Decision support tools for adaptation planning in Africa

Kelvin Shikuku, Ibrahim Ochenje, Derek Chan, Watson Lepariyo, Meshack Baraza, Rupsha Banerjee, Joseph Karugia and Anthony Whitbread

Key messages

- Adaptation decision support tools and frameworks are crucial for coordinating the actions of different actors and developing responses to climate change across multiple levels of time, space and socio-political organization.
- Adaptation decision support tools and frameworks are prioritized differently by national stakeholders across countries and this reflects the heterogeneity in constraints faced as well as existing capacities for implementation.
- Although many tools and frameworks already exist, awareness and knowledge among national stakeholders remain low, making it imperative to invest efforts in the dissemination of the tools and capacity building.

Background

Climate change and variability are increasingly threatening food systems and livelihoods in Africa, a continent with most of the vulnerable people in the world. Human-induced climate change has led to more frequent and more intense climate extremes (Magnan et al. 2021). In sub-Saharan Africa, for example, the occurrence of droughts nearly tripled and that of floods increased more than tenfold by 2010–2019 relative to 1970–1979. Global surface temperature has increased by 0.99 °C from 1850–1900 to the first two decades of the 21st century (2001–2020) and by 1.09 °C from 1850–1900 to 2011–2020 (Arias et al. 2021). Mean precipitation changes have been observed all over Africa (Almazroui et al. 2020).

Consequently, food systems across the world are continually disrupted (Nelson et al. 2014). Both the crop and livestock sectors are increasingly threatened. Moreover, spatially concurrent climate extremes impose a great risk to the global food supply chain and amplify threats to global food security (Gaupp et al. 2020).

Adaptation efforts are crucial. The cost of no action is already immense and will only get more expensive. Taking action not only implies the need for identifying strategies and responses that are practical, sound and meet the actors' varied interests but also requires careful and flexible planning. Adaptation planning in human systems generally entails a process of iterative risk management. Effective responses require both immediate relief as well as the development of longer-term plans. Good collaboration among affected stakeholders is crucial for effective adaptation action.

Therefore, addressing climatic shocks in Africa requires suitable tools, frameworks and methodologies for coordinating the actions of different actors and developing effective responses to climate change across multiple levels of time, space and socio-political organization. While many tools and frameworks for adaptation planning exist, access and use by national stakeholders for adaptation planning is often hindered by lack of awareness and knowledge.

The goal of the 'Facilitating knowledge management for adaptation planning in Africa' project is to enhance resilience of farming systems and livelihoods to climate change through wide-scale use of suitable adaptation planning tools. Funded by the GIZ through the Global Center on Adaptation (GCA), the project is implemented by the International Livestock Research Institute (ILRI).

The project has three main objectives:

- To produce an inventory of adaptation planning tools and frameworks;
- To assess the suitability and promote the dissemination of prioritized adaptation decision support tools and frameworks; and
- To build the capacity of national stakeholders in the implementation of adaptation decision support tools and frameworks.

The '**Facilitating knowledge management for adaptation planning in Africa**' project identifies adaptation decision support tools and frameworks. It then disseminates the tools widely and builds the capacity of national stakeholders to apply them. This project was implemented in three countries: Kenya (representing East Africa); Zambia (representing southern Africa); and Senegal (representing West Africa). However, the identified tools are promoted more widely for application in the entire continent of Africa.

Methodology

To address the first objective, the study conducted a desk literature review. Searches were conducted in English language peer-reviewed journals, and grey literature such as institutional reports and briefs accessible on the internet and organizational websites. Focus was on articles, reports and briefs that described an adaptation planning tool, framework or database. The titles and abstracts of these references were screened and duplicate records removed.

A two-stage screening strategy was used to determine the relevance of articles returned from search strings to the research objective. Article abstracts and titles were screened in stage one. In stage two, the full texts for those abstracts meeting the initial inclusion criteria were downloaded and screened using the same eligibility criteria. In addition to the literature review, CGIAR researchers and projects were consulted.

