

POLICY BRIEF

Making every dollar count: how investing in climate information pays dividends for Africa's key socio-economic sectors

A new framework – the first of its kind – developed by the African Climate Policy Centre can provide governments of climate vulnerable nations with clear social and economic returns for investing in climate information services.

Key points

In the past, there has been limited evidence available that demonstrates the tangible benefits of investing in climate information services (CIS).

A new framework compares the socio-economic benefits (SEBs) generated by investing in climate information services with the costs of investment. It can be applied across Africa's key sectors and be customised by country.

The framework shows SEBs generated from higher quality CIS far outweigh the costs of investing in CIS; equally the cost of investing in CIS are minimal compared with the significant costs incurred if countries do not invest sufficiently.

By showing the value for money of investing in CIS, the framework analysis provides a clear incentive for governments to invest in these services.

Africa's social and economic welfare is intrinsically linked to the health of many climate-dependent sectors – from agriculture to aviation, forestry to fishing, transportation to tourism. As the impacts of extremes in climate variability (such as floods, droughts and tropical cyclones) and climate change deepen, countries need clear strategies that both safeguard these sectors against losses from climate shocks and stresses while also supporting growth. Governments, businesses and communities need to be able to adapt to climate variability in order to mitigate the threats of climate change while seizing the opportunities of adapting to the changing climate.

Investments to improve the capacity of human resource and the technical equipment for generating high quality weather and climate information and prediction services is one such strategy. Related to this, is building the capacity of end-users to apply this information and these services, and assessing the socio-economic benefits (SEB) that result from using high quality information for mitigating climate impacts.

With improved networks for forecasting rainfall and temperature data, government health ministries can provide reliable advice on mosquito borne diseases; planning departments can use current and future trends to climate-proof vital infrastructure such as housing, office buildings, roads, railways,

bridges or dams. Farmers can protect and maximise yields by adjusting harvesting schedules or crop choices if they know when adverse weather and climate will hit, how much rain will fall or when the rainy season will start. Better information can bolster business: more accurate information on sunshine hours can help energy entrepreneurs assess the potential for solar energy to strengthen a country's power provision; better wind outlook data can inform whether investment in wind energy would bring better returns.

From the grassroots to government, high quality information can inform evidence-based decisions to minimise climate damage and protect socio-economic gains. The World Bank estimates that upgrading developing country weather and climate observation could – on a yearly basis - save 23,000 lives, avoid \$2bn in assets lost due to natural disasters and bring up to \$30 billion of additional economic benefits¹.

But when making investment decisions, Africa's governments do not always use good quality climate information. Nor are they committing enough resource to generate, disseminate and apply better information. Insufficient or outdated observational equipment leads to weather stations producing data that is weak and patchy, and insufficient spending on human resource development means countries do not have the technical expertise to prepare and communicate data and information in a way that is easily applicable by users.

There are numerous reasons for low uptake of high-quality climate information, but one point is clear: the implications of Africa not having the capacity to generate and apply best possible Climate Information Services (CIS) are hugely detrimental to the continent's social and economic wellbeing.

New framework provides the hard evidence governments need

While the case for investing in CIS may seem compelling, in the past there has been limited evidence available that demonstrates the tangible benefits. To commit money from national budgets, governments need to know the likely returns – and that the benefits will outweigh the costs of investment.

The African Climate Policy Centre (ACPC) of the United Nations Economic Commission for Africa (UNECA) under the Weather Information and Climate Services (WISER) programme has made significant efforts towards plugging this gap with a framework that uses climate information to simulate the impacts of climate variability and change and assess the social and economic benefits. It compares these benefits with the costs of investing in available information, or of producing higher quality CIS. The framework can be applied across sectors that are key to Africa's socio-economic development and can be customised by country.

