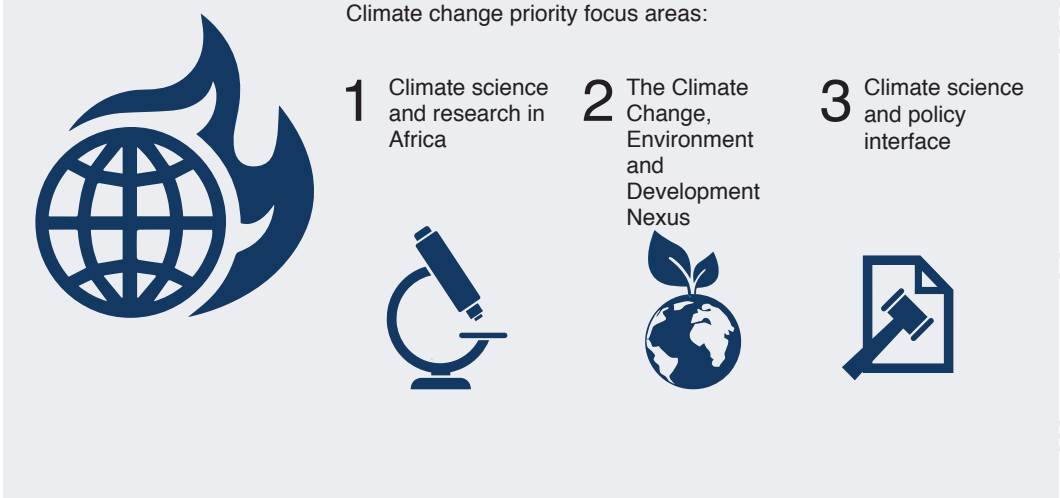
AESA	Alliance for Accelerating Excellence in Science in Africa
ACMAD	African Centre of Meteorological Application for Development
ACRIS	African Climate Resource and Information Service
AfDB	African Development Bank
AGN	African Group of Negotiators
AMCEN	African Ministerial Conference on Environment
APP	African Progress Panel
AU	African Union
AUC	African Union Commission
CAHOSCC	Council of African Heads of States on Climate Change
CIRCLE	Climate Impacts Research Capacity & Leadership Enhancement
IPAC	Climate Prediction and Applications Centre
IEA	International Energy Agency
IGAD	Intergovernmental Authority on Development
IPCC	Intergovernmental Panel on Climate Change
LCM	Life Cycle Management
RCMRD	Regional Centre for Mapping of Resources for Development
RSRPs	Regional Climate Research Partnerships
SAC	Scientific Advisory Committee
SADC	South African Development Community
SASSCAL	South African Science Service Centre on Climate Change and Adapted Land Use
SDGs	Sustainable Development Goals
SIDS	Small Island Developing States
TW	TerraWatt
UNECA	United Nations Economic Commission for Africa
UNEP	United Nations Environment Programme
WASCAL	West African Science Service Centre on Climate Change and Adapted Land Use

Executive Summary

Climate change and environment are key focus areas of the 2018-2022 strategic plan of the Alliance for Accelerating Excellence in Science in Africa. The AESA and its partners have been addressing the need for evidence-based research on climate change through a number of programs. In July 2019, the Alliance for Accelerating Excellence in Science in Africa (AESA) in collaboration with the United Nations University Institute for Natural Resources in Africa and in coordination with Intergovernmental Panel on Climate Change Secretariat convened African scientists and key policy stakeholders to deliberate on key challenges and identify priority actions. As a follow-up to this, AESA produced a Paper on "Climate Change and Development in Africa" which will inform its strategic decisions and programmes and provide the basis for engaging with regional and international partners. The following are the major from this working paper against the priority focus areas identified.

A) Climate science and research in Africa

1. Generating Africa-specific evidence-based data and knowledge on the various aspects of climate change and its impacts is an important prerequisite for ensuring active participation in and contribution of Africa to the global discussion and negotiation on climate change, including the IPCC process. To achieve this, Africa and its development partners have to consolidate their effort in building both individual and institutional capacity in climate science and research in the region.
2. The primary focus of this effort has to be on creating a critical mass of trained scientists with requisite expertise in understanding and predicting climate driving mechanisms across time, space and scales and create adequate observational networks for meteorological, hydrological and related environmental data.
3. Promoting co-production of knowledge through transdisciplinary and consultative process, addressing systemic barriers that prevent African researchers from emerging into positions of leadership and implementing an adaptive funding mechanism for climate science and research would assist progress in climate research in Africa.
4. One of the major challenges faced by most African countries in relation to climate science is the ability to generate and process climate science data with a primary focus on improving the accuracy, quality, accessibility, timeliness and usability of data generated by existing institutions. This can be addressed through enhanced knowledge broker function between African climate science and international climate science groups and African climate scientists and African policy makers.



5. Collaboration among institutions that are engaged in the field of climate science research is critical as it allows to achieve effective utilization of existing knowledge, expertise and institutional capacity and generate more robust evidence-based outputs. This is even more critical for Africa due to the limited and thinly dispersed individual and institutional capacity across the region.

B) The climate change, environment and development nexus

6. Africa's ecosystem assets face threats from a variety of factors, but certain hotspots will be more vulnerable to these stressors because of their location. Climate change will have a big impact on Africa's ecosystem with serious implications on the availability of arable land and freshwater. This would require significantly enhancing the adaptive capacity of the region. Building the socio-ecological resilience of African countries to adapt or transform in the face of change is crucial for ensuring food security and sustainable development in Africa.

7. The infrastructural landscape of Africa is marred by challenges such as low levels of development, coverage, access, and maintenance of existing systems. African countries have a unique opportunity of leapfrogging to transformational energy, urban, and industrial infrastructure making the best use of emerging technology and knowledge systems. This would require having a systems perspective that looks at the ecological, physical, institutional and human infrastructure to get a holistic understanding.

8. Building resilience by utilizing approaches such as ecosystem-based adaptation and climate smart agriculture; managing the nexus between energy development, industrialization and urbanization through an integrated and system-based approach; breaking sectoral silos by adopting more integrated planning and development process; deploying tools of Life Cycle Management (LCM) for infrastructural development and management; and integrating nature-based solution based on principles of eco-design that could help in building transformational infrastructure that is climate resilient.

9. Climate change is acknowledged as a major health risk multiplier resulting in increased health risks from water borne diseases and air pollution. Local changes in temperature and rainfall have already altered the distribution of disease vectors such as ticks, mosquitoes and sand-flies. The continuous disruption and destruction of natural habitats and ecosystems at various levels have increasingly become the source of major pandemics, such as avian influenza, Rift Valley fever, Ebola, and, SARS.

10. For Africa to overcome existing and emerging health challenges it needs to adopt comprehensive health, environment and development nexus approach in the design and implementation of national health strategies and programmes. This is critical on efficiency grounds, but also for distributive justice and and to address the ethical and legal obligations of States. Countries also need to enhance their national health information and knowledge system through better measurement and monitoring frameworks, which has community-based surveillance, early warning and response systems at its core supported by available digital technologies.

C) Climate science and policy interface

11. One of the major gaps in climate governance in Africa is the weak linkage between science and policy. Strengthening the interface between them is crucial to ensure effective development and implementation of evidence-informed development strategies, policies and programmes at different levels. African scientists need to increasingly engage with policy making bodies in defining the research agenda and process on climate change. Such co-development of the research agenda would help in making the research outputs more actionable for policymakers

12. Addressing relational incongruence that arises from the inconsistent relationship between scientists' knowledge and the knowledge demands and use of the end-users or climate policymakers is critical. The promotion of community of practice that is based on direct two-way interactions between scientists, policymakers and stakeholders in which there exists a high degree of engagement, negotiations, reflections and feedback is a useful vehicle for improving the science-policy interface

13. The three-tier continental policy coordinating mechanism, which consists of the African Group of Negotiators, the African Ministerial Conference on Environment (AMCEN), the Council of Heads of State on Climate Change (CAHOSCC), that is facilitated under the auspices of the African Union has been instrumental in facilitating common regional positions. Consolidating these regional coordination platforms through enhanced collaboration

with African focal points in IPCC is necessary to enhance Africa's contribution to the global climate discourse and negotiation on climate change.

14. Providing science-based information to decision-makers and to the leadership of civil societies and major groups, including the informal sector, is a critical factor for mobilizing the general public for transformational changes towards a climate-resilient economy. This would require enhancing investment in both the hardware and software of information infrastructure; expand internet access for providing real-time information to stakeholders; and provide actionable information that are demand-driven and responsive to user needs.

15. The Alliance for Accelerating Excellence in Science in Africa could play a major catalytic role both as a knowledge producer and broker in implementing the above recommendations. This would require it to effectively mobilize its Fellowship and develop strategic partnership with all major players in the field of climate change and development in the region.

Photo credit AESA 2019

CR4D induction meeting in Naivasha,Kenya

Background

Climate change and environment are key focus areas of the 2018-2022 strategic plan of the Alliance for Accelerating Excellence in Science in Africa (AESA). The AESA and partners have been addressing the need for evidence-based research on climate change through a number of programmes including the Climate Impacts Research Capacity and Leadership Enhancement (CIRCLE) and Climate Research for Development (CR4D) fellowship schemes. The CIRCLE fellowship supported thematic research in the climate sensitive sectors of energy, water resources, agriculture, forest, health and the political economy of climate change resilience. The CR4D fellowships are addressing priorities defined by Africa's scientists and include research in foundational climate sciences, climate impacts, information base, translation and communication; and engagement with policy and decision-making communities for uptake of impact information.

The Academy has also established working groups on climate change and environment as part of its strategy on enhancing the active participation and contribution of AESA Fellows and Affiliates in strategic areas of concern for the region. In July 2019, the AESA in collaboration with the United Nations University Institute for Natural Resources in Africa and in coordination with Intergovernmental Panel on Climate Change (IPCC) Africa Secretariat convened African scientists and key policy stakeholders to deliberate on key challenges and identify priority actions to address the issues raised by IPCC Special Report on 1.5 degrees (SR1.5). The meeting identified priority areas for the AESA to explore in order to enhance its contribution to the regional cli-mate change and development forums in line with major policy frameworks including the AU Agenda 2063, STISA 2024, the AESA vision of transformed lives through science, and other relevant regional and global frameworks.

The outcome of this meeting was further reviewed and refined with inputs from a team of Fellows and Affiliates from the Climate and Environment Working Groups of the AESA. This resulted in an Outcome Document of the AESA Climate Change Experts Consultative Meeting that was published by the Academy. Based on the recommendation from the Working Groups, AESA decided to prepare a a detailed working paper covering the key priority areas indentified in the ourcome document. This pro vided the basis for the preparation of this working paper on 'Setting priorities for climate change and development in Africa'.

Introduction

The United Nations Conference on Environment and Development (UNCED) held in June 1992 in Rio de Janeiro recognized Climate change as one of the major environmental challenges faced by humanity. This led to the establishment of the United Nations Framework Convention on Climate Change (UNFCCC) and the subsequent adoption of the Kyoto Protocol on Climate Change in 1998, which included quantified emission limitation and reduction commitments by industrialized countries. While the Kyoto Protocol, which stayed effective until 2012, led to numerous emission reduction initiatives, series of reports produced by the Intergovernmental Panel on Climate Change (IPCC) showed that the effect of clime change continue to rise. This led to increasing number of natural disasters, both in frequency and strength, that mainly affected de-veloping countries.

In December 2015, countries adopted the Paris Agreement on Climate Change that requires deeper emissions reduction commitments from all countries. Countries responsible for 97 percent of global emissions submitted their climate commitments prior to the 21st Conference of Parties (COP-21) held in Paris. These commitments have been enshrined with domestic ratification, acceptance, or approval by countries. Besides mitigation measures for emission reduction, the Paris Agreement established the global goal on adaptation of enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change, with a view to contributing to sustainable development and ensuring an adequate adaptation response for climate change. The agreement contains provisions to hold countries accountable to their commitments and mobilize greater investments to assist developing countries in building low-carbon, climate-resilient economies.

Despite its least contribution to the global greenhouse gas emissions, Africa has been one of the developing regions that has been significantly affected by the effect of climate change. Recognizing the threat posed by climate change, African countries, under the leadership of the African Union, have been actively participating in global climate change negotiations. However, there is a growing need to further strengthen Africa's contribution through enhanced climate science and policy research capacity. This 'Paper on Setting Priorities for Climate Change and Development in Africa' is prepared to inform strategic decisions and programmes and provide the basis for engaging with regional and international partners. The paper has been developed through active contribution of AESA Fellows and Affiliates based on the outcome document from AESA-IPCC consultative workshop. The paper is organised as follows: the first section focuses on the capacity needs and gaps related to climate research in Africa; the second section looks at the critical nexus issues between climate change and development in the context of African Union Agenda 2063 and key global challenges; the third section covers the critical issues related to the interface between climate science and policy with particular focus on enhancing the relevance and contribution of African scientists to regional and global knowledge systems; and each section ends with specific recommendations for action.

Methodology

This paper is based on desk review of available literature and institutional documents related to climate change and development conducted between May and August 2020. The below are the key elements of the methodology in preparing the paper:

Key elements of the methodology

The content of the paper is structured as per the outline prepared by the climate and environment working team based on the priority areas that were identified in the outcome document from the AESA-IPCC Consultation Workshop on Climate Change in Africa held in July 2019.

Existing relevant literature and institutional documents were systematically reviewed with a focus on regional policy and programme documents that identified the key issues related to climate change and development in Africa.

Key recommendations that could be considered by primary stakeholders and the Alliance for Accelerating Excellence in Science in Africa in addressing the major needs and gaps were identified.

The draft paper was circulated to members of the Climate and Environment working team and was independently reviewed by external reviewers. The paper was finalized based on the feedback and comments received.

Limitation: Enormous effort was made to include data on existing scientific and institutional capacity gaps within the region. Unfortunately, this was not possible due to lack of consolidated data at the regional level other than anecdotal statements.

Photo credit: AESA

CR4D grantees Marte Moncho and Anderson Kehbila during the Connecting Minds Africa meeting, held in Nairobi, Kenya in 2019

1. Climate science and research in Africa

The scientific and technical reports produced by the Intergovernmental Panel on Climate Change (IPCC) provide one of the key foundations for negotiations and policy decisions at the global level. The IPCC facilitates this through a global assessment of latest published literature on various aspects of climate change and its implications. The assessment is carried out by scientists from all over the world including Africa through clearly defined clitive process on climate science that consolidates evidence-based facts and figures from published sources and take it through rigorous review processes. Despite the open nature of the IPCC process, there is much to be desired in terms of the contribution of Africa both in terms of the number of peer-reviewed publications focusing on Africa and contribution to the review process. Even when there is, it has been noted that, most of this contribution come either from institutions that are based outside Africa or African Diasporas

Generating an Africa-specific evidence-based data and knowledge on the various aspects of climate change and its impacts is an important prerequisite for ensuring active participation in and contribution of Africa to the global discussion and negotiation on climate change. Increasing number of initiatives (Annex 1) have been launched over the last decade to address these limitations. However, their impact has not yet been that significant due to a number of challenges. Overcoming these challenges is critical in establishing the foundation for enhanced science and evidence-based policy and decision-making in Africa on climate change. The critical issues that need to be considered in this context are: capacity needs and gaps, data generation and processing and the possible institutional collaboration that could be enhanced and promoted in addressing these challenges.

1.1 Capacity needs and gaps for climate research

The major challenges facing the African climate research include lack of a critical mass of trained scientists with requisite expertise in understanding and predicting climate driving mechanisms across time, space and scales (UNECA 2019). Inadequacy of observational networks for meteorological, hydrological and related environmental data coupled with limited understanding of the African climate system has impeded the continent's ability to deliver adequate early warnings and climate predictions. This, in turn, has restricted the use of climate information by African decision-makers and communities most vulnerable to current and future impacts of a changing climate. There has been an increasing number of regional and continental initiatives that are aimed at addressing the major limitations and challenges related to climate research in Africa. Annex 1 highlights some of these initiatives related to enhancing climate research capacity in the region. The most notable ones of these initiatives are the African Climate Research for Development (CR4D) initiative and the Future Climate for Africa initiative.

Solar panels harnessing solar energy. Credits freepik

CR4D strategic plan, 2019-2023

The Secretariat of CR4D, with the support of its Scientific Advisory Committee developed a strategic framework (2019-2023) that provides a road map to improve the provision of climate services in Africa in the coming five years. The strategic plan sets out the following four structural goals to sustainable development and to improve research capacity on the continent:

- Co-design multidisciplinary research for improving climate forecast skill and reliability across temporal and spatial scales;
- Improve information delivery, including information from observing systems;
- Develop scientific and institutional capacity;
- Provide climate services and user interface platforms.

Source: (UNECA 2019)

The Climate Research for Development (CR4D) for Africa is a regional initiative that was launched to strengthen links between climate science research and climate information needs in support to development planning in Africa. CR4D has the objective of supporting the Africa climate research community (scientists and institutions) in generating end-user climate information. CR4D agenda has been organized around four core pillars of climate research for development in Africa including: (i) improved observation system and delivery, (ii) scientific and institutional capacity development, (iii) mainstreaming climate services and integrated research, and (iv) co-designed multi-disciplinary climate research.

Future Climate for Africa (FCFA)[1] aims at generating fundamentally new climate science focused on Africa, and to ensure that this science has an impact on human development across the continent. From 2015-2019 this programme brought together more than 200 researchers from over 20 countries to improve the understanding of climate variability and change across Africa; develop new tools and methods for integrating climate information into decision-making; and contribute to policies, plans and investments that are resilient to medium- to long-term climate change. FCFA recently produced a report (FCFA, 2020) that took stock of the lessons emerging from implementing this cross-regional, use-oriented, and consortium-based research programme, in order to inform future investments into research on climate and development. The following are the most relevant challenges and recommendations that are highlighted in the report: -

Individual and institutional capacity: while capacity development at any level is a positive outcome, the unstable research environment on the continent could mean that individual capacity building efforts have a short institutional legacy. As noted by Cobban et al., (2016), efforts to build individual capacity need to be accompanied by investments in more robust systems that allow that capacity to be mobilised.

Collective and distributed leadership model: international teams and transdisciplinary collaborations bring together partners with different competencies, perspectives, and expectations. The most-cited enabler to building collective capacity are collaborative and distributed leadership, which could lead to new opportunities for partnerships on climate research.

1 More information on Future Climate for Africa can be found at: https://futureclimateafrica.org/

Key needs for institutional collaborations

- Jointly identify key challenges, knowledge gaps and user-driven research priorities;
- Co-design climate research and co-produce user-oriented climate information and services;
- Facilitate the development of multidisciplinary and multi-stakeholder research and outreach teams or partnerships; and
- Promote innovative communication and user platforms and tools for translating new research into applications.

Challenges and recommendations of the Future Climate for Africa Report

Co-production of knowledge: shifting the linear research and knowledge mobilisation practices towards the principles of co-production are more widely relevant to mobilising medium- and longer-term climate information. The principles of co-production described by Carter et al., (2019) as a transition from immersive to consultative process can offer a good starting point for future initiatives.

Addressing systemic barriers: there are significant number of systemic capacity barriers that prevent African researchers from emerging into positions of leadership. These barriers sit at both the level of individual organisations, as well as being embedded in the wider rules and norms of research project development and commissioning (Jones et al. 2018). Effective capacity baseline mapping[2] and proactive management at the inception stage of the project could help to anticipate and develop strategies for addressing many of these barriers.

Adaptive funding mechanisms: the misalignment between the configuration of some Southern institutions and the current funding mechanisms that are largely designed by the Northern institutions is also hindering progress in climate research in Africa. This would require stepping away from the current standardised approach and moving towards a more tailored approach that is adaptive to the specific issues and context in each country/institution.

Barriers to early researcher career: systemic barriers for postdoctoral researchers remain an important issue amongst African universities. Many research institutions and universities in Africa do not provide fully funded postdoctoral programmes which affects their ability to take on larger portions of the research and build experiential capacity.

Conflicting priorities: many African researchers, especially those in a more senior position within universities, are significantly affected by competing time demands and often need to take on additional consulting work to supplement low rates of pay in academia.

1.2 Data generation and processing

One of the major challenges faced by most African countries in relation to climate science is the ability to generate and process climate science data with a primary focus on improving the accuracy, quality, accessibility, timeliness and usability of data generated by existing institutions. In many instances, information generated by climate scientists is not organized and delivered as an actionable information that is user-friendly. This makes it difficult for use in practical decision making and inform action on the ground. Besides the obvious challenge this creates it has also become a source of frustration for both the scientists, which are the producers of climate information, and the users of information.

The five-year implementation strategy (2019-2023) of the CR4D identifies development of foundational climate science with a focus on improved understanding of the underpinning drivers and dynamics of climate variability and climate change projection a key priority. It further identifies the following thematic areas of intervention and support that are related to data generation and processing (UNECA, 2019).

2 Despite the significant effort made during this paper preparation to include a baseline data on existing climate researchers and institutions in the region, it has not been possible to go beyond anecdotal statements.

CR4D thematic areas of intervention and support

1 Improving awareness of the underpinning drivers and dynamics of climate variability and change in Africa with a focus on: observation, data and monitoring; multi-scale climate processes; feedbacks and systems thresholds; and simulation of African climate dynamics at multiple scales.

2 Improving forecast and climate prediction skills through innovation in techniques and tools to enhance decision-making and policy-relevant information; assessment of limits to skill in relation to spatial scales and future time horizons; and understanding and characterizing the scale dependencies of uncertainty.

3 Developing robust climate change projections for Africa at multiple scale through understanding what constitutes climate information in the context of application, establishing new approaches to climate information distillation from multiple streams of conflicting data; and understanding time-dependent critical systemic thresholds.

4 Enhancing the prediction and attribution of extremes of climate and impact through exploration of the nature of extremes; and attribution of extremes of climate and impacts relative to natural climate variability and change.

5 Climate research should be driven by user information needs for decision support and strengthened through interdisciplinary co-design that enables the mainstreaming of climate information into policy for contingence planning of climate sensitive socio-economic activities and decision-making processes (UNECA et al., 2018).

In addition to the above, there is a need to develop new skillsets for an integrative approach to data collection, analyses and application on the use of open source data, application of big data analytics in climate science, and exploration of novel ways of collecting data. There is also need to use of private sources of data to expand the spatial and temporary scale of climate data collection..

1.3. Institutional collaboration

Collaboration among institutions that are engaged in the field of climate science research is critical as it allows to achieve effective utilization of existing knowledge, expertise and institutional capacity and generate more robust evidence-based outputs. This is even more critical for Africa due to the limited and thinly dispersed individual and institutional capacity across the region. Furthermore, the quality of products and services that meet the needs of users and society relies on a synergy built among institutions. In addition, collaboration among the various institutions needs to be harnessed to avoid unnecessary duplication, conflict and the danger of leaving gaps in the process.

Recognizing this, CR4D created the Scientific Advisory Committee (SAC) that consists of African climate scientists and the Institutional Collaboration Platform established as part of its governance structure form the core of CR4D effort to promote institutional collaboration. This structure is further supported by federated network of African climate science, services, policy, and practice communities as well as development partners and other stakeholders that facilitates collaboration at the regions level. These structure support efforts to co-explore, co-design, co-produce and co-communicate climate information and services, thus improving access, quality, and usability as well as mainstreaming of climate information into development planning in Africa.

The Institutional Collaboration Platform provides a space for promoting an interactive and collaborative research approach by bringing climate science, services and policymaking under a coordinated multidisciplinary network of expertise and institutions (UNECA, 2019). In addition to these core elements of the governance structure, CR4D promotes climate research partnerships through six (6) Regional Climate Research Partnerships (RCRPs) for East, West, Central, South, North and African-SIDS as the regional implementation mechanism which serve as regional platforms/ nodes for bringing together multiple stakeholders and institutions to[3]:-

- Jointly identify key challenges, knowledge gaps and user-driven research priorities;
- Co-design climate research and co-produce user-oriented climate information and services;
- Facilitate the development of multidisciplinary and multi-stakeholder research and outreach teams or partnerships; and
- Promote innovative communication and user platforms and tools for translating new research into applications.

Increasingly, development partners look favourably on collaborative projects that are implemented at regional and multidisciplinary scales. As a result, most of regional initiatives and programmes on

3 https://www.uneca.org/cr4d/pages/regional-climate-research-partnerships

climate change implemented by different development partners and African organizations have components on networking and knowledge sharing platforms that facilitate institutional collaboration in the continent. However, these efforts need to be significantly strengthened in order to have an effective institutional collaboration in place. In this regard, it is important to think of innovative ways of fostering institutional collaboration in ways that include – Open library resources; devolution of analytical services on the basis of comparative strengths – who can do the job better and cost-effectively.

The Alliance for Accelerating Excellence in Science in Africa (AESA) has been addressing the need for capacity building for evidence-based research on climate change through a number of programmes including the Climate Impacts Research Capacity and Leadership Enhancement (CIRCLE) and Climate Research for Development (CR4D) fellowship schemes. As one of the implementing partners for CR4D, AESA has been supporting research on identified priority areas for climate change and development linkages, which cover foundational climate science, impacts, information and research translation and engagement with policy and decision-making communities. The fellowship through CIRCLE supported thematic research in the climate sensitive sectors of energy, water resources, agriculture, forest, health and the political economy of climate change resilience. The AESA is also providing Fellowship research support through its programme on Future Leaders - African Independent Research (FLAIR). So far, AESA has supported close to eight research fellowships of which the research projects that are related to the three priority areas are presented under Annex 2.

1.4 Priority focus areas in climate science and research

Following the major issues and challenges highlighted in this section, the following focus areas are identified as priority areas for AESA and relevant regional and international stakeholders to focus on and advocate: -

a. ***Capacity baseline:*** advocate for establishing a baseline data on existing capacity on Africa climate researchers and institutions that are actively working on climate science, climate science-policy interface and climate change and development.

b. ***Co-production of knowledge:*** strive to be the primary agent for facilitating coproduction of knowledge through interdisciplinary and transdisciplinary research given the complex nature of climate and development issues and capitalizing on the unique specialization mix it has in its Fellowship.

c. ***Knowledge broker function:*** enhance its knowledge broker function between African climate science and international climate science groups and African climate scientists and African policy makers by enhancing its institutional engagement with international scientific platforms, including IPCC, and regional policy making platforms, respectively.

d. ***Capacity advocacy:*** advocate for effective and collaborative utilization of existing capacity related to climate science in the continent while at the same time supporting all efforts that are aimed at filling existing capacity gaps with particular focus on enhancing generation of relevant scientific data.

2. Climate Change-Environment-Development Nexus

The *IPCC Special Report on Global Warming of 1.5°C* noted that impacts on natural and human systems from global warming have already been observed and many land and ocean ecosystems and some of the services they provide have already changed due to global warming (IPCC, 2018). It further noted that future climate-related risks depend on the rate, peak and duration of warming. In the aggregate, they are larger if global warming exceeds 1.5°C before returning to that level by 2100 than if global warming gradually stabilizes at 1.5°C with some impacts being long-lasting or irreversible, such as the loss of some ecosystems. The report also indicates that future climate-related risks would be reduced by upscaling and acceleration of far-reaching, multilevel and cross-sectoral climate mitigation and by both incremental and transformational adaptation.

Africa faces a great challenge of sustaining rapid economic growth, as its population is projected to double to approximately 2.5 billion by 2050. Such growth needs to safeguard the life-support system provided by its rich natural capital, which underpins the realization of its long-term vision as outlined in Agenda 2063. Understanding, developing and implementing climate actions in the context of Africa's strategic vision, as captured in the Sustainable Development Goals (SDGs) of the global Agenda 2030 and the regional Agenda 2063 of the African Union, enables institutions and different stakeholders to collaborate, innovate and bring in new ways of thinking to the nexus of climate and development. While there could be a number of nexus issues that may have diverse influence on the development process of the region, the following are identified as the three priority nexus issues that need primary attention in relation to climate change and its impacts. These are: climate change and natural resources, climate change and infrastructure, and climate change and health.

2.1 Climate change and natural resources

Africa's ecosystem assets face threats from a variety of factors, but certain hotspots will be more vulnerable to these stressors because of their location. Depending on the development trajectory that the region follows in order to meet the food, energy and water needs of its growing population, various future scenarios are possible. In anticipation of these different scenarios, the region needs to develop a contingent of policy options that could help the continent to develop sustainably while still meeting development needs (UNEP, 2016). The following are some of the key challenges highlighted by the Sixth Global Environment Outlook (GEO-6) for Africa (UNEP, 2016).

Tree seedlings in a farm. Credit: climdev.africa

Key challenges highlighted by the Sixth Global Environment Outlook (GEO-6) for Africa (UNEP, 2016)

- *Forest:* Analysis at sub-regional level indicates a trend of decreasing forest cover throughout North, West, Central, East and Southern Africa between 1990 and 2015 (FAO, 2015). Net annual forest change between 2010 and 2015 has been recorded at -2.8 per cent. Forest cover is projected to continue shrinking, declining to less than 600 million hectares by 2050 due to increasing conversion of forests to agriculture.
- *Land:* Africa's landmass of 30 million square kilometres makes the region the second largest continent in the world after Asia (UNEP, 2013). However, about 500,000 square kilometres of land in Africa is estimated to be degraded (UNEP, 2013) due to soil erosion, salinization, pollution and desertification. Climate change and variability is one of the aggravating factors for land degradation. Figure 1 below shows the intensity of land degradation across Africa.
- *Water:* The quantity of water available for a range of human needs is variable, depending on the climatic and geological setting. The main source of water for surface and groundwater storage is rainfall and climate change is causing significant rainfall variation across the region, mostly with negative trends.
- *Wetlands:* Wetlands constitute 1 per cent of Africa's total surface area. With projections of sea level rise along Africa's coastal zones, the coastal wetlands of 37 countries will be vulnerable at various spatial and temporal scales by 2100 (Schellnhuber et al. 2013),
- *Fisheries:* Despite the increase in value of the fisheries sector, production in Africa is declining due to overexploitation and habitat degradation. Fishery productivity is also affected by major climatic drivers such as ocean warming and acidification (Niang *et al.* 2014).
- *Biodiversity:* Africa's rich biodiversity is a base for various ecosystems services including food, clean water and air. However, this critically important natural capital faces significant threats from illegal trade in wildlife, mono-cropping, air and water pollution, forest loss, climate change, and increased prevalence of invasive alien species.

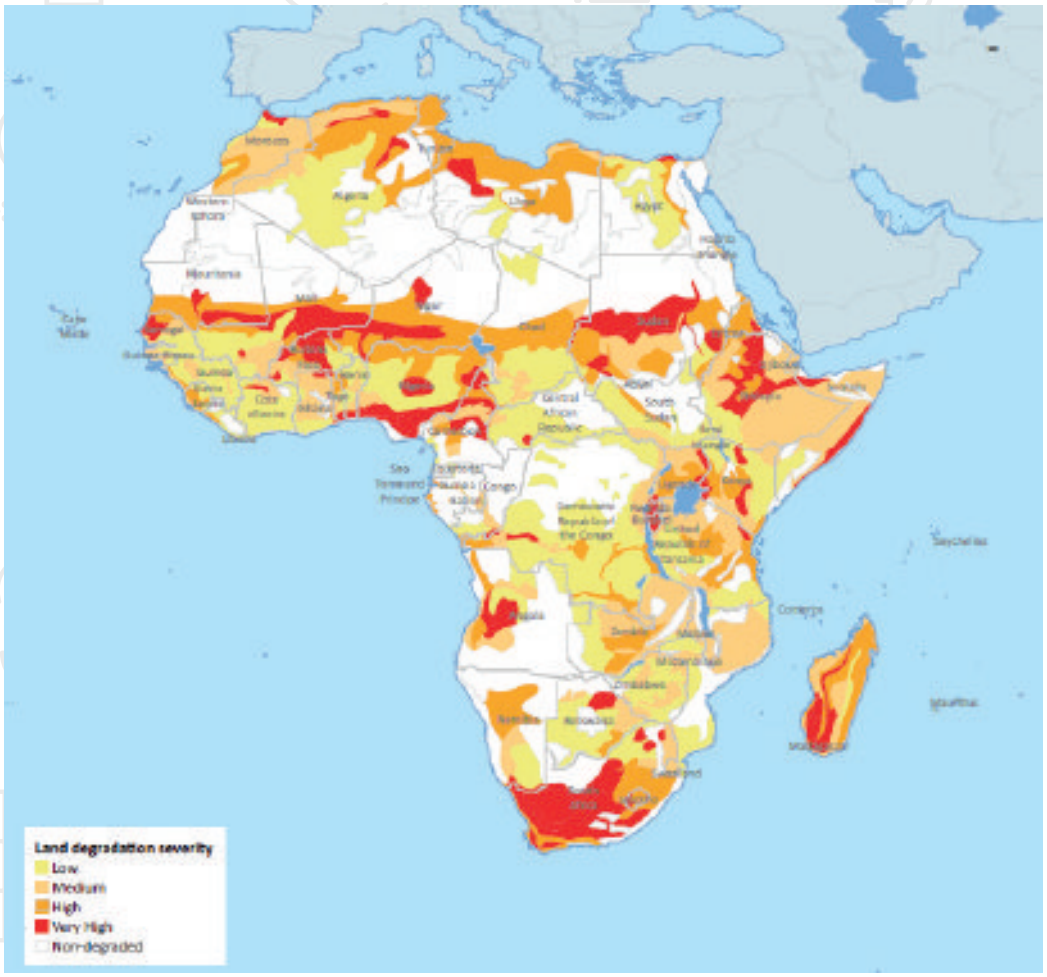
Climate change will have significant impact on Africa's future, with serious implications on the availability of arable land and freshwater. The region's vulnerability to the impacts of future climate change is worsened by its comparatively low adaptive capacity and the relatively strong climate change signals that are projected for the region (Niang et al. 2014, UNEP 2016). Climate change will have direct impacts on food provisioning services on the continent while increased temperatures and shifts in rainfall patterns will have an impact on the suitability of land for agriculture (UNEP, 2016).

Under a low-mitigation future, Africa will have to deal with the adverse impacts of rapidly rising temperatures and associated extreme events during a period considered particularly important for its development (2021–2065) (African Union Commission 2015). A high-mitigation climate future may hold significant advantages for Africa (UNEP, 2016). Building the socio-ecological resilience of African countries to adapt or transform in the face of change is crucial for ensuring food security and sustainable development in Africa (Maciejewski & Drimie, 2019).

2.2 Climate change and infrastructure

The Libreville Declaration on Investing in Innovative Environmental Solutions that was adopted by the 16th Regular Session of African Ministerial

Figure 1: Land degradation in Africa



Source: UNEP, 2016

Conference on Environment (AMCEN) underlined the critical importance of improving and sustaining the productivity of Africa's natural resource; upscale and replicate the circular economy and green business development policies and programmes to enable the growth of sustainable entrepreneurship; develop environmental innovations and resilience to create green jobs and wealth; and upscale the development and use of clean renewable energy to drive sustainable development (AMCEN, 2017). Effective implementation of these decisions would require having a new set of transformational infrastructures.

The infrastructural landscape of Africa is marred by challenges such as low levels of development, coverage, access, and maintenance of existing systems. The longevity of infrastructure poses additional challenges when the infrastructure is developed in a suboptimal way as any problems associated with it will remain in place for decades as part of a broader lock-in effect (Mebratu, 2019a). Africa is the region that will face significant adverse impacts from the global environmental challenges such as climate change. Infrastructure planning and development in Africa faces several constraints. These include geographical constraints, deficiencies in planning, fragmented planning, institutional inefficiencies, regulatory bottlenecks, and a lack of planning and implementation skills (Assefa & Ramjaewon, 2019).

Most of the development discourse on infrastructure has the tendency to predominantly focus on the physical infrastructure that are required to promote economic development. From systems thinking perspective, however, one must look at the ecological, physical, institutional and human infrastructure to get a holistic understanding (Mebratu & Swilling, 2019). The ecological infrastructure provides the resource foundation for any economic activity while the physical infrastructure provides the structural framework for the flow and conversion of the resources into

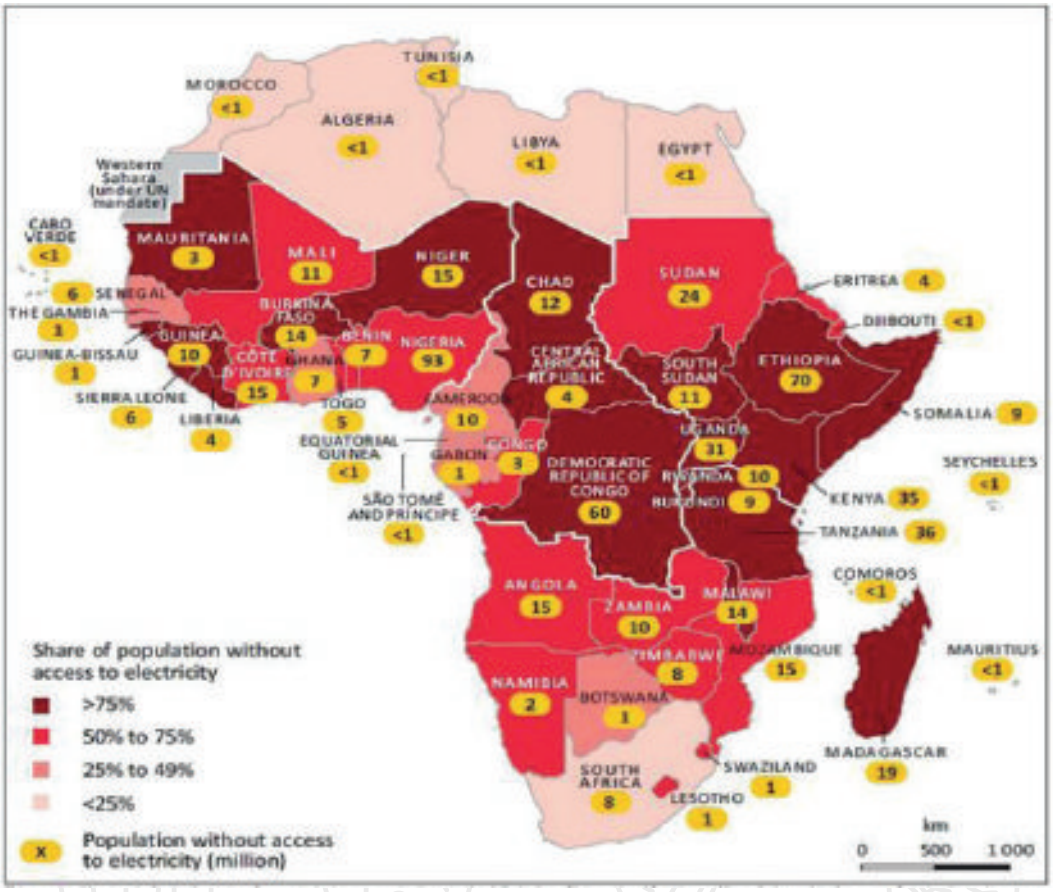
useful goods and services. The institutional infrastructure covers the governance dimension that determines the inclusiveness of the planning and development process while the human infrastructure, captured in the form of embodied skills and knowledge, determines the overall socio-economic outcomes and impacts.

From ecological perspective, Africa is one of the regions that is endowed with relatively abundant natural resources including minerals, diverse flora and fauna and renewable energy resources. And yet it is also the region that suffers from the highest level of poverty and underdevelopment. One of the most common and primary explanation given for the underdevelopment of the region is the extremely low level of physical infrastructure development. In Sub-Saharan Africa, poor infrastructure cuts national economic growth by 2 per cent every year and reduces productivity by as much as 40 per cent. Currently, only 38 per cent of the African population has access to electricity, less than 10% is connected to the internet and only 25 per cent of Africa's road network is paved (AUC, 2019).

The critical nature of energy for development is nowhere more pressing than in Africa in view of the high level of energy poverty in the region and the pressing demand for development. According to International Energy Agency (IEA, 2014), about 600 million people in Africa do not have access to electricity and approximately 730 million people rely on traditional uses of biomass. The high level of reliance on traditional use of solid biomass, typically with inefficient stoves in poorly ventilated space, imposes immense health, environmental and social costs for households (African Progress Panel (APP), 2015). Energy production from unsustainable biomass harvesting in Africa as fuelwood and for charcoal production further exacerbates the strains on the forestry stock and contributes to rises in greenhouse gas (GHG) emissions (Bruckner et al., 2014).

On the resource side, the Atlas of Africa Energy Resources published by the United Nations Environment Programme (UNEP, 2017:2) noted that, 'Africa has 7.5 percent of the world's proved gas reserves, 7.6 percent of its proved oil reserves and 3.6 percent of global coal reserves. The region's renewable energy resources are diverse, consist-

Figure 2: Number and share of people without access to electricity in Africa, 2012



Source: OECD/IEA 2014

A flooded town. Credit: REUTERS

ing of almost unlimited solar potential (10 TW), significant hydropower potential (350 GW), wind (110 GW), as well as geothermal resources (15 GW)'. This provides the region huge climate change mitigation opportunities and transition to sustainable energy systems. Despite this enormous potential, the total power generation capacity of the 48 sub-Saharan African countries, excluding the Republic of South Africa, stands at roughly 45 gigawatts (GW) (less than that of Turkey or Spain), and only seven sub-Saharan countries have electricity access rates exceeding 50 percent (Mulugeta & Agbemabiese, 2019). The practice of widening access to modern energy services across sub-Saharan Africa is complex, largely due to the dual nature of the energy system itself where traditional and modern energy systems and practices co-exist (Sokona, Mulugetta & Gujba, 2012).

Industrialisation remains a major development imperative for Africa to achieve structural transformation of its economy and meet the needs and aspirations of its people, as outlined in Agenda 2063. However, attempting to industrialise through the conventional model of industrialisation is neither feasible nor sustainable in an increasingly resource and carbon-constrained world of the twenty-first century (Mebratu, 2019b). Looking back at the economic history of Africa over the last two centuries, it is evident that the region has mostly missed all three stages of the industrial revolution. We are now faced with the prospect of the fourth industrial revolution, which is expected to have a much higher impact on their economies. Depending on how they prepare and position themselves, African countries will either be further marginalised from the global economy or be an active contributor and beneficiary from this transition.

African countries have a unique opportunity of building an inclusive, resource efficient and climate resilient industrial economy making the best use of emerging technology and knowledge systems that support sustainable industrialization and utilizing the extensive natural resource they have (Mebratu, 2019a). At the core of this transition is the development of set of institutional, physical and technological infrastructure that are responsive to the regional and national context. The development of eco-industrial parks that are seamlessly integrated into the local and national economy provides a strong basis for inclusive and sustainable industri-

alisation. The World Bank Group (2018) noted that embracing and leveraging innovation and building the momentum to leapfrog will be critical for Africa to create the jobs its youth so desperately need.

Urbanization is a mega-trend with profound implications for Africa's growth and transformation. The rate and scale of urbanization is reshaping not only the demographic profile of the continent but also economic, environmental and social outcomes. By 2035, Africa's urban population is projected to reach 49 percent, resulting in considerable demands for employment, services and infrastructure, but creating advantages for economic growth (UNECA, 2017). African cities are currently faced with low productivity, weak job creation, huge infrastructure and service gaps, high level of informalities, increasing inequality, growing environmental damage, and vulnerability to climate change. These coupled with weak institutional systems and capacity are significantly affecting the potential of African urban centres for structural transformation.

Owing to the highest concentration of economic activities and related environmental and social impacts, African cities and urban systems have critical role in achieving low-carbon job-rich inclusive growth and accelerating the transition to sustainability. However, this requires rethinking and reorienting the way African cities are conceived, designed, built and managed. Many African cities had master plans, but most of these plans remained static and rigid, while the realities continuously evolved as the rapid forces of urbanisation took their course. In this context, moving to smart urban infrastructure design and technology that facilitates light-touch top-down planning to provide guidance and structure while allowing adaptation and innovation to suit diverse needs and bottom-up initiatives, that are spontaneous, adaptive and collaborative, can be a game-changer (Kebede, 2019).

African countries face unprecedented challenges of defining future development pathway in an increasingly digitized global economy and a resource- and carbon-constrained world. However, they also have enormous leapfrogging opportunities since significant portion of the required infrastructure is yet to be built (Mebratu, 2019b). Physical infrastructure is a key factor that determines how resource and energy flow and transform through socio-economic systems. Decisions made today by African countries on their infrastructural configuration will determine the inclusivity, resource intensity and climate resilience of their development pathways for decades to come. The following are the key factors of consideration for African countries on infrastructure development (Mebratu & Swilling, 2019).

- *Resilience building:* countries need to continuously invest on building the resilience of their agro-ecological systems by utilizing approaches such as ecosystem-based adaptation and climate smart agriculture in order to contain the impact of climate change and ensure food security for their people.
- *Nexus approach:* managing the nexus between energy development, industrialization and urbanization through an integrated and system-based approach is one of the main strategic approach which provides numerous development opportunities for African countries. This is because better functioning energy systems, economically productive cities and better performing industrialization mostly go hand in hand and all of them face common challenges related to planning and development.
- *Breaking sectoral silos*: the highly fragmented infrastructure planning and development practice that is predominant in most African countries is resulting in numerous negative impacts besides loss of opportunities. Countries need to adopt more integrated planning and development process guided by clearly articulated national strategies for sustainable infrastructure development.
- *Life Cycle Management*: deploying existing and emerging tools of Life Cycle Management (LCM) for infrastructural planning, development and management will enable countries and development partners to optimize the return from their investments and avoid unnecessary operational cost and possible future liabilities from stranded assets.
- *Nature-based infrastructure:* integrate principles and tools of eco-design that utilise various forms of nature-based solutions, such as wetlands, forests, or mangroves, which can substitute conventional elements of man-made infrastructure, wherever it is possible, to enhance the overall resilience of the infrastructure system.
- *Distributed infrastructure systems:* give priority to the development of distributed economy networks that will enable them to create more jobs and sustainable livelihood to local communities by utilizing the opportunities from recent development in distributed energy systems, distributed manufacturing and digitization.

2.3 Climate change and health

As one of the key determinants of wellbeing, human health is adversely affected by the increasing release of greenhouse gases from human-induced

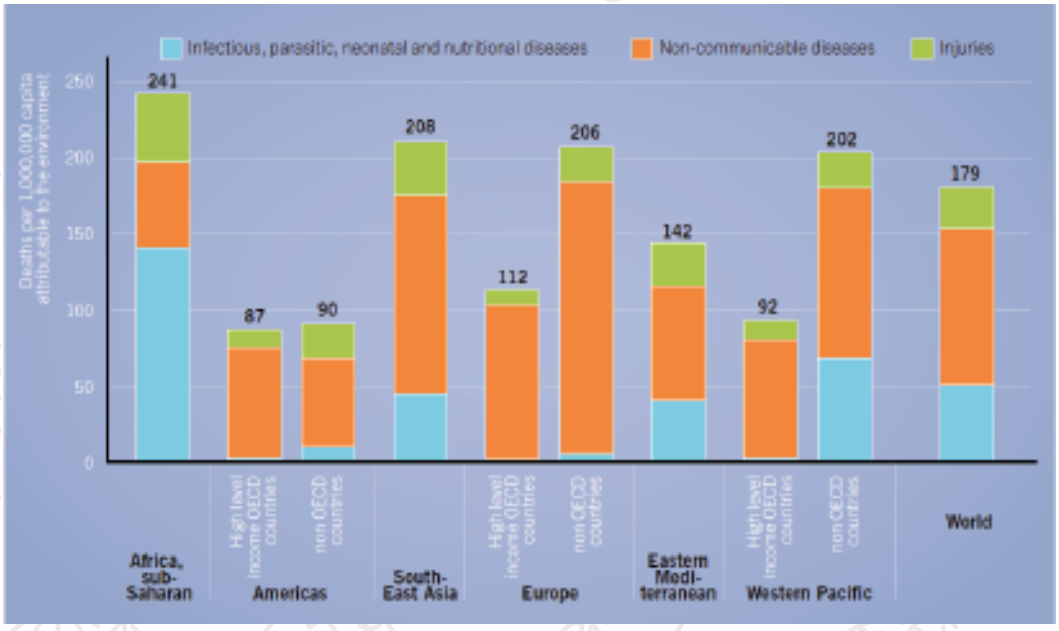
activities. Besides creating fertile condition for the spread of vector borne diseases, climate change can impact air pollution incidences through changes to the photochemical rates of secondary pollutant formation and increasing natural emissions such as from wildfire smoke (Filippelli et al., 2020). Climate change has brought about adverse impacts on biodiversity, changes in the distribution of climate-sensitive diseases, which could be vector-, water and/or food-borne, emergence of new diseases, resulting in increasing adverse health outcomes particularly in vulnerable populations (Linares et al., 2020).

The Libreville Declaration on Health and Environment adopted in August 2008 by a Joint Conference of African Ministers of Health and Environment recognized that the emergence of new environmental risks, including climate change, present new and growing threats to public health (WHO, 2008). The 16th Session of AMCEN noted that environmental pollution is an increasing problem in Africa and that the major forms of pollution in Africa include indoor and outdoor air pollution, water pollution, land pollution and chemical and hazardous waste pollution affecting both urban and rural areas (AMCEN, 2017). The report produced by UNEP (2016b) on health and environment states that, the air we breathe, the food we eat, the water we drink, and the ecosystems which sustain us are estimated to be responsible for 23 per cent of all deaths in Africa. It further noted that a shift away from infectious, parasitic and nutritional diseases to non-communicable diseases, that are attributable to exposure to chemicals, poor air quality and unhealthy lifestyles, is observed globally.

Climate change is acknowledged as a major health risk multiplier, with existing effects that are expected to increasingly affect human health, including through negative changes to land, oceans, biodiversity and access to freshwater, and the increasing frequency and higher impact of natural disasters (UNEP, 2016b). Cautious estimates from the World Health Organization (WHO) under a medium-high emissions scenario indicate that 250,000 additional deaths could potentially occur each year between 2030 and 2050 as a result of climate change (UNEP 2016b). The following are the major environment and climate change associated diseases that may have significant impact on Africa (UNEP, 2016b).

- ***Vector borne diseases***: Local changes in temperature and rainfall have already altered the distribution of disease vectors such as ticks, mosquitoes and sand-flies, which will have a significant impact on the occurrence of disease outbreaks of malaria, dengue fever and other tropical diseases.
- ***Water borne diseases:*** about 40 per cent of Africa's population still does not have access to potable water, and 70 per cent lack adequate

Figure 3: Deaths per capita attributable to the environment, by region and disease group, 2012



Source: UNEP, 2016b

Major environment and climate change associated diseases that may have significant impact on Africa (UNEP, 2016b)

1. Vector borne diseases
2. Water borne diseases
3. Indoor air pollution
4. Zoonotic diseases

sanitation facilities. As a result, water-borne diarrheal infections are responsible for almost 8 per cent of annual deaths in the region.

- ***Indoor air pollution:*** this is a major problem across Africa, responsible for an estimated 600 000 deaths per annum. Due to their reliance on the use of traditional biomass sources of energy for cooking, lighting and heating, 90 per cent of the region's population is exposed to this harm.
- ***Zoonotic diseases***: the continuous disruption and destruction of natural habitats and ecosystems at various levels have increasingly become the source of major pandemics, such as avian influenza, Rift Valley fever, Ebola, and, most recently, COVID-19.

Unlike most continents of the world which may have relatively efficient infrastructure, technology and policies to combat and mitigate these diseases, Africa is burdened with poor health infrastructure, policies, and databases to address these burgeoning health crises. As a result, Africa has the largest proportion of deaths per capita due to infectious diseases (Figure 1) which are mainly attributable to the environment compared to other regions. The following are some of the key measures that need to be considered by African countries in order reduce and mitigate the impact of climate-induced health risks (UNEP, 2016b).

- ***Nexus approach:*** adopt comprehensive health, environment and development nexus approach in the design and implementation of national health strategies and programmes on efficiency grounds, but also for distributive justice and and to address the ethical and legal obligations of States.
- ***Proactive heath policy:*** move away from a reactive to a proactive policy approach, as many environment and health emergencies can be avoided or mitigated, by pre-empting crises that otherwise might cripple a countries' economic, political and physical infrastructure.
- ***Health infrastructure:*** development of an efficient health infrastructure network supported with a responsive health education system that recognizes the critical link between health and environment and is prepared for proactive actions supported with consolidated effort to strengthen the health infrastructure.

key measures that need to be considered by African countries in order reduce and mitigate the impact of climate-induced health risks (UNEP, 2016b).

1. Nexus approach
2. Proactive heath policy
3. Health infrastructure
4. Health information
5. Focused research

- ***Health information:*** countries need to enhance their national health information and knowledge system through better measurement and monitoring frameworks, which has community-based surveillance, early warning and response systems at its core
- ***Focused research*** : There is a need to look at the knock-on effects and amplification of vulnerability and fragility in other systems, as has been witnessed by COVID-19. This will require a scientific focus for instance, in the application of climate science in the predictions and forecasting of future outbreaks and other human challenges.

2.4 Priority focus areas in climate–environment–development nexus

Following the major issues and challenges highlighted in this section, the following focus areas are identified as priority areas for AESA and relevant regional and international stakeholders to focus on and advocate: -

a. ***Ecosystems services:*** encourage and support Fellows and African researchers to engage in identification of existing and emerging knowledge and practices that sustain vital ecosystems services and provide the ecological foundation for sustainable development in Africa.

b. ***Nexus approach:*** enhance the capacity of African scientists working on climate, environment, health and development issues to employ nexus approach techniques and methodologies that goes beyond disciplinary and institutional barriers and result in a more sustainable and transformational outcomes.

c. ***Transformational skill-sets*** advocate and support investing on creating the required knowledge and skill-sets for transformational infrastructure by incorporating eco-design and lifecycle management tools and techniques, which include climate-proofing techniques, in the education and research programmes of engineering, design and construction programmes at tertiary levels.

d. ***Environment-health data:*** enhance its research support on environment-health nexus with particular focus on climate and environment induced infectious and respiratory diseases, including zoonotic diseases, that are expected to be on the rise for the coming decades and which may lead to major socio-economic impacts on African countries.

3. Climate Science and Policy Interface

'The Late Richard Mbra speaking at a past CR4D meeting in 2019'

Climate change science is often described as deeply rooted in society, and thus, represents a new range of environmental problems that require revisiting the relationship between science, end-users and governance (Naustdalslid, 2011). This relationship perspective supports the call for an in-depth consideration of the science–policy interface to highlight possible reasons why the interface falters, and to tentatively suggest opportunities and approaches for successful relationships between knowledge production and policy formulation, especially concerning climate change adaptation (Iyalomhe et al., 2013)

One of the major gaps in climate governance in Africa, which is related to the overall capacity limitation and weak understanding of the nexus issues between climate and development, is the weak linkage between science and policy. Strengthening the interface between them is crucial to ensure effective development and implementation of evidence-informed development strategies, policies and programmes at different levels. This section highlights the key issues that need to be considered to enhance policy relevance of climate research, science-policy interface, and climate science awareness in the region.

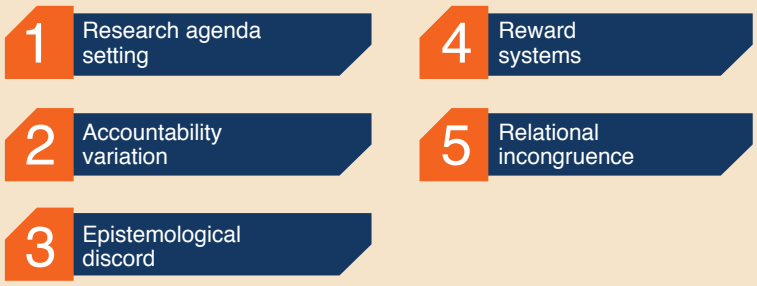
3.1 Policy relevance of climate research

We have seen significant development over the last two decades in our knowledge systems related to climate change owing to the enormous effort made both by the scientific community and international organizations. This led to remarkable innovations and progress in climate science, such as a forecast of changes in climate variables and impacts on ecosystems. What is equally remarkable, in the worlds of science and of policy, is the growing understanding of the challenges and opportunities presented by such knowledge innovation. However, the international community is still faced with significant challenges in transforming the existing and evolving knowledge on climate science into actionable policies.

These challenges are even more pronounced when it comes to Africa due to the various institutional limitations within the continent. One of the key issues that need to be addressed to overcome this challenge is the issue of enhancing the policy relevance of climate research. The following are some of the key issues that are commonly affecting the policy relevance of climate research.

- ***Research agenda setting:*** in most cases climate science defines its own agenda and then informing policy-makers, rather than both science and policy actors defining together the agenda and working together throughout the process of scientific evidence production (Corbera et al. 2006).
- ***Accountability variation:*** Jones and Jones (2008) stress that the science and policy disconnect is also related to different accountability in the two worlds with scientists primarily

Key issues that are commonly affecting the policy relevance of climate research



focussing on scientific norms, methodological standards, research agendas and research funders while policy-makers answer to their constituencies, stakeholders, political agreements and political leadership/parties.

- *Epistemological discord:* Pullin et al. (2009) underline the reductionist approach, considered by many scientists to represent complex physical observations in simpler theoretical terms while McNie (2008) posited that this approach often results in a mismatch between specific questions addressed by science and the broad and complex issues addressed by policy.
- *Reward systems:* McNie (2008) points to the mismatch that stems from the fact that scientists' rewards are mostly based on research publications in scientific journals, but not necessarily on producing information that is considered as useful and relevant by decision-makers and can handle pressing problems.
- *Relational incongruence:* there seems to be an inconsistent relationship between scientists' knowledge and the knowledge demands and use of the end-users or climate policymakers (Iyalomhe, F. et. Al., 2013).

Climate and policy researchers and practitioners have been proposing various mechanism to enhance the policy relevance of climate science. The following are the key approaches that could considered by African scientific communities.

- *Co-development of research agenda:* African scientists need to increasingly engage with policy making bodies in defining the research agenda and process on climate change. Such co-development of the research agenda would help in making the research outputs more actionable by policymakers.
- *Co-production of knowledge:* Vogel et al. (2007) and Kasperson and Berberian (2011), suggest that the engagement between the worlds of science and policy should be seen as institutional actors located in a complex spider-web of connectivity and exchange, in which link and interactions between groups ensure that knowledge and practice are contested, co-produced and reflected upon.
- *Transdisciplinary research:* understanding the complexity and generating policy-relevant climate science requires going beyond discipline-specific research methodologies. This

Key approaches to enhance the policy relevance of climate science by African scientific communities.

can be facilitated through transdisciplinary research portfolios that involve disciplines from both natural and social science domains.

- *Communities of Practice:* the promotion of community of practice that is based on direct two-way interactions between scientists, policy-makers and stakeholders in which there exists a high degree of engagement, negotiations, reflections and feedback is a useful vehicle for improving the science-policy interface (Iyalomhe et. al., 2013).

3.2 Science-policy interface platforms

Africa has been making a concerted effort to harmonize and consolidate its regional positions on climate change through a three-tier continental policy coordinating mechanism that is facilitated under the auspices of the African Union. While these mechanisms have been instrumental in facilitating common regional positions, they also highlight the limitations and constraints of the science-policy interface both at national and continental level. The following are the key regional mechanisms that are serving as platforms for the science-policy interface.

The African Group of Negotiators[4]: The African Group of Negotiators on Climate Change (AGN) was established at the 1st Conference of Parties (COP1) in Berlin, Germany in 1995 as an alliance of African member states that represents the interests of the region in the international climate change negotiations, with a common and unified voice. As the technical body of the three-tier African negotiating structure, it engages in the technical negotiations during the Conferences of the Parties and the intersessional negotiations and prepares draft common positions and decisions by the Ministers and Heads of States. Since its formation, the AGN has played a significant role in the climate change negotiations registering a number of achievements, that ensured adequate consideration and incorporations of Africa's position in climate negotiations outcomes.

The African Ministerial Conference on Environment[5] (AMCEN): AMCEN was established in December 1985 with a mandate to provide advocacy for environmental protection in Africa and ensure that: basic human needs are met adequately and in a sustainable manner; social and economic development is realized at all levels; and agricultural activities and practices meet the food security needs of the region. In 1997, AMCEN formalized its existence as the permanent African Ministerial authority on the environment and sustainable development by adopting its first-ever constitution. Subsequently, AMCEN become part of the African Union Specialized Technical Committee structure feeding to the decisions made by the African Union Summit in relation to environment and climate issues. AMCEN provides an overall policy guidance to AGN deliberations and feeds the outcome from AGN processes to the African Union Summit.

Council of Heads of State on Climate Change (CAHOSCC): CAHOSCC is the highest political tier that was established in 2009 through an AU decision at the 13th AU Assembly[6], in the run-up to the climate summit in Copenhagen. Its primary objective is to provide visible continent-wide political leadership in climate negotiations. The CAHOSCC comprises of leaders of countries representing the five continental regions as well as leaders from countries which are chairing the AU, AMCEN, the AGN chair, as well as the Chairperson of the AU. The CAHOSCC meets at least once a year on the side lines of the AU Summit, in which key messages and decisions are taken for recording by the AU Summit.

Besides the overall foundational scientific support provided through the IPCC as part of the global process, the continental three-tier climate policy coordinating mechanism has been receiving evidence-based technical support through some key partner organizations. The most notable among these organizations are the United Nations Environment Programme (UNEP), the African Development Bank (AfDB) and the United Nations Economic Commission for Africa. These three organizations were consistently providing the required technical support to the African Group of Negotiators and AMCEN. In addition to these coordinating platforms, there are some anecdotal evidence which indicate the existence of similar science-policy platforms at the national levels in countries like Ethiopia, Kenya and South Africa. Consolidating these regional coordination platforms through enhanced collaboration with African focal points in IPCC is necessary to enhance Africa's contribution to the global climate discourse and negotiation on climate change.

High level continental policy bodies especially the AMCEN, have led in promulgating decisions for over 30 years now. But a clear track record of implementation of these decisions, a stocktake or audit of impact of implementation of these decisions is missing. While science-based inputs provided by many supporting institutions have informed promulgation of these decisions, gaps experienced

4 More information on AGN can be found at https://africangroupofnegotiators.org/.

5 More information on AMCEN can be found at: https://www.unenvironment.org/regions/africa/african-ministerial-conference-environment/about-amcen.

6 https://au.int/en/decisions-103

in implementing such decisions are not relayed back to inform streamlined and impactful implementation. This indicates the need for continental science-policy interface platforms to prioritise feedback of country implementation experience so that subsequent decisions can address themselves more specifically to unlock implementation bottlenecks. The role of non-state actors in implementation and how it can be strengthened needs to be explored through clear feedback of implementation experiences from national level to the regional.

The Annual Conference on Climate Change and Development (CCDA) is another continental platform that provides a forum for dialogue and engagement with various stakeholders involved in climate and development in Africa. This annual conference is organized under the auspices of the Regional Initiative on Climate and Development in Africa that is jointly implemented by the African Union, African Development Bank and the United Nations Economic Commission for Africa. The inaugural conference on climate change and development was held in October 2011 and has been held every year since then. Besides sharing knowledge on latest developments in the area of climate change and development, this annual conference has served as a useful regional platform for deliberating on key thematic issues related to global climate change negotiations and policy formulations at national level (UNECA, 2019).

3.3 Climate science awareness

Providing science-based information to decision-makers and to the leadership of civil societies and major groups is a critical factor for mobilizing the general public for transformational changes towards a climate-resilient economy. Stephens et al. (2012) suggest that the non-collaboration of science and policy is due to the imbalance between three communication imperatives. These are: i) saliency for different user groups including interpretability and usefulness of the communication to a particular user; ii) information richness measured by the quality and quantity of information communicated; and iii) adequate representation of robustness determined by the fidelity of the science and the degree to which this is communicated.

While there has been a growing effort on promoting the development of science-based climate awareness amongst key stakeholders in the region, there is still much that needs to be done on building the required level of awareness on climate science. To address this issue, the African Climate Policy Centre (ACPC) commissioned a study which resulted in a recommendation for the establishment of the African Climate Resource and Information Service (ACRIS) Platform[7]. This study identified the following institutions as key players in the climate information services domain:

1. African Centre of Meteorological Application for Development (ACMAD)
2. AGRHYMET8 Regional Centre
3. Council for Scientific and Industrial Research (CSIR)
4. Inter-Governmental Agency for Development (IGAD) Climate Prediction and Applications Centre (ICPAC)
5. Regional Centre for Mapping of Resources for Development (RCMRD)
6. South African Development Community (SADC) Climate Service Centre

The survey carried out during this study on the institutional capacity and readiness for climate information services identified the following as the key features of climate information services in Africa:

- *Data:* there are huge amounts of data available at the institutional level with more data being received on a daily basis. The report further

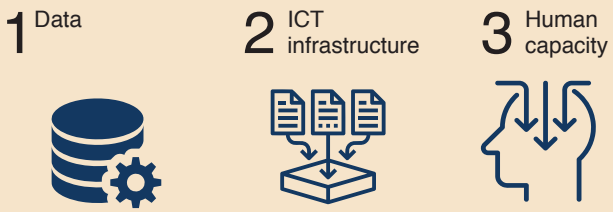
7 Feasibility report for African Climate Resources and Information Services (ACRIS) Platform, downloaded 15 June 2020 from https://www.uneca.org/acpc/pages/reports-acpc-subsite.

8 AGRHYMET stands for Agriculture, Hydrology, Meteorology and AGRHYMET Regional Centre is a specialized agency of the Permanent Inter-State Committee against Drought in the Sahel (CLISS)

key regional mechanisms serving as platforms for the science-policy interface

1. The African Group of Negotiators (AGN)
2. The African Ministerial Conference on Environment (AMCEN)
3. Council of Heads of State on Climate Change (CAHOSCC)

key features of climate information services in Africa



noted that, with such huge availability of data, the main challenge is dispensing data to end users and storage facilities.

- *ICT infrastructure:* there has been a huge investment in ICT infrastructure in the key institutions engaged in climate information services. However, the institutions have not been able to keep up to date with the latest ICT trends as technology evolves both in terms of processing and cloud storage.
- *Human capacity*: Information received from the institutions shows presence of ICT staff that undertake all the available duties. However, they have limited expertise on climate information services. Having a developer support ICT infrastructure reduces the quality of the output application.

The following are some of the key issues that need to be considered in relation to improving the function of climate information services and climate science awareness in the region.

- *Enhanced investment:* There is a need to continue investing in data, hardware, software, and human resources within the existing climate information centres, to enable Africa as a continent to enjoy the benefits of knowledge generated by climate science.
- *Internet:* With increasing digitization and internet access going beyond 40 per cent up from 15.3 per cent in 2011[9], it is critical for Climate Information Services to take advantage of this development and use it as an effective dissemination tool for providing real-time information to stakeholders.
- *Consolidating collaboration:* existing collaboration agreements signed between climate service institutions should be operationalized at all fronts including data sharing, expertise exchange and technological solutions and ensure academic and research institutions share breakthroughs achieved.
- *Actionable information:* climate research outputs must be developed and communicated in a form of actionable information for decision-makers and vulnerable communities on the continent. Moreover, outputs should be demand-driven and responsive to user needs if they are to be effectively incorporated into sustainable development policy and planning.
- *Community outreach:* in a continent where the informal sector predominates economic activities and constitute the wellbeing of majority of the population, an engagement strategy for the community and private sector in climate science will be useful.

9 www.internetworldstats.com.

Key Issues to consider in Improving climate information services and climate science awareness in the region.

3.4 Priority focus areas for climate science and Policy interface

Following the major issues and challenges highlighted in this section, the following focus areas are identified as priority areas for AESA and relevant regional and international stakeholders to focus on and advocate: -

a. ***Research agenda setting:*** while recognizing the critical contribution of the financial and technical support from development partners, it is important for regional institutions like AESA to take the lead on ensuring that climate research agenda are primarily responsive to the policy and operational needs and priorities of African countries.

b. ***Scientific positioning:*** consolidate its engagement with the existing continental policy and negotiation mechanisms under the African Union and position itself as the primary scientific think-tank on climate change and development in Africa by providing evidence-based policy inputs on key regional and global issues.

c. ***Science-policy advocacy:*** support Fellows to be active contributors and players in facilitating evidence-based policy making and development planning by presenting their scientific facts and findings in a form of actionable information that is understandable and applicable by policymakers, planners and stakeholders.

Priority Focus areas for Climate Science and Policy Interface

Conclusion

Continuously improving our understanding of the alarmingly changing climate dynamics and its impact on economic development across the world is a major challenge faced by the international scientific community. The scope of this challenge is much more significant for Africa due to the low level of institutional and scientific capacity in the continent and the disproportionate adverse impacts of climate change on the continent. The Alliance for Accelerating Excellence in Science in Africa, as an umbrella scientific institution, has a major catalytic role to play in filling some of the capacity gaps and supporting evidence-based policy making and development planning in African countries. This would require mobilizing the enormous knowledge and expertise within its Fellowship, its scientific programmes, and effectively coupling this with existing continental and regional mechanisms and institutional capacities.

This paper highlights the key dimensions of the challenges that need to be addressed in the area of climate science and research, climate and development, and climate science and policy interface in Africa. As much as there are numerous challenges that need to be overcome, the paper also shows the existing opportunities for overcoming these challenges. Despite the limitation of being based on desk review only, this paper provides a useful foundation for developing specific strategic and programmatic interventions for advancing investments in climate sciences and development in Africa.

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Annex 3: Acknowledgements

This document is part of the outputs of the science prioritization exercises being conducted under the Africa's Scientific Priorities Programme (ASP), a five-year initiative being implemented by the AESA-AESA in partnership with AUDA-NEPAD and with financial support from the Bill and Melinda Gates Foundation. We acknowledge the contributions of the AESA Fellows, Affiliates and Grantees (Desta Mebratu, Aster Gebrekirstos Afwork, Laban Ayieko Ogallo, Shem Oyoo Wandiga, Davidson R. Ogunlade, Jessica Thorn, Christopher Trisos, Dieudonne Alemagi, Oluyede Ajayi, Philip Antwi-Agyei, Abba Gumel, Salif E. Diop, Youba Sokona, Judy Omumbo, Steffen Eikenberry, Felix Dapare Dakora) who during a consultative meeting July 2019 shaped the scope that informed the outcome document and this final policy document. This team offered feedback on the outline of the current paper and made varied contributions to the drafting process which was led by Desta Mebratu. Daniel Olago, Richard Munang, Judy Omumbo and Johnson Nkem-Ndi reviewed the final working paper. The previous versions of this document have been reviewed by external reviewers and presented for validation at AESA and AUDA-NEPAD meetings. Staff who contributed to the prioritization process and preparation of the paper include Isayvani Naicker, Judy Omumbo, Lydia Manoti, Grace Mwaura, Olivia Osula, Gladys Akinyi, Juliette Mutheu-Asego, Deborah-Fay Ndlovu, and Davies Mbela.

Suggested citation:

AESA (2020). *Setting Priorities for Climate Change and Development in Africa, September 2020. Nairobi, Kenya.* Alliance for Accelerating Excellence in Science in Africa.

About the Africa Scientific Priority Setting Programme

This outcome document is part of the outputs of the science prioritisation exercises being conducted by the Alliance for Accelerating Excellence in Science in Africa under the Empowering Africa Empowering African Ownership Research and Innovation programme (2019-2023). The programme is a collaborative initiative of the AESA and AUDA/NEPAD aimed at engaging key stakeholders in the process of identifying and validating scientific priorities for the African continent. Guided by the SDGs, Africa's Agenda 2063 and STISA 2024, scientific priorities for the continent will be identified and disseminated with the aim to inform investment decisions of major actors including African governments, funders, science leaders and other stakeholders to ensure that resources are directed at the critical gaps identified for the continent. This programme is funded by the Bill and Melinda Gates Foundation.

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