To assess the suitability of the tools and frameworks for adaptation planning, three dissemination workshops were organized: one in Kenya, one in Zambia and one in Senegal. The countries were selected as representative of eastern, southern and western Africa, respectively. During the one-day workshops, an inventory of adaptation planning tools and frameworks was presented to the participants. A participatory exercise followed, where workshop attendees working in smaller groups evaluated and prioritized the tools and frameworks most suitable for adaptation planning in their country contexts. The process was as follows:

- Tools and frameworks were identified and grouped into nine main categories.
- Participants were divided into heterogeneous groups.

- Each group was assigned two or three categories of tools/framework.
- Each group was tasked to identify and prioritize at least three tools/frameworks from each category.
- Each group provided reasons why they picked each tool/framework, the likely users of the tool, the geographical region or sector where the tool is most applicable, and how it can be applied (e.g. what capacities/resources are needed for the tool to be applied).
- Each group chose one member to document the outputs from the group discussions.
- The outputs from the small group discussions were then presented to all the participants in the plenary.

To achieve the objective of capacity building, we conducted two workshops: one in Kenya and another one in Senegal. Focus was on two of the prioritized tools in Kenya and four decision support tools in Senegal.

Figure 1. A national stakeholder contributes to a discussion about adaptation decision support tools during a capacity building workshop in Kenya

Figure 2. A presentation of the CSAIP tool by the Alliance of Bioversity and the International Center for Tropical Agriculture to national stakeholders during a capacity building workshop in Kenya.

Inventory of adaptation decision support tools

Nine categories of adaptation decision support tools were identified (Shikuku et al. 2023). A detailed description of the tools is available at https://hdl.handle.net/10568/131222. The report further provides a description of each of the identified tools, explains how they work and suggests potential users. The nine categories include the following:

1. Tools and frameworks for modelling and simulation of climate change impacts
Most tools in this category consider different emission scenarios and heterogeneity in context to simulate climate change impacts. Some tools further assess impacts of climate change with and without adaptation interventions. Examples of tools in this category are:
- ClimateWizard;
- Land Use Portfolio Modeler (LUPM);
- Comprehensive Livestock Environmental Assessment for Improved Nutrition, a Secured Environment, and Sustainable Development along Livestock and Fish Value Chains (CLEANED);
- Northeast Association of Fish & Wildlife Agencies) Regional Vulnerability Modelling (NEAFWA);
- Land Change Modeler (LCM);
- Sea Level Affecting Marshes Model (SLAMM);
- Assessment of Impacts and Risks of Climate Change on Agriculture (AIRCCA) Model;
- Modelling System for Agricultural Impacts of Climate Change (MOSAICC);
- Agricultural Model Intercomparison and Improvement Project (AgMIP); and
- Climate Adaptation in Rural Development (CARD) Assessment Tool.

2. Tools and frameworks for land use planning and conservation
This category of tools mostly focuses on assessing the vulnerability of different species to climate change impacts, understanding the preparedness of different ecosystems to climate change impacts, and evaluation of conservation efforts and interventions. Notable examples include:
- The framework for categorizing the relative vulnerability of threatened and endangered species;
- Climate Change-Resilience and Adaptation Planning Tool (CC-RAPT);
- Northeast Climate Data; and
- Conservation standards.

3. Tools and frameworks for adaptation tracking

Tracking adaptation is crucial to help national governments assess progress towards their nationally determined contributions (NDCs). At the project level, adaptation tracking is important to assess the effectiveness of interventions and to improve the overall contribution of the projects. Examples of these tools at the national and regional levels are:

- Tracking Adaptation in Livestock Systems (TAiLS);
- Stocktaking for National Adaptation Planning (SNAP);
- Tracking Adaptation in the Agricultural Sectors (TAAS);
- The Pilot Program for Climate Resilience (PPCR) monitoring and reporting system;
- Tracking Adaptation and Measuring Development (TAMD); and
- Self-evaluation and Holistic Assessment of climate Resilience of farmers and Pastoralists (SHARP).
- Examples at the project or community level are:
- Adaptation Monitoring and Assessment Tool (AMAT); and
- Resilience Index Measurement and Analysis (RIMA) tool).

Others can be used at both the national and project level (e.g. the repository of adaptation indicators).