A more accurate picture

The WISER framework is distinct from conventional models in a number of ways:

- It simulates the impacts of climate variability and change on key sectors and enables users of the framework to extract the social, environmental and economic implications – such as GDP growth and job creation. This is a significant advancement: it provides governments with information about extreme events based on past experience – for example, costs incurred by storms or drought. Governments typically view these events in isolation and fail to see them

¹ Hallegatte, Stéphane, 2012. A Cost Effective Solution to Reduce Disaster Losses in Developing Countries : Hydro-Meteorological Services, Early Warning, and Evacuation

as part of the broader picture, i.e. the accumulation of climate impacts and their impacts on extrabudgetary expenditure for reconstruction. They overlook the need to invest in, and apply, CIS for social and economic benefits that can advance development and increase the overall resilience of the economy against climate change impacts. The framework enables the impacts of climate change to be quantified in monetary terms and separated out from other factors that can put a strain on these key sectors – such as population growth.

- The framework can assess four key aspects:
 - climate damage without interventions or investing in CIS
 - **required investments** in interventions that can mitigate the impacts of extreme events
 - **avoided costs** and damages from implementing these interventions
 - **added benefits** such as maintained employment and production, and the added labour income and GDP that results.
- Conventional models tend to take a narrow sector-by-sector focus; this new framework takes a systemic approach which links sectors and enables a holistic view of the social, economic and environmental implications within and across all sectors. Recognising this interdependence enables an analysis of intervention effectiveness across sectors. This ‘nexus approach’ enables synergies across the sectors to be identified enabling more cost effective, streamlined investments.
- The model provides information about where, and to what extent, investing in CIS can bring benefits. It helps identify these benefits (physical parameters such as jobs, tons of production, energy generated) and provides information on their economic value. The results generated by the model have the potential to incentivise investments in CIS, depending on the amount of damages avoided and the investments required. It therefore provides an objective assessment of the value, or ‘payback’ of interventions in terms of added production and avoided damages.

The framework in practice: the costs of climate impacts and benefits of interventions

To date, the framework has simulated climate impacts for disaster risk reduction², agriculture, energy and water sectors. This paper considers the latter three sectors and customisations for Cameroon, Mozambique and Uganda.

Given more volatile rainfall patterns caused by climate variability, higher variability of rainfall is simulated (an increase of 0.5% per year) leading to more floods and droughts. Section A summarises the socio-economic impact of this simulation. Section B demonstrates the SEBs of interventions for adapting to the impacts of climate change and improving the resilience of communities.

Section A: the costs of climate impacts

Agriculture: Yields suffer, GDP drops and employment takes a knock

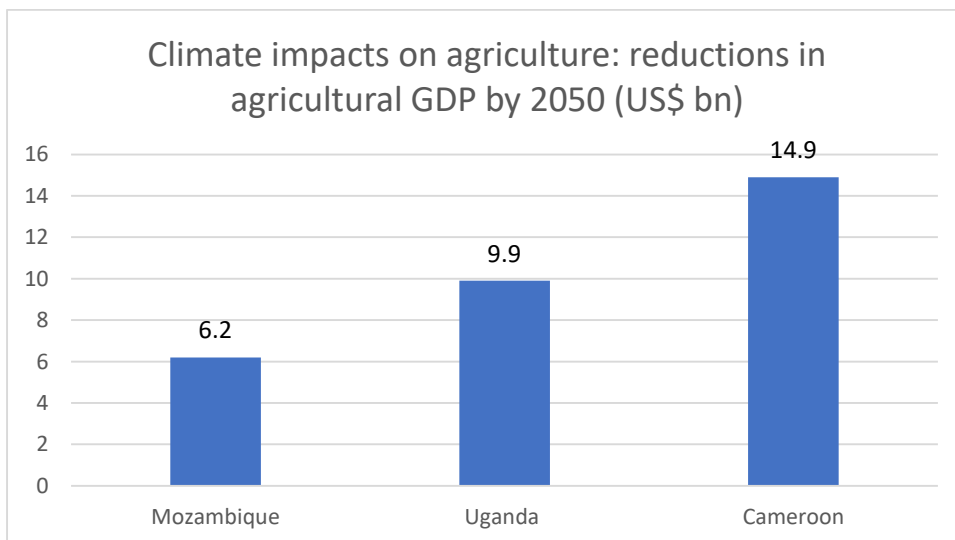
² *Calculating the cost of climate disasters – and why investments in climate information services pay off.* ACPC Policy Brief

With the potential to secure food for the growing population and to power economic growth, agriculture is central to Africa’s development. In its Agenda 2063, the African Union points to the sector’s potential to bring socioeconomic gains and drive sustainable development. Yet climate variability – most notably erratic rainfall patterns – impact agricultural productivity and threaten this vision.

