FUTURE CLIMATE FOR AFRICA

POLICY BRIEF

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Translating Future Climate For Africa science for targeted policymakers needs

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Introduction

This brief summarizes a piece of work that explored the potential value of Future Climate For Africa (FCFA) and the closely related work on climate change, impacts and adaptation in tropical and sub-tropical sub-Saharan Africa. This work is from a policymaker or planner's perspective and has a regional- or national-level focus. Insights developed are derived from an overview of advances made by FCFA climate science in simulating climate processes over tropical and sub-tropical Africa in relation to the state of knowledge as represented by the Fifth Assessment Report of the IPCC.

In conjunction with this overview, an effort was made to identify a potential approach for leveraging this evolving information to inform policymakers of the priority risks and investment needs over the next few decades. The work used the agricultural and livelihood sectors as the primary perspectives for developing this approach but is potentially transferable to other vulnerable sectors. The approach is based upon the potential for identifying levels of climate change that might exceed adaptation limits and may thus result in predictable stepped increases in costs associated with impacts, damages, and adaptation investment needs.

If programs like FCFA are able to effectively communicate the science by using scenarios linked to emissions pathways, it can help to inform policymakers' decisions and their ability to develop more robust plans and policies. Robust evidence supporting these positions would strengthen negotiators' abilities to motivate for technology transfer, funding support and other forms of assistance. This could then contribute to achieving the global mitigation goal while also investing in adaptation planning and implementation appropriate for the level of climate change projected.

About FCFA

Future Climate For Africa (FCFA) is a £20 million programme funded by the UK Department for International Development (DFID) and Natural Environment Research Council (NERC). It is generating fundamentally new climate science focused on Africa and piloting the use of improved medium- to long-term (5 to 40 year) climate change information in development projects. The goal of FCFA is to reduce disruption and damage from climate change and to safeguard economic development and poverty eradication efforts over the long term.

Key messages

- New research, including from FCFA and stimulated by the program's partnerships, is significantly improving the understanding of climate regimes over tropical and sub-tropical Africa. These improvements include the predictive understanding of macro- and meso-scale drivers of rainfall variability, such as remote teleconnections via ocean influences and air pollution impacts. Finer scale regional- to local-scale climate modelling enhances support of risk assessment for Africa, especially for tropical and sub-tropical regions where convective systems are important determinants of local rainfall regimes. This greater understanding can improve projections of future climate scenarios, especially at finer spatial scales.
- Poorly-developed weather and climate observation and documentation systems limit the ability of modelling efforts to test the performance of improving simulation tools.
- Concrete climate projections relating to policy-relevant emissions and development scenarios are not readily available for this region. Improved confidence in projections has not yet translated into a more robust set of spatially coherent scenarios.
- The ability of African policymakers to develop defensible policy informed by risk assessments under a range of plausible scenarios and to identify priority adaptation actions remains limited. However, there is potential for significant improvement if there is a focus on developing concrete sets of projections downscaled using new insights developed during the FCFA program.
- The implementation of adaptation strategies in several sectors may occur in a series of phases, with coping strategies being replaced by incremental, and finally, transformational adaptation responses. Each transition in response to the escalating effects of climate change is likely to entail a significant increase in costs and technology needs. Identifying potential "steps" to take regarding damages and costs relating to impacts and adaptation may be a useful path for policymakers to enable the development of more robust policy positions. The design of targeted simulations and a multi-sectoral assessment to test for such transitions would be of great value to African policymakers.
- Commonly accepted technological solutions to climate change adaptation must be fully explored for feasibility in the sub-Saharan African context. For example, in the agricultural sector, long-term planning for adaptation to anticipated heat and drought stress via crop breeding may be outpaced by climate change under many scenarios. It is important for policymakers to identify these scenarios and reduce or eliminate a perceived reliance on such technologies in scenario planning and investment strategies.
- The value of Indigenous Knowledge Systems and Indigenous and Local Knowledge may be degraded in value as climate change progresses. This is a poorly understood cost, and its value may provide negotiators with additional motivation to argue for the most ambitious mitigation efforts possible.

Main sources of information

Two manuscripts developed for this activity served as the basis for the information. These submissions extensively reference the published work of FCFA participants and related work where relevant.

Midgley, GF, Chapman, A and Araujo, J-P. Potential non-linear transitions in adaptation costs of particular relevance for African policymakers. (submitted: Climate and Development)

Midgley, GF, Chapman, A and Araujo, J-P. Enhancing links between climate change science and adaptation needs and policy in tropical sub-Saharan Africa. (submitted: Natural Resources Forum)

Framework for enhancing the science-policy/planning interface for agricultural livelihoods

The FCFA program addressed several critical information gaps to provide "actionable climate information" (Senior et al., 2016) to stakeholders in the region. The major gaps addressed included:

- Enhancing skills in climate modelling and simulation efforts for Africa;
- Tightening links to key vulnerabilities and adaptation needs; and
- Improving the communication of scientific findings.

FCFA made efforts to advance climate change projections in the areas of teleconnections, the Intertropical Convergence Zone (ITCZ), and regional-to-local downscaling. This work contributed to improved simulations of rainfall seasonality and regional-to-local patterns distributed amongst tropical West and Central Africa, tropical and sub-tropical East Africa, and the Sahel regions. This work effort is captured in Figure 1 as the "climate change science" component. In this brief, it is suggested that the scientific effort could extend more deeply into an understanding of the specific information needs to inform the impacts, risks and security levels and, ideally, the adaptation response planning level (as indicated by the arrows in Figure 1). For example, in the agricultural livelihoods sector, policy and planning needs relate to adaptation needs. The phases move from incremental to proactive and then transformative, informed by risks to intensive and subsistence cropping and livelihood risk in more general terms. The strongest overlap between these areas of concern is at the regional scale, with more nuanced and credibly developed scenarios now available.

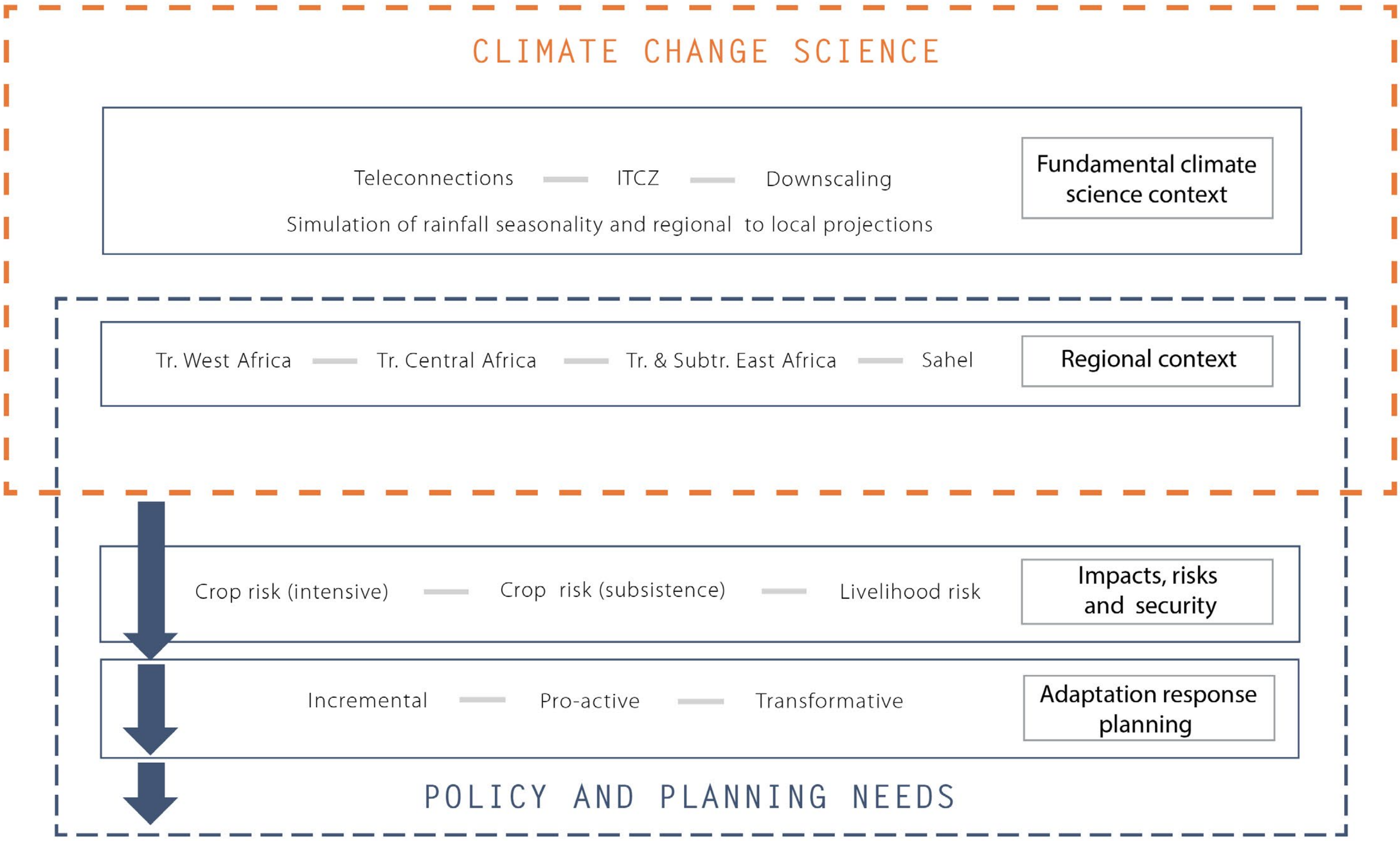

Figure 1: Diagram illustrating the need to enhance engagement of technical climate science practitioners with policy and planning needs as expressed by policymakers, planners and implementers.

In the arena of climate change science, there is progress in improving the understanding of teleconnections (local-to-regional impacts of remote drivers), the seasonal behaviour of the ITCZ, and the downscaling of these insights to the local level. These efforts translate in a variety of ways into each major geographical region, providing a regional context to these findings. However, within each region, policymakers, planners, and implementers are grappling with the phases of adaptation as these unfold. The agricultural livelihood sector requires clearer guidance on anticipated impacts and risks in relation to emissions and global warming levels. Climate change science could engage productively by using an explicit risk-based approach that attempts to identify thresholds of cost and impact increases, and the potential timing of such transitions on axes of global emissions and warming levels (the solid arrows in Figure 1 indicate the need for an integrated extension of climate change science into these areas of policy and planning).

Adaptation phasing model applicable to specific cases

This brief develops a proposed model for enhancing targeted communication and focused simulation efforts shared between fundamental climate science and policy stakeholders. The principal idea is to elaborate on how a sequence of adaptation response effort is required as climate change progresses. Adaptation effort transitions are categorized as incremental, transitional, and transformational (Hadarits et al., 2017). The initial incremental (coping) phase may be perceived as inexpensive, comprising reactive responses involving a low-cost use of readily available existing technologies and indigenous and local knowledge. A transition may occur to an increasingly proactive and more costly phase of adaptation (transitional phase), with greater technology and expertise required but retaining the essential characteristics of the sector. A third phase comprising high-cost and high-skill technological solutions (transformative phase) may then follow, in which novel approaches (Gosnell et al., 2019) transform the sector.

The case of agricultural livelihoods serves as an example. The impacts of climate change on 14 strategic crops, primarily increasing temperature (See Adhikari et al. 2015) and declining water resource availability, indicate substantive risks for food production in the region. Observations of adverse effects have already been attributed to warming (Lobell et al., 2011; Schlenker & Lobell, 2010), which supports the use of temperature indexes for projecting impacts and prioritizing adaptation responses. Estimates indicate sensitivity and vulnerability in cereal crops such as wheat, maize, rice, soybean; root crops such as cassava, sweet potato, and potato; cash crops such as coffee, tea, sugarcane; and fruit crops like bananas.

Some of the most spatially explicit modelling of impacts and potential adaptation has been undertaken by Watkiss and Cimato (2018), who identify a series of possible adaptation responses that can be linked to the adaptation phasing model described above. Under future warming scenarios, two main adaptation responses are the in-situ cooling of the crop (via the planting of shade trees) with the physical shifting of tea plantations upslope to take advantage of cooler air at a higher elevation. The three phases can be described as follows:

- Phase 1 - A gradual rise in cost with initial warming responses (planting of shade trees);
- Phase 2 - Technical, higher-cost solutions like shade-cloth and misting; and
- Phase 3 - Physical relocation of the cropping area, high establishment costs, and lower yields due to thinner and poorer soils at higher elevation, and thus more expensive cropping methods.

This sequence is illustrated in Figure 2 below. The recommendation from this brief is that climate scientists, producers and production experts with local knowledge, and policy stakeholders collaborate to estimate the levels of warming where these phase transitions might occur. Climate science could, via simulation, inform how these transitions will relate to emissions and development scenarios through the logical steps illustrated in Figure 2.

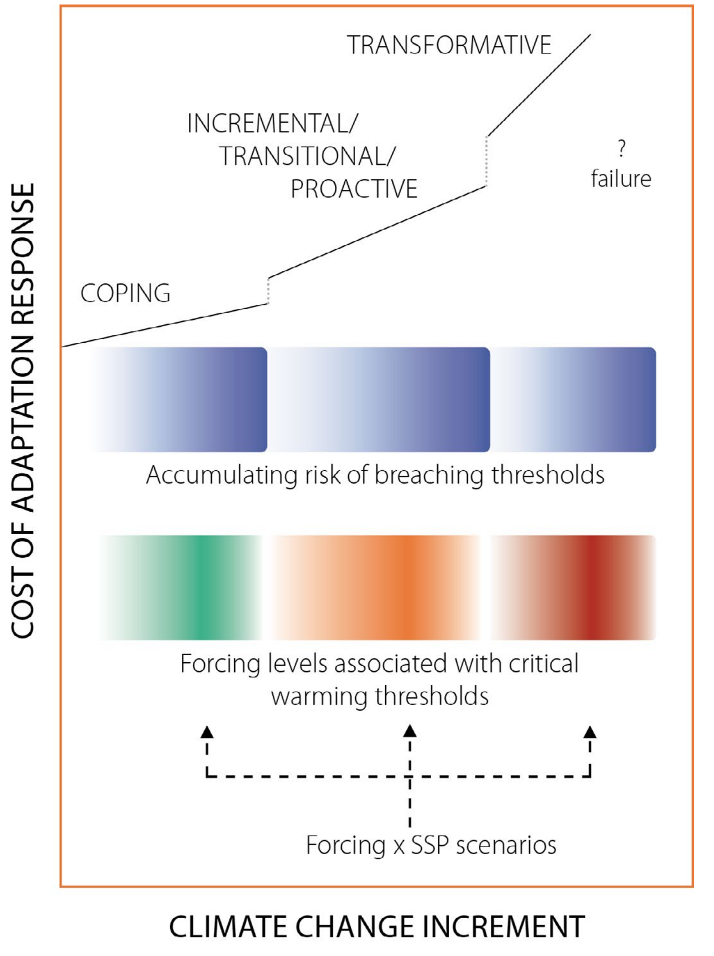

Figure 2: Diagram illustrating how climate science might support risk assessment by policymakers, planners and implementers. Three fundamental phases of adaptation are defined and represent a step increase in costs and imported expertise and technology. Each phase is linked to a measure of climate change (the "climate change increment") such as 'Global Surface Air Temperature (GSAT) above the pre-industrial times'. Such levels could be estimated using expert quantitative approaches combined with consensus-building engagements with experts with relevant local knowledge. Fundamental climate science could link the accumulating risk of breaching these limits to climate forcing x Shared Socioeconomic Pathway (SSP) scenarios.

Conclusion

The FCFA program was not explicitly designed to directly address the needs of national or regional policymakers engaged in strategic planning and policy position development. Despite this, the FCFA program of work nonetheless enhanced the understanding of several regional- to local-scale impacts and risks relevant to high-level policymaking. However, these either need to be distilled from the new information produced, or a focused effort could provide targeted information to stakeholders. Translation of such information into probability-density functions of impacts and their costs as a function of a climate change metric (e.g. warming or rainfall change) and linking this to commonly considered forcing and shared socio-economic pathways would significantly enhance African policymakers' abilities to assess critical vulnerabilities and investment needs.

References

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Future Climate for Africa (FCFA) aims to generate fundamentally new climate science focused on Africa, and to ensure that this science has an impact on human development across the continent.

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