4. Tools and frameworks for monitoring climatic shocks, forecasting and early warning, and dissemination of climate information services

Examples of the tools and frameworks that were identified in this category include:

- KAZNET crowdsourcing digital platform;
- Intelligent Agricultural System Advisory Tool (ISAT);
- Africa RiskView;
- CCAFS Regional Agricultural Forecasting Toolbox (CRAFT);
- NextGen Agricultural Drought Monitoring and Warning System (NADMWS);
- Invasive Species Forecasting System (ISFS);
- Maximum Entropy (MaxEnt);
- Participatory Integrated Climate Services for Agriculture (PICSA);
- Famine Early Warning Systems Network (FEWS NET);
- Kenya Agricultural Advisory Platform (KAOP); and
- Picture-based advisories (PBA).

5. Tools and frameworks for natural resource management

The tools considered in this category are helpful in helping land managers understand potential impacts and integrate climate change into their planning and management. Such tools can also be used to map climate risks and support assessment and planning in land and water management. In this category, the study identified:

- Climate Change Response Framework (CCRF);
- Aqueduct;
- Ecosystem-Based Management Tools Network;
- NatureServe Vista; and
- Spatial Trends in Coastal Socioeconomics (STICS).

6. Knowledge exchange platforms

Knowledge exchange platforms facilitate interactions among different stakeholders involved in adaptation planning and implementation. These platforms can also link stakeholders to the diverse tools and data sources available for adaptation planning. Notable examples of knowledge exchange platforms include:

- weADAPT;
- Climate Adaptation Knowledge Exchange (CAKE);
- Climate Change Knowledge Portal (CCKP);
- Adaptation Community Platform;
- CommunityViz;
- Digital Coast; and
- Google Mashup.

7. Climate-smart agriculture and adaptation intervention prioritization tools and frameworks

Several climate smart agriculture (CSA) and adaptation interventions have been identified and applied in varied settings. It is important to prioritize CSA interventions to ensure local relevance and increase effectiveness. The tools presented in this category take a multi-dimensional approach to prioritizing CSA interventions (e.g. the Climate-Smart Agriculture Prioritization Framework, CSA-PF). Some tools, such as the Climate-Smart Agriculture Investment Plan (CSAIP), emphasize a value chain approach in the prioritization of CSA. Other tools take a multidisciplinary approach (e.g. the Climate-smart agriculture rapid appraisal, CSA-RA). Other tools in this category include the Participatory Social Return on Investment (PSROI) and Economics of Climate Adaptation (ECA)–Guidebook for practitioners.
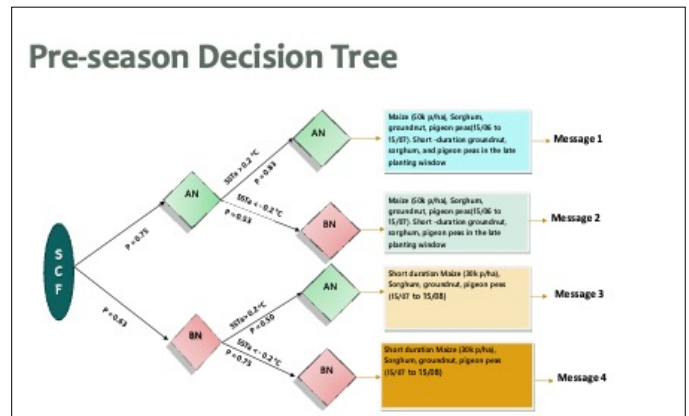
8. Climate risk and vulnerability assessment tools and frameworks

In order to effectively address climate change impacts, it is crucial to understand the risks and vulnerabilities that exist within systems. Assessment should further account for spatial and temporal heterogeneity that exists across contexts, sectors and value chains. In this category, the study identified the following tools:

- Climate Change Vulnerability Index (CCVI);
- Climate Change Sensitivity Database;
- Hazard United States Multi-Hazard (HAZUS-MH);
- Social Vulnerability Index (SoVI);
- System for Assessing the Vulnerability of Species to Climate Change (SAVS);
- Climate Vulnerability and Capacity Analysis Framework (CVCA);

- Climate Risk Screening and Management Tools;
- Participatory Assessment of Climate and Disaster Risk (PACDR);
- Community-based Risk Screening Tool – Adaptation and Livelihoods (CRiSTAL);
- Coastal Inundation Toolkit;
- National Oceanic and Atmospheric Administration's Coastal Service Center (NOAA CSC) roadmap;
- ThinkHazard!;
- Climate Risk Management in Agricultural Extension (CRMAE) Reference Guide;
- Technical Guidance on Comprehensive Risk Assessment and Planning in the Context of Climate Change;
- Risk Stress Test Tool (RiST);
- Notre Dame Global Adaptation Initiative (ND-GAIN);
- Platform for Agricultural Risk Management (PARM); and
- Caribbean Climate Online Risk and Adaptation tooL (CCORAL).

9. Tools for adaptation support

Finally, the study identified tools for supporting adaptation. These tools include:
- Robust Adaptation Planning (RAP) framework;
- Robust Decision Making (RDM);
- Adaptation Database for Planning Tool (ADAPT);
- Climate Canvas;
- Adaptation Support Tool (AST);
- Climate, Environment and Disaster Risk Reduction Integration Guidance (CEDRIG);
- Training manual on bundled climate-smart agriculture, climate information services and One Health technologies for priority value chains;
- A guidebook for operationalizing climate-smart agriculture into local action planning;
- Climate-smart agriculture training manual for training of trainers;
- Land Degradation Surveillance Framework (LDSF); and
- The framework for the assessment of skills for national adaptation planning.

Figure 3. A facilitator at a capacity building workshop in Senegal explains the tools developed and used by ANACIM to deliver climate information services (photo credit: Lamine Diedhiou/ILRI).

Figure 4. A pre-season decision tree as part of the iSAT tool, presented by ILRI during the capacity building workshop in Senegal.

Prioritized adaptation support tools in Kenya, Zambia and Senegal

Kenya

In Kenya, the most prioritized tool for land use planning and conservation was the *framework for categorizing the relative vulnerability of threatened and endangered species*. The reason for ranking this framework highest was that it provides an understanding of vulnerability based on a broad range of drivers, including behavioural, demographic, habitat usage, psychological and ecological.

The Tracking Adaptation in the Agricultural Sectors (TAAS) framework was the most prioritized for adaptation tracking. National stakeholders indicated that TAAS provides a holistic single framework for tracking adaptation interventions in the agriculture sector.
In terms of tools and frameworks for modelling and simulation of climate change impacts, the ClimateWizard was identified as the most prioritized because it provides easy access by both experts and non-experts to global climate change research and outputs.
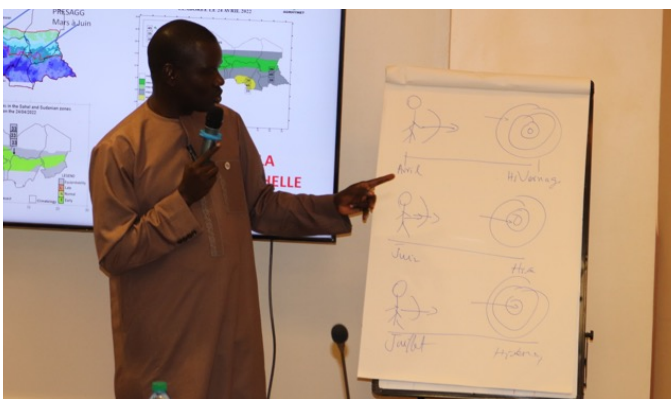
In terms of tools and frameworks for modelling and simulation of climate change impacts, the *ClimateWizard* was identified as the most prioritized because it provides easy access by both experts and non-experts to global climate change research and outputs.

The Climate Change Knowledge Portal (CCKP) was the most prioritized knowledge exchange platform. CCKP provides a comprehensive repository of knowledge products, contains quality and updated data, offers various levels of complexity, and serves the specific needs of diverse users.
Of the tools for natural resource management,

Climate Change Response Framework (CCRF) was the highest ranked. This tool was prioritized because it is collaborative, focuses on forestry resources, can be adapted to different locations and landscapes, and integrates a monitoring and evaluation component.

KAZNET was ranked highest amongst the tools for monitoring climatic shocks and dissemination of climate information services. The main reasons for selecting KAZNET were that it is an open-source platform, allows mobile and web application, has data quality control mechanisms, is accessible in remote locations, and provides data on near-real time basis.

For climate risk vulnerability assessment, the most prioritized tool was the Platform for Agricultural *Risk Management (PARM)*, not only because it is applicable in developing countries, but also because it has potential to contribute to sustainable agricultural growth, increased rural investment, reduced food insecurity, and improved resilience of poor rural households to climate and market shocks through better management of risks. *The Climate Smart Agriculture Prioritization Framework (CSAPF)* ranked highest for the prioritization of CSA and adaptation interventions. Stakeholders indicated that the framework is helpful in determining the best ways to prioritize adaptation options and guiding resource allocation among various alternatives in different value chains. CSAPF takes a multidimensional approach to identifying manageable and feasible portfolio options. It is also applicable to various value chain actors within all sectors.

In terms of adaptation decision support, the *Robust Adaptation Planning (RAP)* Framework was the most prioritized because it builds a robust action approach that allows for long-term actions, is useful in planning adaptation intervention in climate-vulnerable multisector and multi-level settings and reduces the complexity of implementing chosen adaptations.

Figure 5. An example of the forecast information provided by ANACIM as presented during a capacity building workshop in Senegal.
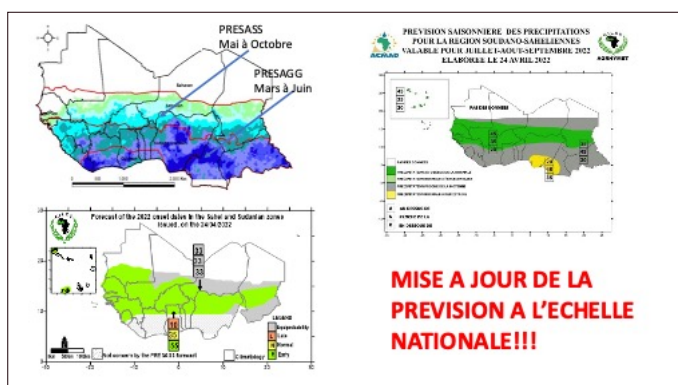
Zambia

In Zambia, the most prioritized tool for land use planning and conservation was conservation standards. The reasons for ranking this framework highest were that:
- It provides a clear systematic approach for monitoring, planning and learning from past conservation efforts; promotes use of best practices;
- It is easy for communities to apply;
- It allows for easy sharing of data;
- It helps to further refine conservation standards; and
- It facilitates real-time decision-making because data is available on real-time basis.

The *Stocktaking for National Adaptation Planning framework (SNAP)* was the most prioritized for adaptation tracking. National stakeholders indicated that SNAP targets a wide range of stakeholders, generates a comprehensive database usable for many stakeholders (nongovernmental organizations), highlights the country's capacity, and is a familiar tool that has been tested making easier to adopt and adapt.In terms of tools and frameworks for modelling and simulation of climate change impacts, the *Climate Adaptation in Rural Development (CARD)* assessment tool was identified as the most prioritized because it provides qualitative and quantitative information for decision-making on the yield of major crops, identifies priority areas for investment and indicates alternative enterprises for famers.

The *Climate Adaptation Knowledge Exchange (CAKE)* was the most prioritized knowledge exchange platform. Through knowledge sharing, CAKE can facilitate better preparation for disasters, enhance the ability to adapt and encourage learning through others' experiences. The *Participatory Integrated Climate Services for Agriculture (PICSA)* tool ranked highest for monitoring climatic shocks and dissemination of climate information services. The main reason for selecting PICSA was that it has the potential to enhance weather information systems.

For climate risk vulnerability assessment, the most prioritized tool was the *Community Based Risk Screening Tool – Adaptation and Livelihoods (CRiSTAL)*, which equips project planners and managers with the capacity to design strategies for addressing potential future hazards. CRiSTAL can also facilitate the mapping of local livelihood resources.

Similar to Kenya, CSAPF ranked highest for the prioritization of CSA and adaptation interventions. Stakeholders indicated that the framework is helpful in identifying and prioritizing options following a step-by-step process. CSAPF guarantees community participation, maps out all the value chain actors and provides them with the relevant information for choosing the viable options. In terms of adaptation decision support, *Climate Canvas* was the most prioritized.

Senegal

In Senegal, the most prioritized tool for land use planning and conservation was the *Northeast Climate Data (NCD)*. The reasons for ranking this framework highest were that it considers many natural resources at the same time (land, water etc.); allows for monitoring, prediction and adaptation to climate change using many variables such as temperature, relative humidity, sunlight, precipitation and wind; and presents results in an easy to understand and usable format.

The Adaptation Monitoring and Assessment Tool (AMAT) was the most prioritized for adaptation tracking. National stakeholders indicated that AMAT is multi-sectoral, allows regular updating of indicators over the years, and provides the instructions and methodologies used to develop each indicator.

In terms of tools and frameworks for modelling and simulation of climate change impacts, the Land Use Portfolio Modeler (LUPM) was the most prioritized because it can help to understand the cost:efficacy ratio of adaptation options, predicts the effects of adaptation strategies and allows monitoring.

Similar to Kenya, CCKP was the most prioritized knowledge exchange platform. CCKP generates data to inform planning decisions at multiple levels and integrates past data with projections.

The highest ranked tool for natural resource management was the Spatial Trends in Coastal Socioeconomics (STICS). Stakeholders in Senegal found this tool relevant because of the country's long and vulnerable coastline and the need to monitor the fishing and tourism sectors (which are among the largest contributors to the economy).

The CCAFS Regional Agricultural Forecasting Toolbox (CRAFT) tool ranked highest for monitoring climatic shocks and dissemination of climate information services. The main reasons for selecting CRAFT were that it can support decisions in agricultural seasons, including the choice of crop varieties and application of agricultural inputs.

For climate risk vulnerability assessment, the most prioritized tool was the Climate Change Vulnerability Index (CCVI) because it covers all dimensions of vulnerability (environmental, economic and social), is multisectoral and looks at multiple risks.
Participatory Social Return on Investment (PSROI) ranked highest for the prioritization of CSA and adaptation interventions. Stakeholders indicated that the tool is aligned to the principles of locally led adaptation, considers endogenous practices and facilitates capacity building of community planning.

In terms of adaptation decision support, the Adaptation Support Tool (AST) was the most prioritized because it has all the sequential steps that enable adaptation (i.e. from conception and evaluation of strategies to development of climate change adaptation plans); enables mitigation of the risks linked to climate change by controlling the pollution of water bodies, drought, and floods; and considers the efficiency and costs of interventions.

Learnings and next steps

In all three countries where the project was implemented, awareness exposure on adaptation decision support tools was generally low. This means that while farming systems and livelihoods are increasingly threatened by adverse climate change impacts, and although there exist tools and frameworks to facilitate planning and decision-making, the effectiveness of adaptation is still largely hampered by awareness and knowledge gaps.

On a positive side, there was enormous interest among national stakeholders in implementing prioritized adaptation decision support tools. The identified and prioritized tools should be applied at different levels and require varied capabilities. While some tools could readily be implemented using existing capacities, the study identified several areas for capacity building (at individual and institutional level) and partnerships in skill development, data collection and analysis, downscaling data to local levels, adapting the tools to local contexts, and development of data sharing protocols.

The study further shows that stakeholders in each of the three countries prioritized the tools differently, meaning that context matters. A tool that is prioritized in one context cannot be generalized for application in other countries in Africa. A more appropriate approach will require prioritization and capacity building efforts beyond the three countries that the study focused on.

Relatedly, the technical capacity building workshops were quite intense. In-person meetings are more suitable for such detailed training sessions compared to virtual sessions. As a general recommendation, it would be important to conduct similar activities in northern Africa while including more countries in the current project regions (i.e. in East, West and southern Africa).

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