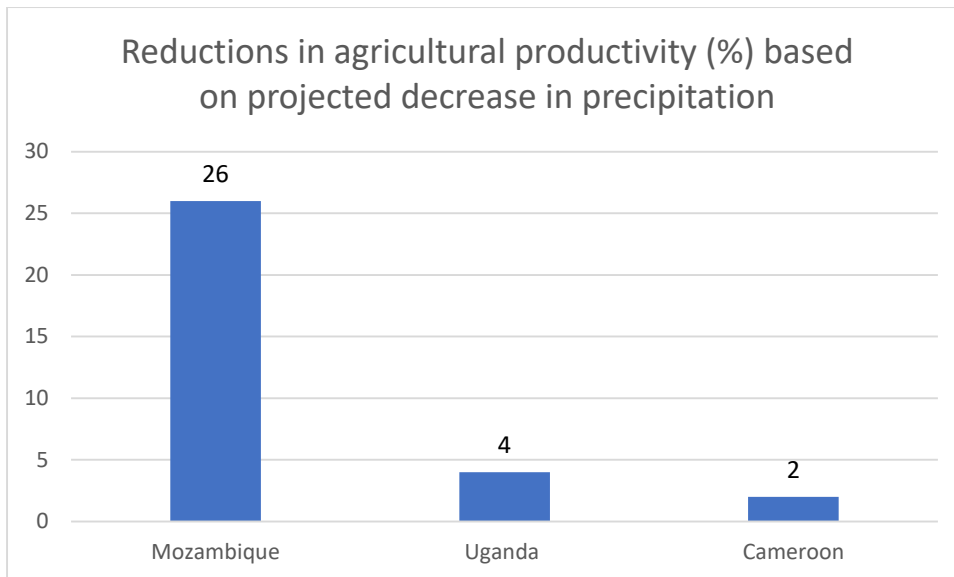
Under the presented framework, agriculture production is determined by the amount of productive agriculture land and the yield per hectare of cropland, which depends on water availability per hectare. Climate impacts are most visible in Mozambique which is hit particularly hard by the variation in rainfall due to severe water shortages during the dry season when most of the land is not irrigated.

Projections to 2050 show agricultural production in Mozambique is reduced by approximately 26% due to water shortages during the dry season; production in Cameroon and Uganda agriculture drops by up to 4% and 2 % respectively. Although these figures are relatively low compared with Mozambique, they are still significant – for example when considering the local impacts on nutrition.

The framework translates the reduction in production into pure economic terms: agriculture GDP in Mozambique is projected to fall by an average of 24% (USD 6.2 billion) with Cameroon and Uganda seeing reductions of 14% (USD 14.9 billion) and 12% (USD 9.9 billion).



Reduced productivity has direct social implications, putting employment in the sector at risk. In Mozambique, approximately 42% of jobs in agriculture are threatened, leaving around 1.26 million jobs vulnerable by 2050. Employment in Cameroon and Uganda’s agriculture sector are reduced by just under 3% each, respectively.



Water resources dry up

Water is at the heart of Africa’s social and economic growth and is the primary medium through which Africans will experience the impacts of climate change. Climate variability and change exposes millions to increased water stress as clean, reliable water sources come under pressure. The framework projects the impact of rainfall variability and evapotranspiration on water resources and highlights the uncertainty of water supply.

Mozambique’s water balance is projected to decrease by almost 70% - from an average shortage of 5.98 billion m³ in 2018 to 10.1 billion m³ annually

The water balance (indicating whether there is a surplus or scarcity of water at any given point in time) declines for all three countries. Mozambique sees water shortages almost doubling with the water balance decreasing by 68.8% from an average shortage of 5.98 billion m³ in 2018 to 10.1 billion m³ annually up to 2050. Uganda’s water balance declines by 5 billion m³ between 2018 and 2050 to approximately 4.3 billion m³ per year in 2050. By 2050, Cameroon sees a decrease by 6.6 billion m³ by 2050 – a 30% drop compared with 2018.

Energy sectors loses power

Reliable, affordable energy is the driver of wealth creation and enhances human wellbeing – from lighting to cooling, transportation to cooking. Energy supply underpins many aspects of modern life, such as water consumption, access to goods and services, and land use; energy access for all is the cornerstone of achieving the UN’s Sustainable Development Goals (SDGs).

Changes in temperature, precipitation, sea level, and the frequency and severity of extreme events all affect how much energy is produced, delivered, and consumed. The model simulates the impacts of increased rainfall variability and higher temperatures and shows the need for countries to compensate for the impacts on power generation: Mozambique is projected to need an additional 25MW of capacity (the cost of which ranges between \$25 and \$50 million), while Cameroon and Uganda require and 16MW and 4MW respectively. Damages to power generation capacity also incur significant costs: by 2050, Cameroon requires a cumulative investment of CFA 10.49 trillion, followed by Uganda and Mozambique with required investments of Ush 47.66 trillion and MZN 221.1 billion respectively.

Section B: proactive investments to adapt, drive growth and avoid future climate damage

As demonstrated above, by comparing climate change simulations to a baseline simulation without climate change impacts, the framework shows heavy implications for the agriculture, water and energy sectors.

The next stage of the analysis uses CIS to assess and implement interventions that mitigate the social and economic vulnerabilities created by climate change on the three sectors.

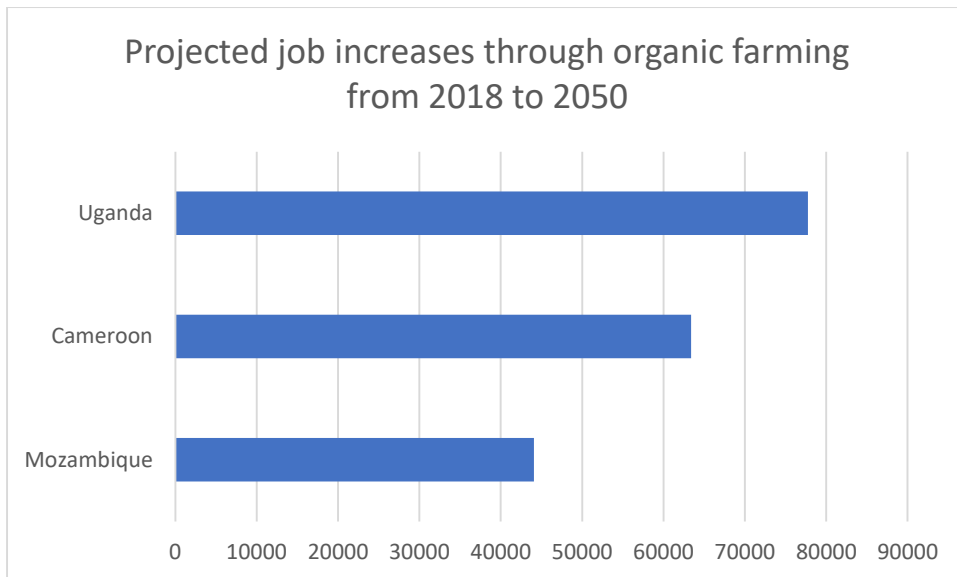
The following interventions are considered:

- For the agriculture sector, the framework assesses whether a transition towards organic farming practices increases resilience. Organic agriculture, or Climate Smart Agriculture practices, have been proven to reduce the impacts of climate change impacts, leading to more reliable agriculture production, especially for small scale farmers.
- For the energy sector, the framework simulates whether decentralised renewable energy reduces the threats to power generation. Power generation from renewable energy is less susceptible to water scarcity or temperature increases that are projected to increase into the future as a consequence of climate change. The transition to renewable energy is assumed to contribute to higher and more reliable provision.
- Drip irrigation is deployed to increase water security. More efficient irrigation infrastructure for agriculture production reduces the total water demand from the sector, hence making water available to sustain a higher amount of productive agriculture land through dry periods.

Organic farming: yields rise, jobs increase

The transition towards organic farming is projected to increase the productivity of the agriculture sector considerably, increasing annual agriculture production by an average by 5%. The biggest gains are observed in Cameroon where total production increases by 3.12 million tons in 2050. Increases for Uganda and Mozambique are projected at 1.59 million tons and 0.86 million tons respectively. Translating yields into money, Cameroon's agriculture GDP increases by CFA 114.7 billion over 30 years. The cumulative additional GDP for Uganda and Mozambique during the same period is Ush 13.74 trillion and MZN 133 billion respectively.

In addition to the economic benefits, organic farming creates employment for all three countries: 63,410 additional jobs in Cameroon, 77,770 additional jobs in Uganda and 44,080 additional jobs in Mozambique.



Renewable energy powers growth

The transition towards renewable energy increases the resilience of the power generation sector in the face of climate change impacts and adverse climate events. Between 2018 and 2050, the increase in resilience leads to a cumulative additional power generation of 24.9 million MWh in Mozambique, followed by Cameroon and Uganda with 4.1 and 3.5 million MWh respectively.

Renewable energy creates a total of 245 hours more electricity hours per year

Electricity generation is between 1.5% and 2.8% higher if adaptation measures are implemented. An increase of 2.8% in electricity generation corresponds to a value up to 245 additional hours³ (or approximately 10 days) of electricity availability per year.

Drip irrigation yields water savings

Projections for the water sector indicate that introducing efficient (drip) irrigation can significantly reduce water consumption and boost productivity. The most significant savings are achieved in Mozambique, where introducing drip irrigation yields cumulative water savings of 27.9 trillion m³ over a 30-year period. During the same time, the projected cumulative water savings obtained in Uganda and Cameroon average 7.26 and 1.54 trillion m³ respectively. If water savings are used to irrigate additional cropland, the total amount of cropland could be increased by between 12.8% and 14.4% (assuming that the same amount of water is used, when water efficiency increases the number of hectares irrigated can also increase).

Nexus approach: summary of findings

- Using climate information to simulate climate impacts has significant social and economic implications for the agriculture, water and energy sectors across the three country

³ The number of hours are calculated based on the total hours of production per year (8,760) and the increase in production compared to the climate scenario without adaptation measures (+2.8%). $8,760\text{hrs/year} * 0.028 = 245.28\text{hrs/year}$

customisations. Agriculture GDP, for example, is forecasted to drop by between 12.1% and 16.7% by 2050.

- The SEB framework enables the analysis of climate impacts and shows the potential for **avoiding costs** through extreme weather events in **monetary terms** – such as avoiding the costs of damage when countries decentralise their power generation capacity.
- The SEB framework demonstrates the potential for generating **social and economic benefits** of investing in adaptation interventions (organic farming, drip irrigation and renewable energy). Across the three countries, results – from an economic perspective – show improved GDP growth; from a social perspective, interventions create more jobs. CIS can identify areas where investments in interventions for climate change adaptation are most needed and yield the highest socio-economic returns.
- Social and economic benefits of robust CIS far outweigh the costs of investing in CIS; equally the cost of investing in CIS are minimal compared with the significant costs incurred if countries do not invest sufficiently.
- By showing the value for money of investing in climate information, the framework analysis provides a clear incentive for governments to invest in CIS.

Policy recommendations

- Increase investment in human resources and in developing equipment for the collection, processing, dissemination and use of CIS, such as early warning systems. This would give decision makers a strong foundation for improved planning and more timely intervention.
- Develop the capacity of metrological departments to generate and disseminate CIS across weather- and climate-sensitive sectors: such as agriculture, health, water and energy. These departments need:
 - The right infrastructure for generating CIS
 - Competent staff to correctly analyse and prepare this information for end users
 - Manpower and infrastructure to disseminate this information to the end user
 - Access to end users that know how to use the information to improve their own production in the face of climate change.
- Require the preparation of integrated economic analysis i.e. cost benefit analysis that includes economic, social and environmental outcomes.

WISER is supported by:

