Synthesis

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INTRODUCTION

The *GCA's State and Trends of Adaptation in Africa* report presents a comprehensive overview of the present and future prospects of the African continent in the light of climate change. It is also a blueprint for how individuals and institutions in the African and international policy space can finance, design and implement adaptation plans to best protect the lives and livelihoods of millions of African people from such disruptive change.

For many reasons surveyed in depth in this report—including its large youth population, large proportion of the workforce in informal employment and in agriculture, historical and current development trajectories, distinctive geographical features and climatic characteristics, decreased fiscal space after the COVID-19 pandemic, and the continent's pressing challenges in the realms of food security, urban infrastructure and energy—Africa faces a stark threat from the present and potential effects of climate change. It has no choice therefore but to adapt.

In this context, the *State and Trends of Adaptation in Africa* report is especially timely. As the recently released first volume of the IPCC Sixth Assessment Report (AR6) in August 2021 suggests, it now appears that critical warming levels for the world are likely to be reached earlier in the century than previously projected. Given the time-lag between the strong mitigation measures recommended by the report to prevent average global temperature rising by 1.5°C is the ipcc recommendation or more by mid-century, and such measures taking effect, both the need and the urgency to adapt are stronger than ever in Africa. Research presented in this report shows that the relative economic impacts of climate change on Africa are projected to be greater than in the developed world, meaning a potential reversal of decades of hard-won economic progress. Adaptation can also be a wellspring of future development, generating hundreds of thousands of green jobs, ensuring stability and food security for the vulnerable, forestalling conflicts over key resources like water and energy, and having positive impacts on many other human development indicators. This report is published before COP26 and we hope it will support the design of adaptation programs and actions, linking to the race to resilience as it sets out to catalyze a transformational change in climate resilience globally and, in particular, for Africa and its most vulnerable populations.

What are the most optimal pathways that an integrated program of climate adaptation for Africa might choose from the available options and resources at its disposal? And how can governments, regional bodies, and institutional actors work together to deliver a systematic and integrated program of adaptation to help secure the lives and livelihoods of the people of Africa? This Synthesis chapter presents an overview of the key findings and policy recommendations of the papers featured in the *State and Trends of Adaptation in Africa* report. It calls for a combination of coordinated and supportive bottom-up and top-down solutions. Adaptation is everybody's business.

PRESENT AND PROJECTED CLIMATES IN AFRICA

Africa is exposed to complex, interconnected climate systems, with three of the most important being El Niño Southern Oscillation (ENSO), the monsoons, and cyclones. Each is already affecting the lives and livelihoods of people across the continent. As anthropogenic climate change causes the planet to warm, each of these climate systems is likely to increase their influence on extreme weather outcomes and to become more erratic.

The recently released first volume of the IPCC Sixth Assessment Report (AR6) suggests that it is becoming increasingly difficult to avoid reaching a rise in average global temperature of 1.5°C within the next decade or so and 2°C or more by mid-century. Even if lower emissions pathways are to be achieved, African climates are likely to be more erratic, with most of Africa becoming more arid and much of it so hot that outdoor work and tourism will be life-threatening for much of the year. Droughts and floods already threaten livelihoods and trap people in poverty, and both are likely to increase in intensity and frequency in the future. Africa is particularly vulnerable to climate extremes, or even shifts in weather norms such as the start of the monsoon, as so much food production is dependent on rainfed cropping and pastoralism. Infrastructure that supports the wider economy is also highly exposed to extreme events. Therefore, adaptation is now more urgent and challenging than ever. The Present and Projected Climate Risks in Africa chapter sets the scene, showing us where we stand now and the increasing climate challenges that are imminent.

Key Findings

The African continent is often associated with disasters. Like most other parts of the world, Africa has shown a marked decline in the number of people reported as being killed in disasters. For example, in the 20 years from 1970 to 1989, 679,000 people were reported as being killed in African climate disasters, compared with only 44,000 fatalities over the most recent 20-year period. Most of this change represents real improvements from better hazard-reduction measures, social safety nets and humanitarian support to alleviate the worst of the impacts. But some of the decline is due to changes in the attribution of the cause of death, especially in relation to drought.

From 1991 to 2020 there were about 50 reported disasters per year across Africa, with floods contributing two out of three events. But droughts have the greatest impact on African lives and livelihoods, with five times more people affected by droughts than floods. Floods are recorded as causing greater financial damage, but as only 14 percent of disasters in Africa have an estimate of damages recorded, little can be made of the damage data. The number of flood events reported has increased about five-fold since the mid-1990s while the numbers of other types of disaster have changed much less. Some of the increase in floods could be due to a changing climate, but changing exposure patterns of populations along rivers and coasts and improved reporting almost certainly contribute as well.

In August 2021 the first volume of the AR6 Report was released with new insights and modelling. It is based on a major new modelling effort (CMIP6) that compares over 30 models of general circulation to include more detail within the models and greater spatial resolution. Analysis for Africa shows that changes in temperature drivers are already observed to be consistently higher across Africa. Annual precipitation is expected to decrease in North Africa and Southern Africa by 2050, even though such a trend is not yet clear in the observational data. Northern and Southern Africa are expected to become more arid throughout this century, but in some parts of Southern Africa aridity will be accompanied by an increase in heavy rainfall events, possibly leading to floods.

Confidence in the prediction of changed climate patterns and their attribution to human effects has increased, and it now appears that critical warming levels are likely to be reached earlier in the century than previously projected. This is the AR6 Report's strongest message for adaptation. Both the need and the urgency to adapt are stronger than ever.

A major challenge in the planning for climate change is the deep uncertainty at small geographical scales (like a city) and over longer timeframes (the decades of useful life of infrastructure assets). This calls for a strong emphasis on no-regret robust solutions able to handle that uncertainty.

Climate change attracts attention when some form of climate shock occurs. However, more subtle climate changes also threaten ecosystems and the people whose well-being depends on them. Small changes in weather patterns arising from climate change can gradually erode productivity of food systems and cause losses of assets through events too small to attract global or even national attention. These affect people's well-being and can counter efforts to rise


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Table 1: Summary of effects of increasing emissions on African climates

Temperature	
	Observed mean annual temperatures are increasing at 0.2°C to 0.5°C per decade.
	Under each of the major emissions scenarios assessed, a global temperature increase of 1.5°C over pre-industrial levels is likely to be exceeded in the next decade or so, and by mid-century all but the lowest emissions scenarios suggest temperature increases of 2°C or more.
	High-emissions scenarios suggest it is very likely that warming will exceed 3°C by 2100 except in Central Africa, where the estimate is 2.5°C.
	Extreme heat-observations are limited so no evidence of a recent increase. Modelling suggests days above 35°C will increase by 20 to 160 days annually depending on scenario and region.
	Life-threatening temperatures above 40°C are projected to increase by 10 to 140 days depending on scenario and region.
	Cooling degree days will increase and heating degree days will decrease.
Summary: Heat waves and heat stress will increase and drastically so in the worst scenarios.	

Precipitation	
	The frequency and intensity of heavy precipitation events are projected to increase almost everywhere in Africa, leading to more flooding events.
	Observations are variable, but in many areas there is evidence of a drying trend, especially in parts of North Africa, West Southern Africa and Central Africa. Models project that this trend will continue.
	River floods-observations suggest there has been some increase in recent decades. Model results vary with scenario and region, but they suggest that present 1 in 100 year floods could become as frequent as 1 in 40 years under low-warming scenarios and 1 in 20 years under higher warming scenarios.
	The West African monsoon appears to arrive later in the year and rainfall is more intense and erratic.
	Life-threatening temperatures above 40°C are projected to increase by 10 to 140 days depending on scenario and region.
Drought	Droughts are expected to increase in all regions of Africa except the northern parts of East Africa and the Horn of Africa.
Aridity	Observation and modelling suggest increasing aridity in North Africa, West and East Southern Africa, and in Madagascar.
Summary: Changes in total precipitation are small, but more rain is likely to fall in heavy rainfall events in most regions. But the effect of increased precipitation must also be considered alongside the prospect of increasing temperatures and evaporative demand. Thus the overall picture is one of drier conditions over most of the continent with more droughts but also more flooding.	

Coastal & ocean	
Sea levels	African sea levels are currently rising slightly faster than the global average, although a little slower in parts of the Indian Ocean coast. They are virtually certain to continue rising by 0.4 m to 0.5 m by 2100 under low-warming scenarios, and 0.8 m to 0.9 m under high-warming scenarios.
Ocean temperatures	Marine heat waves are expected to continue to increase in frequency and intensity, especially around the Horn of Africa.
Cyclones	Cyclones are possibly decreasing in frequency, but high-intensity events will become more common, often associated with very heavy rainfall.
Coastal flooding	Projections suggest that a current 1 in 100 year flooding event will become events with a return period of 10 or 20 years by 2050, and of 5 years to annually by 2100, even under moderate warming.
Fire weather	Likely to increase throughout extratropical Africa.
Dust storms	Evidence is uncertain due to confounding factors, especially changes in land cover and general uncertainty in detailed wind modelling. The whole topic is impeded by lack of controlled observations.

out of, or can push people back into, poverty, leading to millions of people never being able to escape from the threat of poverty. Table 1 summarizes the AR6 climate trend observations and projections for Africa.

Effective action on climate adaptation and resilience is only possible with high-quality weather, climate, hydrological, and related environmental data ("hydromet" data). This data is collected in each country by national hydromet agencies. Data is, of course, not enough. In the end, what is required is for all stakeholders in society—governments, businesses, civil society, and citizens—to take appropriate action based on weather and climate information and projections. The meteorological value chain—from weather observations to local forecasts, warnings, seasonal outlooks, and other climate services—needs to work in a coordinated manner to be truly effective.

An essential product of this meteorological chain is multi-hazard early warning systems. According to an estimate by the World Bank, if early warning systems in low- and middle-income countries were upgraded to European standards, lives lost could be halved and annual losses to assets of between $300 million and $2 billion avoided. High-quality hydromet data has many other benefits, including economic productivity in key sectors, from agriculture to logistics. Better historical hydromet data and projected climate changes are becoming more critical to mobilizing climate finance. The collection of weather and climate observations in Africa is weak and deteriorating in recent years. For example, over the last five years (January 2015 to January 2020), the number of upper-air observations dropped by almost half in Africa. This foundational problem poses significant challenges for the ability of Africa to adapt to climate change.

SECTION 1 – ECONOMICS AND FINANCE

Macroeconomics of adaptation

While Africa has enjoyed high levels of economic growth over the last decade, it now experiences high economic losses from climate-related variability and extreme events, such as major floods, droughts and storms. In fact, it is the region with the highest vulnerability to such events globally. These events have major macroeconomic consequences. The strong growth rates experienced in Africa over the last decade would have been even higher if climate shocks had been better managed; a failure to prepare for these events has led to foregone growth.

Looking to the future, climate change will exacerbate these existing impacts, and create new risks even in the near term. In the long term, it will lead to potentially very high future economic costs, though the level of these impacts will depend on global mitigation agreements and their implementation. Africa already has a large existing adaptation deficit.

The Macroeconomics of Adaptation chapter provides a deep dive on the economics costs and macroeconomic risks of climate change impacts in Africa. It considers the potential economic benefits of adaptation, and the range of cost-benefit ratios of adaptation interventions in Africa.

Key Findings

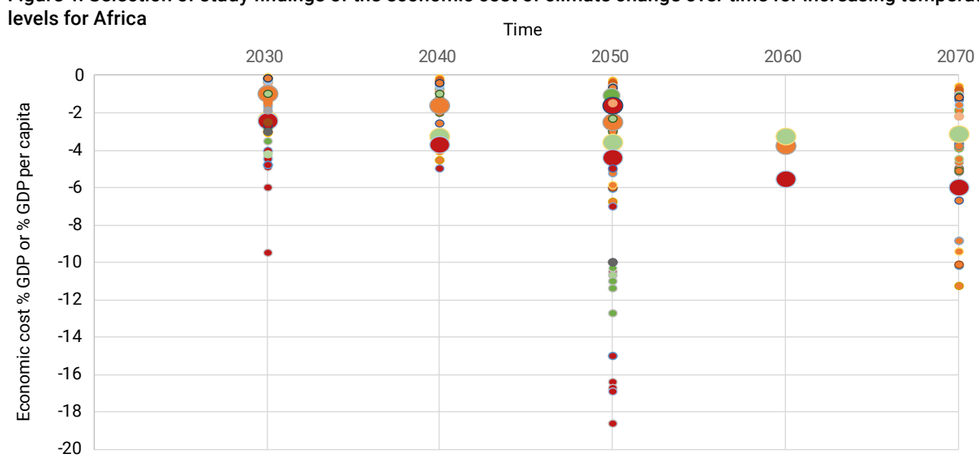
There is an established literature on the economic costs of climate change, going back several decades. Despite the modelling challenges and uncertainties involved, there are many common insights across the various studies. Our analysis shows that:

- Even if the goals of the Paris Agreement are achieved, the economic costs of climate change in Africa are projected to be large. It is likely that Africa will experience higher relative impacts (as a percentage of GDP) than most other world regions, even though it is less responsible, both historically and in the present day, for global greenhouse gas (GHG) emissions than other major regions of the world. If the Paris goals are missed, the economic costs will be very significant in Africa, and potentially catastrophic.
- Climate change will affect near-term development and poverty reduction, as well as long-term growth for the continent. There is less agreement on the exact size of the economic costs of climate change in Africa and on which regions and specific countries in Africa will be most affected. Most studies report significant economic costs over the next few decades (i.e., several percent of GDP per year), rising significantly for high-warming scenarios in the longer term (to >5 percent and plausibly >10 percent for some countries), as shown in Figure 1. In addition, it is likely that these impacts will be unevenly distributed within countries, disproportionately affecting the most vulnerable.

Data shown are from a series of recent studies for low (green), medium (orange) and high (red) warming scenarios, including World Bank (2010), OECD (2015), Kompas et al. (2018), Baarsch et al. (2020), AfDB (2020), De Bruin et al. (2020), and Bosello (2021). They include regional studies for Africa and country studies: small circles represent country studies; large circles represent regional studies. Studies are plotted on the same scale, but they report slightly different metrics (e.g., percent of GDP, gross damages [including non-market impacts] as an equivalent percent of GDP, percent GDP per capita).

- A further finding is that the relative distribution of climate change impacts will not occur evenly across the world. The absolute costs of climate change are influenced by the size of regional and national economies, and thus the proportion of global total damages in Africa is low. However, the relative cost of climate change reveals a different picture. All studies project much higher relative economic impacts in Africa and Asia, as a percentage of GDP, than in other world regions. This means that even if the Paris Agreement goals are achieved, the economic costs of climate change in Africa are projected to be large, and it is likely that Africa will experience higher relative impacts than most other world regions, even though it is the least responsible for global GHG emissions. If the Paris goals are not met, then the economic costs in Africa could be extremely large and climate change will fundamentally affect development and growth objectives for the African continent.

Figure 1: Selection of study findings of the economic cost of climate change over time for increasing temperature levels for Africa



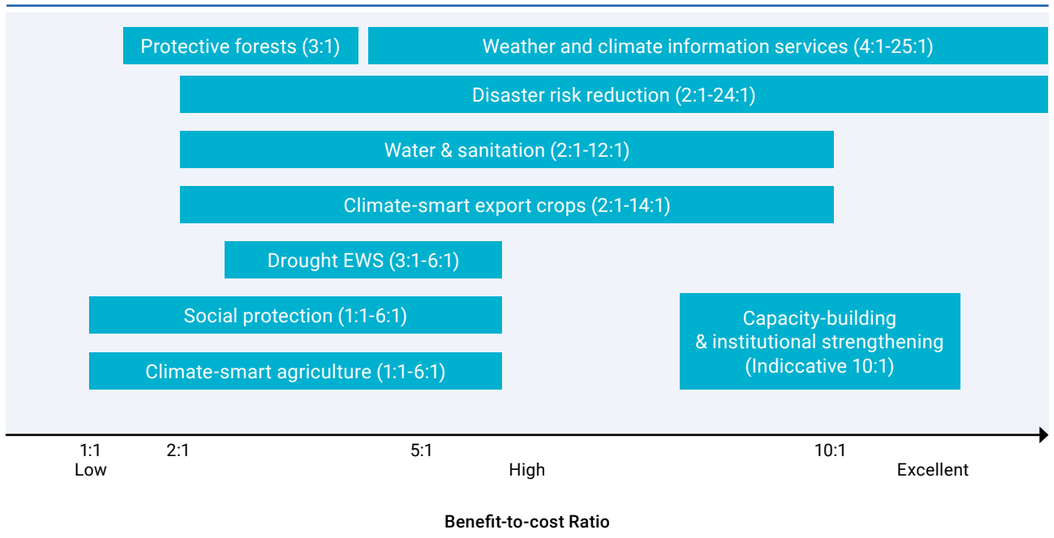
Source: Authors

- Only adaptation can reduce the economic costs of climate change in Africa over the next 20 years: Africa urgently needs to scale up adaptation now. Without a doubt, international mitigation policy is the only way to avoid the economic costs of high warming pathways, i.e., above 2°C relative to pre-industrial levels. However, while ambitious mitigation will provide huge benefits by avoiding these high-warming scenarios and the associated economic costs, the benefits of these policies have a relatively limited impact in the short term. Mitigation primarily has benefits after 2040, due to the inertia in the temperature response to greenhouse gas concentrations. To put this another way, the level of climate change in the next 20 years for Africa is already locked in, and these impacts can only be reduced by adaptation.
- There is a need to consider climate change in public financial management. The impacts of climate change on public finances, combined with the need to finance adaptation, could add pressure to debt levels in Africa. Financial market anticipation of these various impacts could hasten and exacerbate climate-related economic costs in Africa.
- Adaptation can reduce the economic costs of climate change in Africa very effectively. It should be seen as a complement to mitigation, not a substitute. While adaptation is found to be highly beneficial, the amount of adaptation (and the cost) depends on the decision framework used, as well as the level of warming.
- Early adaptation has high benefit-to-cost ratios. Our analysis focused on information for Africa specifically, to identify the potential benefit-to-cost ratios for adaptation. The findings are summarised in Figure 2. As shown in the figure, BCRs for a range of adaptation measures are mostly above 2:1, and often above 5:1, which is a sizable rate of return.

Policy Recommendations

A rapid scale-up of adaptation in the next 20 years is needed in Africa: doing nothing is not an option. It is important to strengthen the consideration of climate adaptation upstream (at a more strategic level in government policy and strategy), as well as to develop pipelines of bankable projects, considering both climate-proofing of planned development (e.g., resilient infrastructure) and also targeted adaptation projects (e.g., flood defences). Many countries will require external finance to deliver these scale-ups. There is an important role for government to identify the strategic economic case for action, and to consider where and how best to intervene to create the enabling environment for adaptation to ensure it is effective, efficient and equitable. There is a need to integrate economic thinking when designing adaptation strategies and policies, i.e., to consider market and policy failures, to identify where it is appropriate for government to act, and to design strategy and policy accordingly, as with other public policy areas. This will require analysis of these issues by governments and involve relevant ministries and expertise. It will also require external support.

Figure 2: Adaptation benefit-to-cost ratios for a selection of options from Africa-specific studies



Source: Authors
Note: The figure shows the indicative benefit-to-cost ratios and ranges for a number of adaptation measures. It is based on the evidence review undertaken for this study. It is stressed that BCRs of adaptation measures are highly site- and context-specific and there is future uncertainty about the scale of climate change. Actual BCRs will depend on all these factors.

COVID recovery

Globally, the unprecedented economic challenges of COVID-19 are being addressed by a combination of fiscal and monetary interventions. As some countries have begun to emerge from the depths of the health crisis, fiscal spending has again been the favored lever, this time to support long-term recovery by stimulating new jobs and enabling a return to pre-COVID-19 levels of economic growth. However, only a small share of the fiscal stimulus packages is explicitly green. Yet recent global economic studies suggest that green spending can secure both greater growth and a greener future. The COVID Recovery chapter reviews the COVID-19 recovery fiscal stimulus expenditures in selected African countries, analyzes their immediate benefits, and proposes ways to enable sustainable green economic growth. Selected countries include the Democratic Republic of the Congo, Egypt, Kenya and South Africa.

Key Findings

Before the COVID-19 pandemic, investment in adaptation to climate change was low when compared to investment in mitigation. Considering the economic crises and the disruption to livelihoods caused by the pandemic, it is important to stress on the idea of resilience and to contemplate new, green pathways to growth. This is especially so in the case of Africa, which has one of the largest populations of poor and vulnerable people in the world.

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Agriculture is a dominant sector in the economies of most African countries. A focus on natural capital has the potential to bring economic, social, and environmental benefits, creating jobs rapidly and safeguarding communities against climate change. There is a clear and strong codependency between agriculture, natural capital, and climate change. Natural capital management provides a great variety of critical services to agriculture. Among them, for example, are ecosystem services (water, soil, nutrients, etc.) and regulating environmental conditions (physical protection against natural hazards like floods, tsunamis or wildfires, purifying water, etc.). On the other hand, poor agricultural practices and management reduce the availability and quality of natural capital, which in turn may create a spiral of degradation of both natural capital and agricultural activities. Both sectors are extremely vulnerable to climate change. Climate change accelerates the depletion of natural capital and ecosystem services by altering major geophysical conditions—average surface temperatures, ocean temperatures, precipitation patterns, the oxygen content and acidity of seawater—too quickly for natural systems to adapt. When these changes reach thresholds that ecosystems can no longer sustain, natural capital and ecosystem services often degrade along a nonlinear path.

The sustainable use of natural capital, particularly to address vast adaptation needs through nature-based solutions (NbS), and the adaptation of the agricultural sector to cope with current and future climate change impacts are vital for Africa's recovery and for resilient green economic growth.


Photo: courage007/Shutterstock

Policy Recommendations

The examples of the four focus countries show that COVID-19 has caused a severe disruption to the countries of Africa, with huge consequences for both lives and livelihoods. Further, the absence of much fiscal space to generate remedial measures has meant that African countries have been able to spare only a fraction, when measured per person of the population, of the sums spent in the developed world and in low- and middle-income countries elsewhere in the world on relieving economic distress and providing safety nets.

But in the present crisis there is also a window of opportunity. As the nations of Africa seek to rebuild their economies, a new policy orientation emphasizing green and sustainable growth can not only boost the economy and create jobs on a large scale, it can also make the continent more resilient against the long-term challenges of climate change. Key principles that define and govern the "green growth" approach to development include sustainable economic growth; resource-use efficiency; climate change response through adaptation and mitigation; creation of decent green jobs; and human well-being and social inclusiveness.

Many of the countries surveyed in this chapter, and more broadly in this report, have a significant percentage of their populations involved in, and a significant share of their GDP generated by, agriculture. As they seek to rebuild after the pandemic and to restructure their economies in the face of climate change, focusing on adaptation and natural-resource management can have many beneficial effects, among them the large-scale creation of sustainable green jobs for adaptation and resilience.

The needs and possibilities of each country are slightly different, and, as this chapter shows, under the broad orientation of green growth there is considerable room for the generation of portfolios of policy options tailored to each case. The provision of concessional finance by international partners, including foreign governments and multilateral organizations, is imperative for a successful COVID-19 recovery for Africa and to significantly reshape the economic, social, and environmental future of the continent.

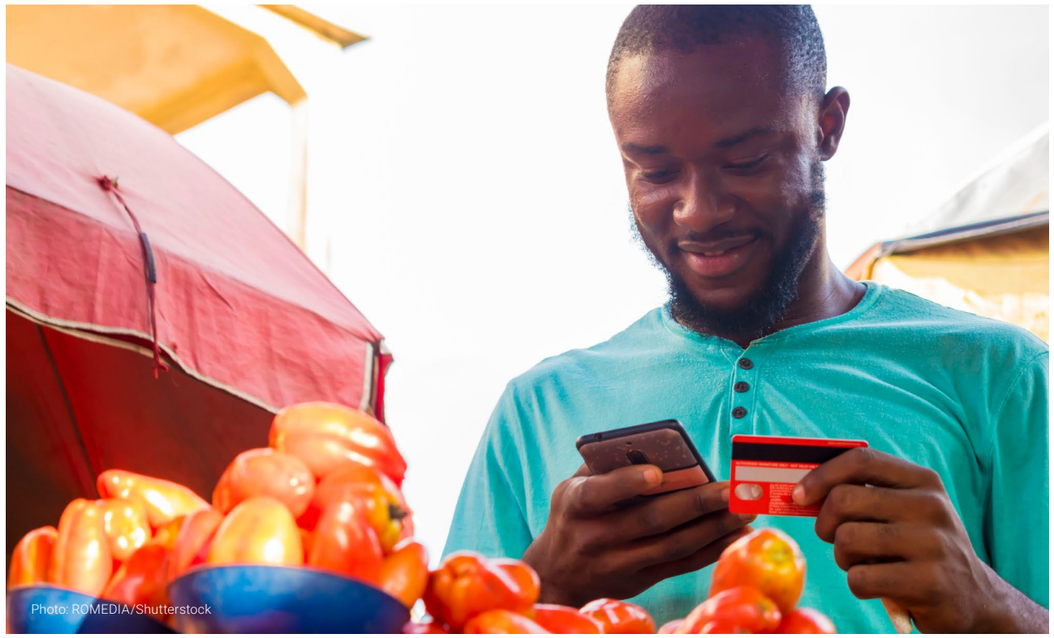


Photo: ROMEDIA/Shutterstock

Finance

Current adaptation finance flows to Africa are insufficient to meet growing adaptation needs on the continent. The Finance chapter provides an overview of existing adaptation finance flows in Africa and identifies opportunities to increase the volume and efficacy of that finance.

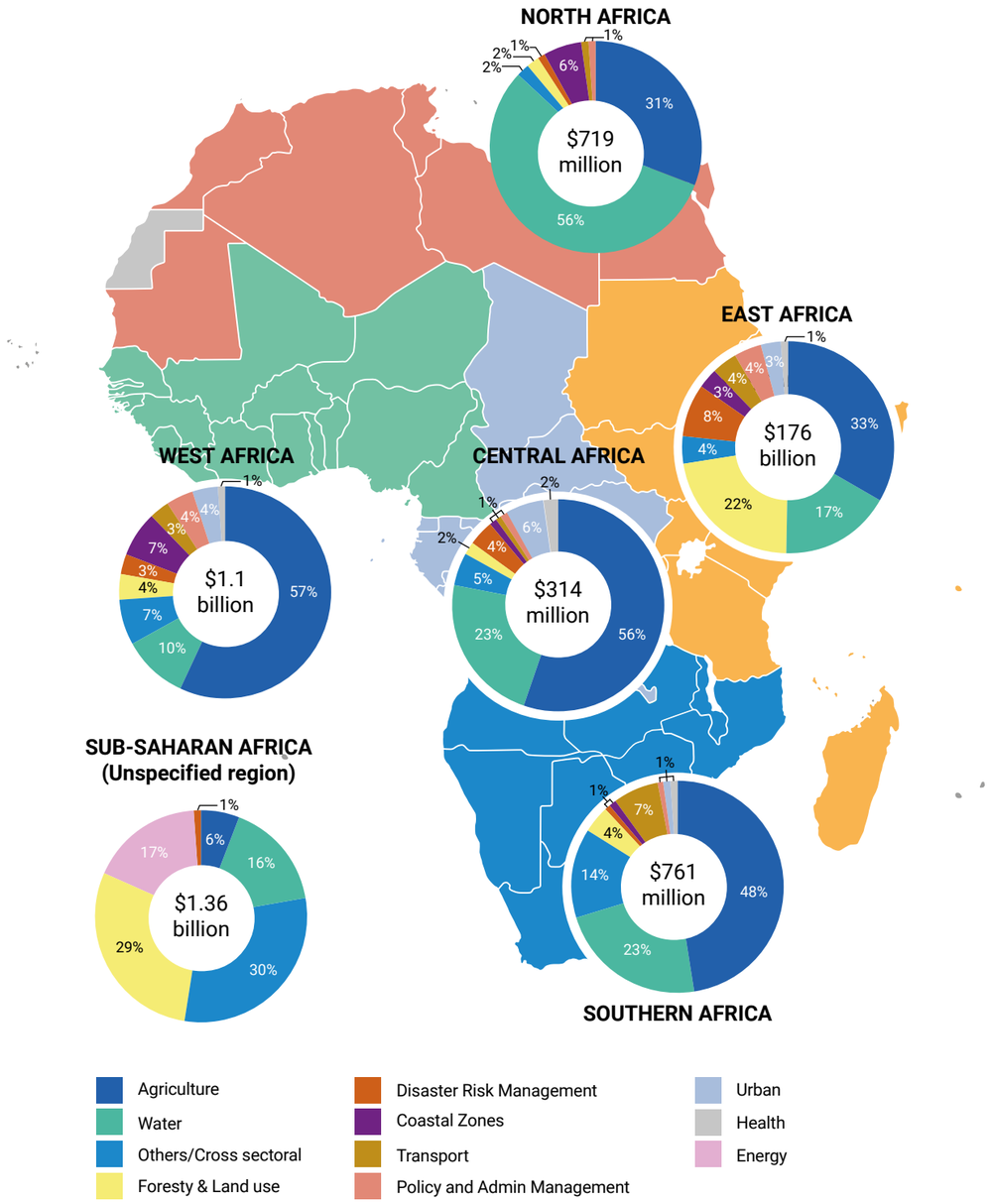
Key Findings

There is a pressing need to increase investment in climate change adaptation in Africa. While only six African countries have submitted National Adaptation Plans (NAPs) to date, all African countries, with the exception of Libya, have submitted Nationally Determined Contributions (NDCs), all of which include an adaptation component, as part of their commitment to the 2015 Paris Agreement. Based on these NDCs, all African regions prioritized at least three of these four sectors: 1) agriculture 2) water 3) health 4) forestry, land-use, and ecosystems. A total of 40 African countries provided estimated investment needs for adaptation, totaling roughly $331 billion through 2030. Fifteen countries provided a breakdown of conditional vs unconditional cost estimates, with an average ratio of 80:20. An average 80:20 ratio indicates that of the $331 billion estimated investment need (or $33 billion annually), countries expect to contribute around $66 billion (or $6.6 billion annually) from their national budgets, while the remaining investment gap of $265 billion (or $26.5 billion annually) must be met by international donors and domestic and international financiers.

Globally, an annual average of $30 billion in adaptation finance was tracked for 2017 and 2018, mostly provided by public actors (DFIs alone accounted for 67 percent of the total). Due to data limitations, nearly all flows tracked are from international public finance. Just over $6 billion was tracked in adaptation finance to Africa in that period. If this trend continued through 2030, total finance from 2020–2030 would only amount to $66 billion, far short of the $331 billion (or approximately $30 billion annually) in estimated needs per stated cost estimates in NDCs. Adaptation finance is therefore scaling up too slowly to narrow the gap, even as the costs of climate impacts rise. Of the $6 billion in adaptation finance tracked, grants and concessional debt accounted for approximately 90 percent of financial flows to adaptation in Africa.

Two sectors—agriculture, forestry, land-use, and natural resource management; and water and wastewater management—combined have received 62 percent of total adaptation finance in 2017–18. These results are consistent across African sub-regions (Figure 3). The majority of finance flowed from Development Finance Institutions (DFIs) both from the region and external to Africa: multilateral, national, and bilateral DFIs contributed and managed 67 percent of total adaptation finance flows to the region, followed by bilateral government flows at 19 percent. The most vulnerable countries in Africa have not been recipients of proportionally high volumes of adaptation finance.

Figure 3. Tracked adaptation finance by region and sector (USD, 2017–18 average)



Policy Recommendations

There is a pressing need to accelerate finance for climate adaptation in Africa over the coming decade. Adaptation investment needs to be mobilized from a wider variety of finance sources. Based on announced commitments, future adaptation finance for Africa is expected to more than double by 2025. However, even if many of the main DFI actors adopted best-practice commitments (similar to the World Bank's commitment to dedicate 35 percent to climate finance, of which 50 percent will go to adaptation) and if currently announced private sector mobilization efforts are successful (assuming at least 20 percent of MDBs' $40 billion private sector mobilization target goes to adaptation in Africa), annual adaptation finance flows may still not meet minimum estimated investment needs by 2025.

There are many potential sources of adaptation finance for Africa, offering finance on a range of terms from highly commercial to highly concessional. Governments and stakeholders must mobilize different blends of these finances to ensure that adaptation efforts can be sustained on a consistent path, even as there is a greater effort made to generate high-quality, low-cost climate data and to translate climate science into policy. Figure 4 summarizes the financial actors which have a role to play in mobilizing finance for adaptation at scale in Africa. These actors offer financing along a spectrum of terms, ranging from highly concessional terms (lower return expectations and/or longer tenors) to commercial terms (market returns and tenors expected). Concessional capital is intended to fill a gap where the private sector (commercial capital) would not otherwise invest.


Photo: I_am_zews/Shutterstock

Yet there are numerous barriers to investment in adaptation that must be addressed. As discussed in the chapter, there are cross-sectoral barriers as well as sector-specific barriers hindering investment in adaptation activities, such as inadequate risk-adjusted returns, limited capacity to collect and analyze relevant climate data, policy and regulatory barriers in the agriculture sector, the need for regional coordination in the energy sector, lack of subnational fiscal autonomy for cities, and challenging economics for coastal ecosystems, among many others.

To mobilize these investors, a three-pronged strategy is needed.

1. Mainstream resilience into investment decision-making, through the following steps: (i) increase access to robust climate data; (ii) incubate technical expertise in financial structuring; (iii) engage pension funds through appropriate financial instruments; (iv) build capacity of African financial institutions and government entities to evaluate and act on climate risks; (v) require disclosure of climate risks—via national legislation and/or via DFI on-lending; and (vi) support small and medium-size enterprises (SMEs) that are offering adaptation-relevant products and services.
2. Build the enabling environment for adaptation investment, including the following: (i) articulate investment-ready NAPs and mainstream climate resilience in government procurement; (ii) build capacity to develop science-based policy and projects; and (iii) improve macroeconomic environments and adopt a multifaceted approach to address debt burdens faced by African countries.
3. Deploy innovative finance instruments, not only including grants and project finance, but also financing facilities, results-based finance, debt-for-climate swaps, liquidity instruments, and insurance.

Action taken now across the full range of potential adaptation finance sources will be critical to determining the course of Africa's capacity to respond to present and upcoming climate impacts and to building a more climate-resilient and livable future.

Figure 4: Potential Sources of Adaptation Finance in Africa

Offer Finance on Commercial Terms

- **Commercial Banks:** Commercial banks can raise their own funds through bank deposits and are governed by international standards set by Basel II and III regulations for capital adequacy. Commercial banks have networks that can be leveraged including relationships with farmers, co-operatives, and MSMEs and can build technical capacity to structure financial instruments in partnership with development banks and other concessional finance providers.
  - **Pan African Banks:** PABs can invest in MSMEs and mainstream resilience into their lending portfolios. PABs have been successful in increasing firms' access to finance and increasing competition and efficiency in the banking industry and can have a positive impact on micro-prudential stability with the least cyclical behavior in times of crisis.
- **Private Equity and Venture Capital:** Africa's PE industry was cultivated by DFIs that had a mandate to invest in private sector businesses in Africa to promote social and economic development. Gradually the industry expanded and by 2020, there are more than 150 active fund managers of different sizes spread across geographies and sectors in Africa. The nature of their investments is suitable for scaling up adaptation finance and has potential for investment in new and innovative adaptation technology and services.
- **African Institutional Investors:** African institutional investors have USD 1.8 trillion assets-under-management in 2020. Institutional investors' core goals are capital gains and stabilization of returns over the long term. They have very high ability to mobilize funds through pensions in the right regulatory environment and their prudential responsibilities require them to invest in assets with high credit ratings and assets that are listed.
  - **Sovereign Wealth Funds** invest in domestic markets and have potential to finance adaptation focused securities and government bonds.
  - **Pension Funds** are instrumental in mobilizing long-term saving and can support long-term adaptation investments.
- **Insurance:** Insurance penetration is concentrated in a few major markets like South Africa, Egypt, Morocco, Nigeria, and Kenya. Insurers have advanced technical capacity to evaluate climate risks and capacity for innovation in climate risk transfer mechanisms. Insurance companies must undertake qualitative and quantitative assessments of impact of physical and transition risks on their investment portfolio.
- **Large Corporations:** Sustainability and resilience in food production and supply chain are increasingly a focus for large multinational corporations especially those with global supply chains. Corporations have potential to deploy finance and technology at scale to undertake adaptation measures though will be largely focused on their own supply chains.
- **Multilateral & Bilateral DFIs:** DFIs play a critical role in mainstreaming adaptation in development finance by assessing climate risks and vulnerability, assisting country governments to build capacity for mainstreaming adaptation, and mobilizing private capital. DFIs can bridge knowledge gaps through tools such as feasibility studies, business risk assessments, technical assistance, and market studies.
- **Sub-Regional Development Banks:** SRDBs have a mandate to contribute to regional integration and regional infrastructure development projects. Four African SRDBs: Eastern and Southern African Trade Development Bank, East African Development Bank, West African Development Bank, and Ecowas Bank for Investment and Development are operational in Africa in three separate regional economic communities. 40 African countries are shareholders of the SRDBs and in 2013, the total assets of African SRDBs were USD 6.2 billion.
- **National Development Banks:** NDBs are state-owned or government-sponsored financial institutions with a primary mandate of providing long-term and concessional capital to high-risk sectors and industry which are underserved by private commercial banks and contribute to the country's development agenda. NDBs are important intermediaries for international climate finance and more than 10 currently have direct access to GCF funding.
- **Multilateral Climate Funds:** Multilateral Climate Funds established through international agreements or for a specific mandate provide financing for adaptation in Africa either through grants or market-linked instruments. They are catalytic in facilitating and accelerating financing in perceived high-risk adaptation projects by providing instruments like first-loss or junior equity, repayment guarantees, and grants to mobilize private investments.
- **National Climate Funds:** National, country-driven, dedicated, catalytic financial institutions designed to address domestic market gaps, take ownership of climate finance and crowd-in private investments in low carbon and resilient projects. NCFs have potential to provide integrated access to grants and finance to meet NDCs and have strong potential to mobilize private sector investments.
- **State-owned Enterprises & Financial Institutions (SOEs):** SOEs are public entities that are partly or wholly owned by government to deliver services in a particular sector or sectors. SOEs have not financed many climate adaptation activities to date but have substantial opportunity to lead in climate resilience given size of market share and public governance model.
- **African Governments:** African governments are already spending a considerable share of their budget on adaptation. For 42 African countries where data was available, the total weighted adaptation expenditure was around 0.18 percent of GDP, and the unweighted expenditure was around 3.4 percent of GDP, both higher than the share of adaptation finance received from international donors. African governments are instrumental in deploying capital to noncommercial adaptation activities and current levels of expenditure meet around 20 percent of the total adaptation need.
- **Official Development Assistance (ODA):** ODA is a critical component of adaptation finance in Africa to de-risk adaptation activities and support more commercial finance. Bilateral agencies have a relatively high risk appetite and strong climate mandates.
- **Philanthropies, Foundations, and Non-profits:** Like ODA, funding from these organizations can de-risk adaptation activities, draw in private finance, and support technical capacity building. Philanthropic funding is more nimble and flexible than ODA and can serve as catalytic capital for private sector investment.

Offer Finance on Highly Concessional Terms

The private sector

The private sector generates two-thirds of the investments, 75 percent of the economic output, and 90 percent of the employment in Africa, through a diverse range of companies that include large multinationals on the one hand, and many micro, small, and medium-sized enterprises (MSMEs) on the other. The Private Sector chapter seeks to provide further insights on the role of the private sector in adaptation in Africa. It is based on a GCA analysis of the CDP's Corporate Climate Change Disclosure Questionnaire 2020; a survey of MSMEs in Africa by the GCA; and interviews with multinational companies, conducted jointly with the World Business Council for Sustainable Development.

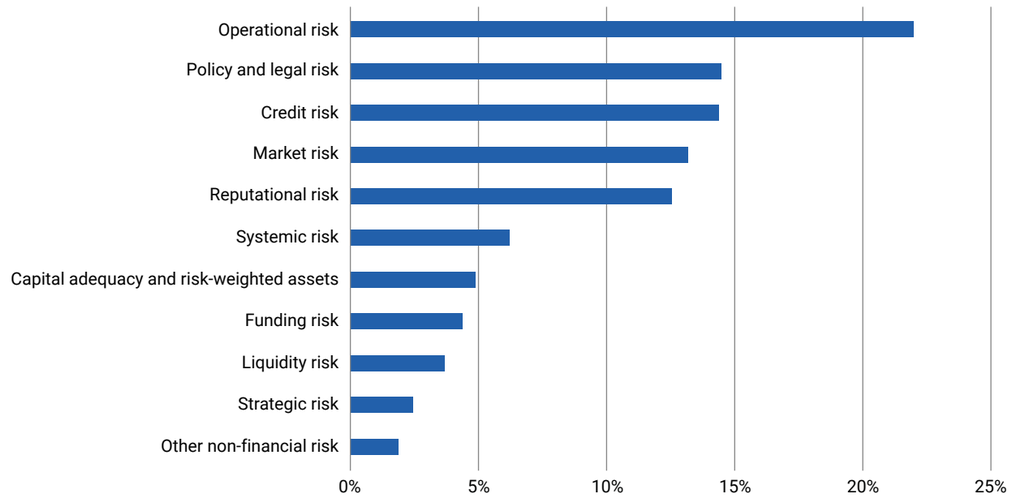
The Private Sector chapter discusses key drivers, barriers, and motivations to enable adaptation by the private sector in Africa—including the role of policies and institutions; data and information; collaboration and capacity building; infrastructure and supply chains; and access to financial and economic instruments.

Key Findings

Our analysis of responses submitted to CDP by 515 companies working in Africa in services, manufacturing, agriculture, infrastructure, and hospitality, among others, shows that the climate risk assessments undertaken by companies consider risks that relate to current regulations, emerging regulations, reputation, markets, physical infrastructure, and technology. The climate-related risks that are identified most often are categorized under operational risks, policy and legal risks, credit risks, market risks, and reputational risks (Figure 5).

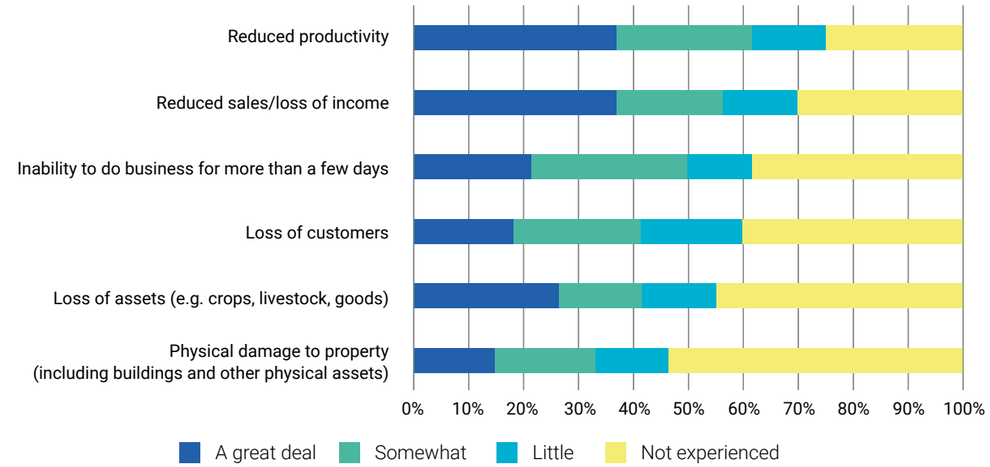
The companies surveyed identify droughts and flooding as the most urgent climate risks, followed by extreme weather events. Water scarcity is also of particular concern. For instance, South Africa has the largest number of businesses reporting detrimental water-related impacts globally, while businesses in Zambia, Malawi, Benin, Mozambique, and Kenya are also frequently affected. Stricter regulations and statutory water withdrawal limits are also cited as water-related impacts by companies in some countries.

Figure 5: Most frequently identified climate-related risks by businesses in Africa



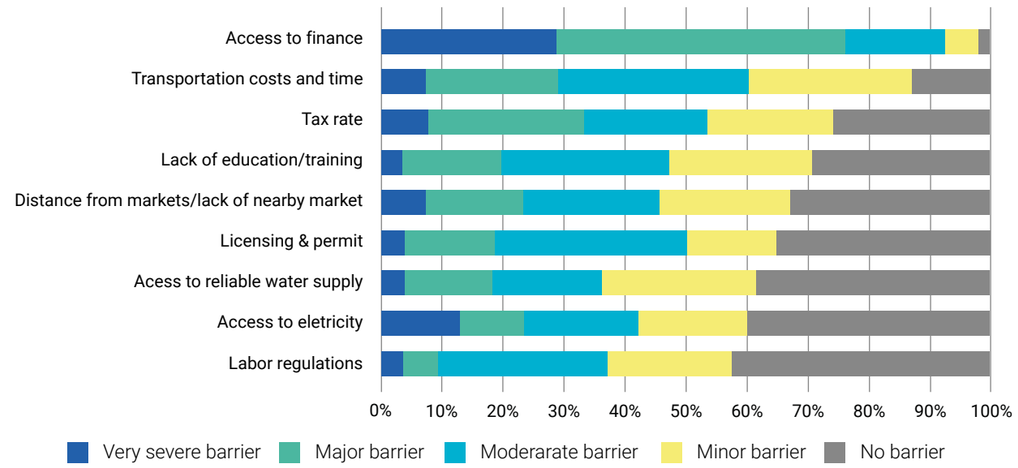
Source: Based on *CDP's Corporate Climate Change Disclosure Questionnaire 2020*

Figure 6: Direct impacts of extreme weather events on MSMEs in Africa



Source: authors

Figure 7: Climate adaptation barriers for MSMEs in Africa



Source: authors

Our analysis indicates that the private sector in Africa already feels the impact of climate change, including droughts, floods, extreme heat and extreme rainfall, whether directly or indirectly, throughout their supply chains. In the interviews, the representatives of large corporations were more likely to be able to point to future climate risks and indirect impacts on their operations due to the instability of supply chains. By contrast, the MSMEs participating in the survey said they had less access to information on future impacts and were more likely to focus on current or recently experienced direct impacts of extreme climate events, including reduced productivity (75 percent); reduced sales and income (71 percent); loss of customers, for instance, due to displacement, resulting in loss of income (62 percent); and physical damage to property (47 percent) (Figure 6). The climate risks experienced by MSMEs also varied across regions. In West Africa, all surveyed companies were directly affected by climate change impacts, while in East Africa and Southern Africa, 70 percent and 47 percent respectively were directly affected.

Awareness of government policies that could support private sector adaptation is also low among MSMEs. Only 12 percent indicate that they received (mainly technical) support from national governments, while 10 percent indicate that they received support from local governments. MSMEs identified the following policy-related areas that pose barriers to their operations and subsequent adaptation actions: access to finance (93 percent); transportation costs and time (83 percent); high tax rates that impede action or additional investments in adaptation and resilience (69 percent); restrictive business operations licensing (60 percent); and lack of education or training (67 percent) (Figure 7).

Policy Recommendations

Adaptation is not a choice, but a requirement for the private sector to face worsening climate realities across Africa. Yet the African private sector remains underrepresented in discussions and in action due to a combination of factors, including lack of awareness, inadequate tracking mechanisms, and limited resources. Greater efforts to enhance awareness, mobilize private sector actors, and to provide visibility for their activities, along with accessible financial instruments, are therefore necessary. Frontrunners among Africa-based businesses capitalize on resilience and adaptation action, which not only helps them to manage climate risks but also positively impacts their productivity and profitability. A strong and supportive regulatory and policy environment can positively impact the scaling up of private sector climate adaptation efforts. Well-designed adaptation technology transfer programs for African SMEs must be part of the solution.

Large companies have the capacity to generate information on climate impacts on their operations through risk assessments, while MSMEs lack the same capacity and therefore the information. Sharing data and information with MSMEs, which are often an essential part of the value and supply chains of larger companies, will benefit larger companies in the long term.

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Traditional project funding does not always work for private sector adaptation and resilience-building efforts, because investments can sometimes lead to a short-term loss of income or require investments in new skills or technologies. Appropriate support and financing mechanisms are necessary to help MSMEs switch to climate-resilient practices. Highlighting potential business opportunities, for instance in the form of new products and services that become necessary, can also enhance private sector engagement in adaptation and resilience-building efforts.

Youth

Africa's young population—often referred to as "the youth bulge"—has been a concern of African policymakers and stakeholders for some time and is characterized as both a crisis and an opportunity. Much of the discussion on youth-specific issues in Africa has focused on creating better employment opportunities, both for instrumental reasons—because this is necessary for economic transformation, poverty reduction, and possibly to realize a demographic dividend—and for intrinsic reasons—to help youth transition to economic independence from their parents, become empowered, and realize their full potential. The youth employment challenge will only worsen as climate change advances.

Key Findings

Overall, most employment opportunities in Africa are found in the informal sector—household farms and firms. This will only change as economies transform, a process which climate change will negatively affect without adaptation investments. Africa is the world's youngest region. 43 percent of the population is under the age of 15. Youth comprise 20 percent of the total population (compared with 16 percent for the world as a whole). Income is one of the key determinants of demographic transitions, so it is not surprising that as a lower-income region, Africa's demographic transition is at an early stage and its population is largely young. However, Africa's transition has been unusually slow owing to persistently high fertility.

Africa's demographic structure brings challenges for youth livelihood development and youth employment and earnings outcomes. The lowest-income countries are characterized by a lack of modern, formal private firms in non-agricultural sectors offering wage jobs. As a result, most people work informally with members of their family or household, on farms or in informal businesses. As the economy develops, it transforms, creating more formal firms that grow, increase productivity, contribute to GDP, and importantly, employ people. These employees usually receive higher wages on average than those working in household farms or businesses, because of opportunities to specialize, use skills more intensively, and work with more capital and technology. This employment transformation—an increase in the share of employment in formal wage work—is caused by an increase in labor demand relative to supply. High fertility creates a fast-growing labor force (a rapidly increasing labor supply), which delays the employment transformation. Africa's labor force is currently increasing at 3 percent per annum, and this pace is projected to slow very gradually.

Our analysis shows that the youth and climate change nexus cuts across a range of development issues not limited to employment. For example, the youth—especially young males—play a big role in urbanization trends, as they are most likely to migrate from rural areas or between urban areas. Climate change could accelerate this trend, even as urban areas suffer as well, trapping the youth in substandard living conditions (slums) and poverty. The youth are a vital part of the informal social safety net in Africa. Although the youth are only starting to develop their livelihood patterns, in the absence of any form of social safety net, many young people have to contribute financially to support younger siblings, and sometimes parents. Negative effects of climate change on their employment and earnings opportunities will have cross-generational implications. Young women in Africa devote many hours to unpaid work supporting families—their own nuclear family and their extended family—as caregivers and in charge of household maintenance.

We have also reviewed the key interactions between the youth demographics of Africa—in particular,


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Sub-Saharan Africa—and the region's economic development progress and prospects (especially the prospects for higher earnings and more secure employment for youth), youth engagement and empowerment, and the way climate change adaptation policies and investments interact with these trends. We find that the effects of climate change, which are already being felt as more extreme weather events, are likely to negatively affect the livelihoods and welfare of rural and urban youth in several ways.

In rural areas, declines in agricultural productivity and soil degradation will not only affect those engaged in agriculture, but they will also be felt all the way down the rural value chain. Meanwhile, the negative effects of climate change in rural areas could increase youth migration to larger urban areas, increasing the share of the urban population in slums. Urban youth will also be negatively affected, but the trajectory could be slower. For those youth who live in slums, the rainfall increases projected for the middle of Africa would soon negatively affect their living and working conditions, as both activities often use the same location. Youth in urban slums in drier areas will have to devote more time and money to procuring water, a burden which falls mostly on women. If adaptation measures are taken now, the projected negative effects on youth in 20–30 years could be reduced. This would benefit African youth during their peak earning years and beyond. However, changing the trajectory of public and private investment toward adaptation, while necessary, may have costs in the next 10–20 years, which will be felt by youth as well.

In sum, absorbing these youth into productive, remunerative employment opportunities has been and will continue to be a challenge for African countries.

Policy Recommendations

Multiple countries in Africa achieved broad-based growth and successfully improved employment opportunities through a combination of (i) supply-side policies (expansion of education), (ii) demand-side policies to encourage the entry and growth of firms and (iii) investments supporting productivity increases, especially in agriculture and digital services. Nonetheless, most youth and their parents continue to work in the informal sector. COVID-19 has interrupted this transformation process, frustrating the youth's ambitions. For the benefit of their youth as well as their older adult population, countries need to restart this process.

Africa's youth, including those not yet born, will bear the costs of climate change in the coming decades. Opportunities for Africa's youth depend on complex demographic and economic transitions, which now also face headwinds from climate change. Climate change could reverse progress made on improving employment opportunities for the youth and could also increase rural-urban inequality. The implications of climate change for other development processes like migration, gender roles and expectations, and education are all considerable.

African countries can avoid some of the worst effects of climate change by taking up adaptation measures now. But these will be costly investments, both in terms of funds spent, and in opportunity costs—the activities and investments which were not undertaken because funds and time were absorbed by adaptive investments. Yet not adapting is not an option.

Finally, although they are the most educated generation ever in Africa, there is not yet a significant level of engagement by the youth with the climate crisis, partly because of the pressing nature of their immediate needs and aspirations for education and employment. The youth in Africa are also often excluded from community political activities and national leadership roles—the youngest continent has the oldest political leadership. Given the importance to their future, youth should be consulted and actively and effectively engaged in both early-stage investment decisions and in monitoring outcomes at the local and national levels. A prerequisite appears to be a better understanding among youth of what is at stake for them, and what are the parameters for adaptive change to reduce the risks to their welfare ahead.


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Jobs

Job creation and retention in Africa is central to building community resilience in the face of climate change. While Africa's labor force participation rate of 63 percent is higher than the global average of 61 percent, it is dominated by own-account workers. Furthermore, Africa also has the world's highest proportion of workers in informal employment, at around 86 percent. This combination of high levels of own-account work and informality has resulted in almost 250 million workers in Africa currently living in extreme or moderate poverty.

The Jobs chapter presents the risks and challenges that climate change poses for jobs, the job creation opportunities that climate adaptation and resilience-building activities provide, and the policy responses needed to reduce the climate risks for jobs and enhance the creation of jobs for adaptation and resilience.

Key Findings

Between 2000 and 2015, 23 million working-life years were lost annually at the global level because of environment-related disasters caused or exacerbated by human activity. This is equivalent to 0.8 percent of a year's work globally. Africa suffered some of the greatest losses of working-life years, with an annual average of 376 working-life years per 100,000 people of working age lost between 2008 and 2015. At the same time, globally, some 1.2 billion jobs—particularly those dependent on farming, fishing, and forestry—currently rely directly on the effective management and sustainability of a healthy environment. In Africa, these sectors represent 58 percent of total employment.

Without adaptation measures, the combined effects of climate change and poor natural resource management will threaten these jobs, which could lead to devastating social and economic impacts. In addition to threatening the natural resource base, climate change exacerbates the stresses on jobs in several other ways. Negative impacts on employment

include job losses through impacts on business assets and business interruptions, disruptions in transportation of market and essential goods, impacts on working conditions and occupational safety and health affecting labor productivity, forced migration, and reduced demand due to economic shocks and instability. Business assets and transport and industrial infrastructure, as well as the workforce, are increasingly concentrated in cities in Africa. All of these are at risk when disaster events hit urban areas.

Agriculture accounts for a high percentage of employment and a key source of livelihoods in many African countries and is particularly vulnerable to water scarcity. In 2019, more than 232 million workers in the region were employed in agriculture, accounting for over 50 percent of the continent's total employment. Many of Africa's farmers depend on rainfed agriculture, which will be particularly at risk. In addition, increases in labor migration are likely because of climate change and other factors.

Social protection represents a central lever of adaptation to climate change, but it is also necessary to acknowledge its current limits. Despite recent progress in Africa, 83 percent of the population is currently excluded from any form of social protection, which corresponds to a financing gap to achieve universal coverage estimated by the ILO (including the impact of COVID-19) of $136.9 billion for 2020. Collaborative approaches at the national, regional and international level to increase fiscal space for both social protection and climate policies are therefore necessary to fill this gap.

Policy Recommendations

While climate change is already having negative impacts on jobs in Africa, adaptation responses can reduce these impacts by protecting existing jobs, minimizing job losses, and providing opportunities for new economic activity, investments, and decent work. For this to occur, adaptation policies must be coordinated and coherent, human-centered and address key risks to workers, enterprises, and vulnerable sectors. They must also support a just transition to a resilient and greener development path and be equitable and socially inclusive, taking the concerns of women, youth, indigenous people, and other minorities into account.

These policy interventions will be critical, as Africa's rapidly growing population means that it is projected to have more than a third of the global workforce by 2040. The substantial share of its population in informal employment and without adequate social protection means that it already has a substantial deficit of decent work and of resilience to the potential effects of climate change on employment, particularly in the agriculture sector.

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Green jobs—defined by the ILO as employment in the environmental sector that meets the requirements of decent work—and, in particular, jobs for adaptation and resilience, a sub-category of green jobs, need to be prioritized by African policymakers. There is also an urgent need for increasing adaptation finance to support and scale up interventions that increase resilience and generate income and employment. A stimulus in climate-resilient infrastructure is already necessary if Africa is to meet the Sustainable Development Goals, and will have to be a critical element of Africa's adaptation strategy. This will not only help protect and secure existing jobs but will also present an immense opportunity for direct and indirect job creation. Working more closely with nature though nature-based solutions and improved natural resources management also provides a key opportunity for Africa in this context. Its massive endowment of nature can be harnessed as both an engine for jobs and a pathway for cost effective adaptation, allowing Africa to embark on a more sustainable development pathway.

To build adaptation and resilience, skills are required to transition to green resilient jobs, nature-based solutions, and hybrid 'green-gray' approaches. Skills development should build on the capabilities of local institutions to ensure they anticipate climate risks and uncertainties, generate resilient solutions, and manage adaptation initiatives over the long term without being dependent on project-based donor funding.

Effective adaptation will also require the redesign and expansion of social protection systems in Africa to protect workers against the increased and new climate-related risks they will face. Finally, social dialogue and community participation in the design and implementation of adaptation policies and measures will be important to ensure more inclusive adaptation measures that support local development and employment creation.

SECTION 2 – FOCUS SECTORS

Agriculture and food systems

Food and nutrition security in Africa is off track. In 2020, more than one in five people in Africa faced hunger—more than double the proportion of hungry people in any other region. About 282 million of Africa's population are undernourished. While Africa's agricultural exports are rising, the continent remains a net food importer at an annual cost of $43 billion, and could top $110 billion by 2025 as demand for food is rising at more than 3 percent per year. The African Union's most recent Biennial Review shows that only 4 of 49 member states are on track to achieve the goals and targets of the Malabo Declaration on Accelerated Agricultural Growth by 2025. This means that Africa is also lagging on progress to achieve Sustainable Development Goal 2, which calls for ending hunger in all forms by 2030.

The Agriculture and Food Systems chapter reviews the current and projected impacts of climate change on the sector. It discusses the most important adaptation solutions, including in the areas of research and extension services, climate information and risk management services, climate-resilient infrastructure, sustainable water management, restoration of degraded landscapes, and sustainable land management. The chapter presents new analyses of incremental costs for adaptation of the agriculture and food systems in Africa, as also the cost of inaction. It reviews new approaches to more effectively channel larger financial resources to the sector.

Key Findings

Food security in Africa needs urgent and serious attention from policymakers. Climate change is already stalling progress towards food security in Africa, interacting with multiple other stresses and shocks, including inequality, conflict, and the COVID-19 pandemic. A 3°C warming trajectory will cause catastrophic disruption to African food systems within the next 30 years. A 1.5°C trajectory provides more options for adaptation of African food systems, but still demands urgent action. Agriculture and food are the leading sector for synergies across development and climate action, delivering

simultaneously on Sustainable Development Goals, national growth and food security goals, and climate adaptation and mitigation.

Massive changes in agricultural suitability can be expected across the continent, with farming systems, food production, and import dependency changing beyond recognition. For example, under a 3°C (RCP8.5) scenario, Africa is expected to lose 30 percent of current growing areas for maize and banana and 60 percent for beans by 2050. Other crops will see smaller but significant effects, with up to 15 percent loss of production area for cassava, yams, millets and sorghum.

Large areas will need to shift out of crop production altogether. Over the 2050 to 2100 timeframe, Africa's typical mixed cropping-livestock systems will need to change to pure livestock systems across 3 percent of Africa's land area, directly supporting around 35 million people in agricultural livelihoods. At the same time, these pastoral systems will be under increasing threat in terms of forage quality, fire frequency, and water availability. Significant drops in the catches of African marine fisheries are also expected, putting further pressure on people's access to highly nutritious animal foods.

Leading adaptation options for food systems are well-defined and build on evidence and experience, including in Africa. They include public policy and incentive solutions, food value chain and livelihood solutions, and on-farm and productive landscapes solutions. Among these options, the priorities for public sector investment in Africa are fivefold: research and extension, water management, infrastructure, land restoration, and climate information services. Some of the adaptation practices have long-term African experience to build on (e.g., livestock management, agroforestry), while others are newer areas of endeavor on the continent or globally (e.g., fiscal measures, co-benefits of mitigation finance). Some are lower-hanging fruit (e.g., low-cost early warning systems) while others need more complex multi-sector reforms (e.g., affordable healthy diets).

These groups of solutions are not 'better' than others, not will they solve all adaptation problems in food systems on their own. They are highlighted because they are areas in which the case for public sector investment is high for the following reasons: strong public good benefits; the need for interventions at a large scale, such as the national level or whole landscapes or whole catchments (often cross-boundary or transnational); opportunities for progressive distributional outcomes, improving equality of access for women and poor people; initially high capital outlays that may be prohibitive for all but the largest private operators; and the associated need for policy incentives that provide signals to land and water managers and to food system participants.


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A modern approach to climate adaptation moves beyond purely agricultural solutions into whole food system approaches. For example, problems with agricultural production can be addressed not through on-farm solutions alone but also through trade, social safety nets, and policy incentives for consumers and food businesses.

Given the pace and unpredictability of climate change, another principle is that building of ongoing adaptative capacity is more important than one-off investments; hence the importance attached to enhancing systems for rapid learning, foresight and lesson-sharing, through digital-based R&D and extension systems. This capacity will be critical as farmers, governments and businesses increasingly need to build proactive preparedness for the larger transitions required should the 3°C warming scenario become a reality—such as a country or region needing to move out of production of a major staple crop.

Appropriate investments in the agriculture sector can help the food systems adapt by increasing productivity, resilience, and resource-use efficiency. All indications are that financing adaptation to climate change will be more cost-effective than financing increasingly frequent and severe crisis response, disaster relief, and recovery pathways. The adaptation costs for Sub-Saharan Africa include annual public investments that already address resilience needs: that is, the reference scenario ($5.9 billion) and annual incremental investment costs ($9.6 billion) to offset climate change effects on hunger between 2015–2050 (Table 2).

The agricultural financing gap in many African countries surpasses government budgets and available donor funding. The financing gap for climate adaptation is at risk of widening in the future due to fiscal drain on resources from the coronavirus pandemic.

For more than a decade, Multilateral Development Banks have been tracking climate finance flows in their operations across sectors through an agreed joint methodology for adaptation and mitigation. Climate finance flows to the agriculture sector in Sub-Saharan Africa increased from $433 million in 2015 to $2 billion in 2018 and then declined to just over $1 billion in 2020. Adaptation flows are consistently higher than mitigation flows, ranging from 58 percent in 2019 to 69 percent in 2017. These levels are clearly insufficient.

Key opportunities to close the gap lie in developing the business case for climate finance and for blended private finance, based on the growing information base on costs of action and of inaction. Closing the finance gap will require a range of public policy actions including increasing the space for private sector activity, improving the policy and regulatory

Table 2: Annual reference scenario and incremental investment costs for agricultural adaptation for sub-Saharan Africa by 2050 ($ billion)

Scenarios	Research and extension		Water management		Infrastructure and market access	Sustainable land management	Climate information services	Total
	International agricultural research	National agricultural research	Efficient irrigation and increased water use efficiency	Improved soil water holding capacity				
Reference scenario ($billion)	1.11	1.11	3.11	0.39	0.18	-	-	5.9
Incremental costs ($billion)	1.66	-	1.42	1.20	1.90	3.35	0.053	9.58
Total	2.77	1.11	4.53	1.59	2.08	3.35	0.053	15.48

Sources: Sulser et al. (2021); World Bank (2021), and others' calculations
Financing adaptation to climate change will be more cost-effective than frequent disaster relief. For sub-Saharan Africa, our estimates based on a synthesis of existing studies (Table 3) indicate that the annual agricultural adaptation cost is $15 billion (0.93% percent of regional GDP), but the cost of inaction could be more than $201 billion (12% of GDP).

Table 3: Annual agricultural adaptation costs and costs of inaction ($ billion)

	Research and extension	Water management	Infrastructure and market access	Sustainable land management	Climate information services	Total
Cost of action ($ billion)	3.88	6.12	2.08	3.35	0.053	15.48
Cost of inaction ($ billion)	71.21	90.67	12.56	26.76	0.488	201.69
Cost of action as proportion of cost of inaction (%)	5.44	6.75	16.56	12.51	10.86	7.67

Sources: Authors

environment, and using public financing to help crowd-in private-sector investments to optimize the use of scarce public resources. In addition, it will be important to design new financing mechanisms and overcome longstanding technical and institutional barriers, such as the limited capacity to manage production, marketing and price risks, and the high transaction costs of lending to farmers.

The adaptation investments by small-scale producers will be a vital component of building the resilience of African farmers. Therefore, increasing and targeting flows of capital to these farmers, livestock keepers, fishers and small businesses is critical.

Policy Recommendations

Climate change adaptation in food systems can be enabled and driven through various policy instruments, not only in the environment and agriculture sectors but also in economic development, finance, health, infrastructure, gender equality, digital, trade and social safety net policies. The food system offers opportunities for win-win-win outcomes for food security, adaptation, and mitigation.

- **Ramp up support to research and extension services.** As climate change accelerates, real-time data collection, analysis and learning become increasingly important to manage emerging unpredicted climate risks. This is important on the 1.5°C trajectory where research and extension are critical to dealing with climate shocks, and even more important on the 3°C trajectory, under which climatic conditions will soon move beyond anything experienced by farmers since the introduction of agriculture.
- **Public spending programs would need to focus on innovation systems because a robust supply line of technologies is not enough.** It is critical that the knowledge on these technologies and innovations reaches farmers, especially small-scale producers, and that they adopt it.
- **Strengthen inclusive climate information and risk management services.** The provision of tailored information related to current and forecasted weather, on a timeframe ranging from daily to seasonal to multi-year, is vital to cost-effective planning by farmers, food businesses and governments. Key climate information services include seasonal weather forecasts for farmers, and early warning systems that can help anticipate and manage natural disasters, pest outbreaks and yield failures.
- **Implement insurance schemes against shocks and wider social safety nets to counter climate risks.** Designing climate-responsive social protection strategies can strongly support proactive measures to avoid, minimize and address the complex, long-term impacts of climate change on human health, livelihoods, poverty and inequality. For smaller climate events, revenue diversification and remittances are helpful; market insurance is best for more intense events. Financial inclusion is helpful against medium climate events.
- **Repurpose subsidies and eliminate policy distortions that increase climate vulnerabilities.** No country in sub-Saharan Africa is currently on track to meet its commitment of allocating at least 10 percent of total budget funding for agriculture in 2019. Yet, in many sub-Saharan African countries, a significant share of public spending goes to poorly targeted and distortionary market price supports and subsidies. This calls for adopting smarter public spending programs.
- **Deploy mitigation policy and finance in ways that support adaptation.** Agriculture is the largest source of GHG emissions in Africa, accounting for about 58 percent of emissions in the continent. Several adaptation and mitigation measures can help address climate change, but no single measure is sufficient by itself. Mitigation finance is an adaptation tool that will allow African regions to mitigate the adverse effects and reduce the impacts of climate change.
- **Reduce trade barriers, especially in times of crisis.** As discussed in the Trade chapter, international trade is an important adaptation mechanism to deal with the geographic variation in climate-related harvest failures. Climate change affects parts of the world differently, shifting crop suitability and regional comparative advantages and altering trade patterns.
- **Provide and maintain adaptative climate-resilient infrastructure.** In the food supply chain, practical logistics and infrastructure for food storage, such as the correct use of metal drums and hermetic bags, can drastically reduce grain losses. Other


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options include drying equipment (e.g. for grains, fish or vegetables) and enabling cold storage for fresh produce (where the highest losses typically occur).

- **Reduce and manage food loss and waste.** About 36% of the food produced in sub-Saharan Africa is lost or wasted, and the largest proportion of the losses occur at the production and handling stages. Helpful interventions to manage food loss and waste include biological controls, storage infrastructure management and information systems, and diversification of value addition and byproduct use.
- **Create demand for affordable healthy diets.** In general, solutions have framed adaptation and resilience for African food security in the light of supply and neglected the demand-pull aspect of the food system. For both nutrition and sustainability reasons, Africa needs to accelerate its transition towards diets that meet people's health and cultural needs, and are widely accessible and affordable.
- **Climate-smart agriculture (CSA) interventions increase productivity,** adjust farming systems to perceived or projected climate change impacts, and reduce or remove (where possible) GHG emissions.
- **Improve sustainable water management at both farm and catchment levels.** Agriculture accounts for the highest percentage of total water withdrawal in Africa, at up to 81 percent. Water management is a key priority for adapting to climate change and achieving sustainable food systems and zero hunger.
- **Nature-based solutions are fundamental to climate adaptation strategies in the agriculture sector, for purposes of water management as well as additional benefits such as biodiversity.** Mangroves protect shorelines from storms, lakes store large water supplies, and floodplains absorb excess water runoff. If combined, nature-based solutions and engineered options can maximize ecosystem services such as clean water supply, soil and slope stability, water storage, soil fertility, and nutrient recycling.
- **Restore degraded landscapes and practice sustainable land management.** Land management options for climate adaptation include increasing soil organic matter, no-till farming, perennial crops, erosion control, dietary change, forest protection, sustainable forest management, controlled grazing, rangeland management, clean cooking, fuel and fire management, peatland restoration. Other measures include regulating the management and conversion of peat soils, coastal restoration, mangrove conservation, long-term land use planning, vegetation management, afforestation and grazing-land management.
- **Scale up context-specific climate-smart soil management.** Sustainable land management (afforestation, reforestation, agroforestry, and rangeland management) can help reduce the negative impacts of multiple stressors, including climate change, on ecosystems and societies.
- **Improve livestock management.** Livestock systems are impacted by climate change, both through direct impacts related to heat and through

an array of indirect impacts on forage quantity and quality, water availability, and disease spread. Climate adaptation of the livestock systems need technical, behavioral and policy actions.

- **Monitor and manage new trends in pests and diseases.** The range, intensity and frequency of pest and disease outbreaks are all likely to shift under climate change. Key adaptation options include climate and pest monitoring to predict and respond rapidly to emerging and existing pests, and pest prevention measures to discourage the establishment and development of pest populations.
- **Promote diversification of crops and livestock.** On-farm diversification is a promising strategy for farmers to adapt to climate change. Diversification can enhance biodiversity, pollination, pest control, nutrient cycling, soil fertility, and water regulation without compromising crop yields.
- **Use climate-ready species, cultivars, and breeds.** Recent breeding work has enabled several crops and animals to become better adapted to African climate risks, such as Drought-Tolerant Maize for Africa (DTMA) varieties, heat-tolerant beans, and fat and thin-tailed ovines.
- **Incorporate perennial crops, including agroforestry.** Trees outside forests substantively contribute to livelihood improvement while also enhancing biomass and carbon stocks. Agroforestry's resource management is proven to enhance livelihood benefits in provisioning, regulating, and supporting ecosystem services. The objectives of the UN Decade on Ecosystem Restoration are particularly relevant in this area.

Trade

Trade can play two crucial roles in supporting Africa's efforts to adapt to a changing climate. Trade cushions the volatility of food markets by providing a vital flow of supplies to regions that may see a sudden reduction in domestic production of food crops due to a climate shock. Over time, trade enables producers and consumers to adapt to changes in comparative advantage, thereby helping the transformation of Africa's agricultural sector and the diversification of its broader economy. More broadly, international trade can also help create jobs and raise incomes, which strengthen households' resilience, not least by enhancing their ability to purchase food. The Trade chapter analyzes the climate change and trade nexus and how trade can play these roles in supporting Africa's efforts to adapt to a changing climate, with a focus on the agriculture sector.

Key Findings

Trade considerations have a role to play in the adaptation components of countries' NDCs as well as in National Adaptation Plans being produced. Africa is no exception and trade could support their climate adaptation policies and strategies. Many African countries may be foregoing significant opportunities to bolster their climate adaptation strategies through proactive, forward-looking trade policies. Five action areas offer opportunities to help integrate trade and climate adaptation policies in Africa and ensure that international trade can better support the continent's climate adaptation and economic diversification strategies: (i) improve the functioning of markets for food and agriculture; (ii) strengthen policies and institutions for sanitary and phytosanitary (SPS) measures; (iii) reduce barriers to trade in goods, services and technologies for adaptation; (iv) enhance the climate resilience of transport and other key trade-related infrastructure; and (v) use economic integration policies to promote trade and economic diversification.


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Climate change is expected to have implications for both rural and urban populations and may have differing effects on the food security of different types of actors in rural areas, depending for example on the extent to which the source of their livelihoods is exposed to the impacts of climate change. Yet close to 60 percent of sub-Saharan Africa's population lives in rural areas, with many engaged in subsistence agriculture, while close to 10 percent of the rural population lives in remote less-favored agricultural land or on remote land with poor market access (lack of roads, railways, navigable waterways). These factors complicate any prospective role for trade in agricultural goods to alleviate the threat to food security in rural areas unless there is a substantial improvement in trade-related infrastructure.

Our analysis shows that the role of trade in adaptation to climate change is complicated by an additional factor. While Africa is endowed with abundant natural resources (renewable like forests, and non-renewable like subsoil), property rights for these resources tend to be poorly defined, making them vulnerable to 'tragedy of the commons' outcomes prone to be exacerbated by international trade. Threats to biodiversity, already present, will increase. Under weak environmental governance, increased international trade presents a challenge.

To play an essential role in supporting food security, trade must be underpinned by open, transparent, and predictable policies that improve how food markets function, not least by allocating resources more equitably and sustainably.

International trade in goods and services can help lower the cost of climate adaptation in the short term and promote economic and export diversification in the long term. In addition to helping countries adapt to the impacts of extreme climate events and changing climate conditions, trade also strengthens countries' resilience to climate change by fostering


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economic growth and reducing poverty. Yet, trade considerations have been largely absent from the adaptation components contained in countries' NDCs under the 2015 Paris Agreement, let alone the National Adaptation Plans produced to date.

Policy Recommendations

The following policy recommendations offer opportunities to help integrate trade and climate adaptation policies in Africa and ensure that international trade can support the continent's climate adaptation and economic diversification strategies. Integrating trade and climate adaptation policies calls for action by African countries, both at national and regional levels, along with action by all WTO members.

- **Improve the functioning of markets for food and agriculture:** In an interconnected global economy where global value chains span national boundaries, policy action, including in response to climate shocks, can affect producers and consumers in other countries. Governments should ensure that policies adopted in response to climate shocks do not undermine the competitiveness and resilience of food producers and consumers in other jurisdictions, while still achieving better climate and development outcomes. Many types of policies that boost productivity sustainably are allowed without limits under WTO rules, such as

farmer extension and advisory services, research, rural infrastructure, or pest and disease control. Governments can use these programs to redress historic underinvestment in the farm sector and improve resilience to future shocks.

- **Strengthen policies and institutions for sanitary and phytosanitary (SPS) measures:** As intra- and extra-regional trade in agricultural commodities is likely to increase with climate change, regulatory bodies that set SPS measures will have to be strengthened to deliver safe trade at least cost. Countries that are unable to provide traceability in the value chain and the necessary trading infrastructure such as certification and inspection services to ensure that their products meet SPS and other requirements may be excluded from markets overseas. The same challenges apply to trade in agricultural products within Africa.
- **Reduce barriers to trade on goods, services and technologies for adaptation:** Open and transparent trade policies are an integral part of a broader strategy to access high-quality and low-cost goods and services that are essential to help the agricultural and other economic sectors to adapt to climate change. Examples of such goods and services include stress-tolerant cultivars, pesticides for weed control, early warning systems, equipment for renewable off-grid power generation, irrigation technology and related engineering and technical services, as well as agricultural extension services. For Africa specifically, eliminating barriers to trade in adaptation goods and services would significantly reduce the cost of acquiring efficient, innovative, and competitive inputs that are critical to carry out countries' adaptation priorities.
- **Enhance the climate resilience of transport and other key trade-related infrastructure:** The proliferation of regional and global value chains has important implications for African countries and their ability to diversify their economies. Value chains provide an opportunity for African countries to integrate into global and regional markets by exporting just one part or component of a product, instead of having to develop the industrial base required to manufacture the entire finished product from scratch.


Photo: Sunshine Seeds/Shutterstock

Drylands

Drylands are regions where primary production is generally limited by water availability. Nearly a third of global drylands occur in Africa, where they cover 19.6 million km^2, and nearly two-thirds of Southern, Western, Eastern, and Northern Africa (see Figure 8). This area is home to over 525 million people in Africa (40 percent of the population), growing by about 3 percent per year (faster than the African average of around 2.5 percent), with a demography firmly skewed toward the young. The drylands of sub-Saharan Africa are the most vulnerable to food insecurity compared to other global drylands. There can be no climate-adapted Africa without its drylands being climate-adapted.

The Drylands chapter reviews the impacts of climate change in African drylands in the context of other


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major biophysical and social trends, proposes a positive vision for a future for drylands largely centered on climate-adapted development, and identifies key opportunities for successful adaptive actions.

Key Findings

The outcomes of climate change in African drylands are driven mainly by the vulnerabilities of its population that collectively lead to a low Human Development Index. After decades of improvement, food insecurity and undernourishment are on the rise in almost all subregions of sub-Saharan Africa. In drought-sensitive sub-Saharan African countries, the number of undernourished people has increased by 45.6 percent since 2012.

The year 2019 recorded a deteriorating food security situation in sub-Saharan Africa, as well as increased population displacement and the increased food insecurity of those displaced people. As a result, adaptation is essential but cannot and should not be addressed separately from Africa's development—the target must be climate-adapted development.

To unlock this potential to transform the resilience of drylands at sufficient scale to adapt to climate change, important challenges need to be acknowledged and addressed. Adapted drylands with resilient communities and livelihoods cannot be achieved piecemeal by sector or by individual projects.

Many of Africa's longest running conflicts are associated with drylands, arguably because drylands are often the hinterlands of nations, being remote with poor infrastructure, or in border areas where countries struggle most to maintain control over their territories and where arbitrarily drawn, post-colonial boundaries exacerbate this issue.

Large initiatives for African dryland resilience like The Great Green Wall Initiative (GGWI) and AFR100 currently tend to be founded around a notion of restoration, whereas climate-adapted development needs to capture transformative opportunities and value creation. Dryland regions are not places of endemic famine and shattered societies and policies, where deep transformation is impossible. In general, African drylands are well-endowed with space, solar energy, minerals, water resources in many areas, carbon storage capacity, with important climate mitigation opportunities, biodiversity, spectacular landscapes, rich cultural traditions, and abundant human capital, including women and youth, among many other potentially positive resources. They do face many challenges—population growth, competition for land, climate change, poor governance and conflict, among others. But this should not inhibit a vision for transformation at scale, as described in

more detail in the Drylands chapter, informing realistic programs with the potential to trigger a virtuous cycle that can stabilize and improve the security, well-being, and prosperity of dryland inhabitants.

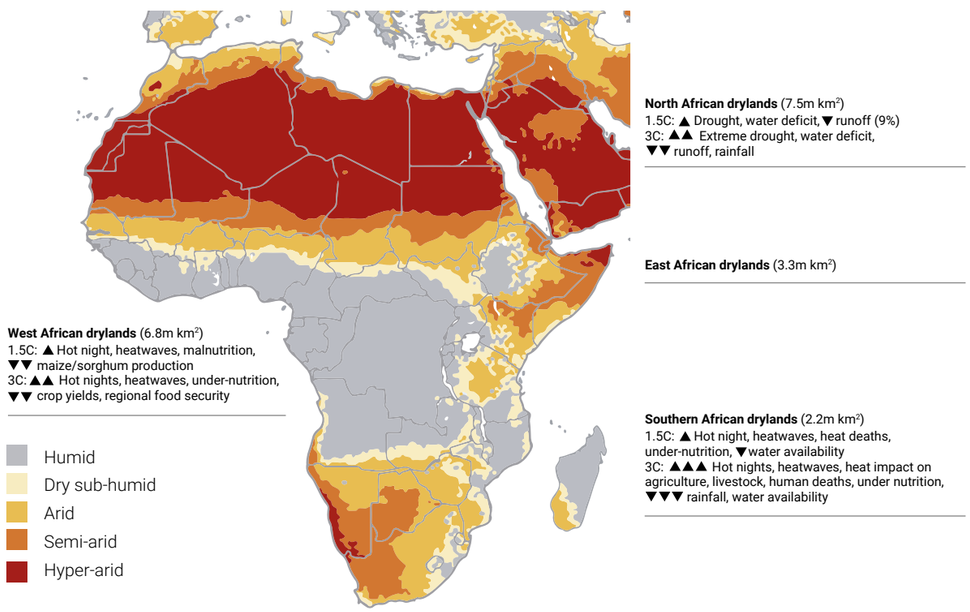
In regions facing the worst impacts of climate change, the emphasis should be on people-based policies (like health, education and social protection) and not only on place-based policies (like infrastructure and urban development).

Policy Recommendations

Several key underlying challenges, exacerbated in the drylands, also require addressing at a larger and more strategic scale to create an environment in which these elements of success can thrive and drive wider drylands resilience, and eventually reduce the pressures for conflict. To this end transformative interventions and targeted investment partnerships are needed to:

- **Support major initiatives that already exist,** as long-term vehicles to integrate and implement the elements of success in drylands at scale, improving the resilience of dryland environments and livelihoods to climate change around conventional dryland opportunities based on natural capital in pastoralism, farming, forestry, and land restoration.
- **Establish a series of ambitious, cross-border decadal initiatives in new domains** where drylands have a comparative advantage, to also act explicitly as integrating vehicles to develop additional climate-adapted livelihoods based on natural and other capitals (such as conservation and tourism, renewable energy, sustainable irrigation, food processing, carbon storage through sustainable land management). Support market links within regional economies and global value chains to this end.

Figure 8. Predicted changes in drylands of Africa, under 1.5°C and 3°C global average rise in temperature



Source: IPCC (2019). Climate Change and Land, Special Report; & IPCC (2018). Global Warming of 1.5°C, Special Report

- **Support the establishment and operations of an African drylands entity or initiative** to help ensure that policies are implemented in dryland-sensitive ways. Such an entity is essential to ensure a drylands voice over two-thirds of the continent, and should contain nested drylands commissions within countries.
- **Patiently support African drylands through strengthened regional and global partnerships** while they transition to greater resilience and contribute to the global economy. This support must act to reduce accidental and deliberate interference; help control capital export from drylands; ensure transparency in resource extraction; ensure transfer of appropriate technology and practices; and enable equitable participation in global trade. It must also help deliver humanitarian safety nets, and relief and recovery in the face of disasters and conflict.
- **A positive vision of adapted African drylands is essential.** Misleading negative imagery has obscured the potential for value creation based on the endowment of space, solar energy, minerals, water resources, biodiversity, and rich cultural heritages, as well as people, including women and youth, in drylands. Recent decades have shown that livelihoods based on natural capital can deliver significant economic returns and reduce poverty locally.

Transport and energy

Poor infrastructure continues to hinder economic growth in most African countries. To close the infrastructure gap, investments in infrastructure in Africa must go up to 4.5 percent of GDP from approximately 3.5 percent, where it has persisted since 2000. Moreover, climate risks are affecting infrastructure development strategies and investments. Rising temperatures, changes in rainfall patterns and intensity, and the increasing frequency of extreme weather events are leading to losses in asset values, higher operating costs, and reductions in the economic benefits that infrastructure generates.

Infrastructure spending and access to infrastructure services is a key contributor to development, economic growth, and poverty alleviation in Africa. It is crucial that investments in infrastructure in Africa are sustainable and resilient. This requires a fundamental systemic transformation. A revolution in the planning, design, financing, and delivery of infrastructure is urgently needed to meet the acute needs of warming Africa.

The Transport and Energy chapter analyzes how climate change impacts infrastructure in Africa, with a focus on the energy and transport sectors, with sobering implications across social, economic, environmental, and development outcomes.

Key Findings

While African governments need to integrate adaptation and resilience into infrastructure investments to minimize the harm caused by climate impacts and maximize development opportunities, they face significant challenges:

- The impacts of climate change on infrastructure can be acute or chronic. Acute climate impacts cause a sudden shock to the system, often from an extreme event such as a flood. The event may have widespread impacts (like coastal flooding) or may be very localized (as in a landslide). Climate-related damage to infrastructure disrupts social services and exacts a significant short and long-term human and economic toll in Africa.
- Closing the infrastructure gap and enhancing climate resilience is critically important for economic development, improving the quality of life, and the growth of the private sector in Africa. The good news is that infrastructure investments in Africa have risen increasingly over the past 15 years, and international and national investors have both the desire and the funds to spend much more across the continent. However, while investments in adaptation and resilience for energy and transport infrastructure are rising (from $19 million to $252 million between 2010 and 2019 for the energy sector; and from $11 million to $128 million in the same period for transport), they are still well below actual needs.
- Making infrastructure more climate-resilient will have additional upfront costs of 3 percent, but returns can be four times the initial investment, in addition to important social returns.

Climate-resilient infrastructure planning needs to begin 'upstream' in the early planning stages;

be integrated across sectors and activities at a strategic level; make use of better analytical tools to understand climate risk at a systems level; and prioritize resources for building resilience. Proactive adaptation—modification of designs and incorporation of resilient construction norms at the very outset of infrastructure projects—is a no-regret option in the energy and transport sectors, including for instance for hydropower and paved roads.

There is momentum building for national governments, development partners, and the private sector to integrate climate change into asset design. Development partners such as the World Bank and African Development Bank, for example, already screen projects for adaptation. However, there needs to be a fundamental shift further upstream to integrate climate resilience into how country and sector projects pipelines are planned, financed, and developed.

Once these 'upstream' decisions on the location, nature, and design of infrastructure are made, the options for climate risk management narrow. Such proactive 'upstream' adaptation and resilience measures can increase up-front investment costs, but reduce 'downstream' operations and maintenance costs.

Despite evidence of these benefits, investments in improving the climate resilience of infrastructure in Africa are well below the needs. Only 2.3 percent of total official development assistance (ODA) for Africa was allocated for investments in infrastructure adaptation between 2010 to 2019. Of this, 6.3 percent, or $831 million, was allocated for the transport sector, and 12.9 percent, or $1,694 million, for the energy sector. Domestic resource commitments form a large proportion of infrastructure investments in Africa, totaling $37.5 billion, or 37 percent of total infrastructure investments in 2018. While these investments are not screened for adaptation and resilience, ODA sponsors are increasingly calling for such screening, supporting a positive trend where total adaptation investments in energy increased from $19 million to $252 million between 2010 and 2019, while transport sector investments increased from $11 million to $128 million in the same period (Figure 9).

Policy Recommendations

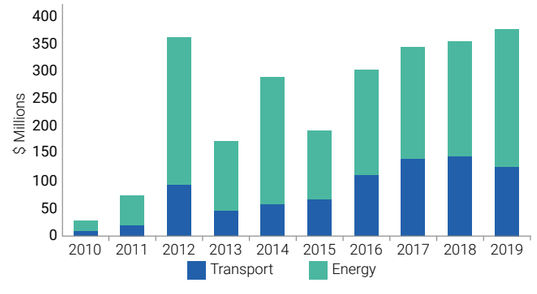
The following recommendations help chart the way forward:

- **A transformational shift is necessary in how infrastructure is planned and designed, with systemic climate risks and resilience integrated upstream.** While infrastructure development in the energy and transport sector is vital to Africa's growth, there is a high potential that climate change will offset or reduce the benefits of such infrastructure. Adaptation has great potential to reduce the negative impacts of climate change, but the planning and design of infrastructure in Africa is still conducted largely without taking climate change into account. Proactive adaptation in the energy and transport sectors, meanwhile, is a no-regret option.
- **Adaptation of rural infrastructure** needs special approaches and cannot be left behind urban infrastructure.
- **Invest in integrated systems to generate data for investment planning.** To bring down the cost of the analysis needed to integrate climate considerations into energy and transport development, and to mainstream systemic risk and resilience, significant amounts of data on climate, infrastructure assets, supply chains, the environment, economic activities, and other socioeconomic aspects is needed. Most African countries and their development partners already have existing systems and projects that generate the required data, but these systems are siloed and mostly disconnected from decision-making processes. While data alone will not increase infrastructure adaptation and resilience, it is a vital entry point for putting in place the building blocks for climate-smart investments in infrastructure. African countries should focus on two priorities: Climate data and infrastructure asset data. This will also improve assessments of key vulnerabilities of infrastructure when used with the climate data and will help to prioritize investments.
- **Invest in tools and methodologies to quantify energy, transport, and infrastructure-related ecosystem services provided through natural assets.** NbS, implemented on a large scale, could reduce costs by 90 percent for the same level of adaptation benefits. There is a need to ensure sharing of research within and across sectors, and to standardize methodologies and approaches for integrating NbS in infrastructure planning and implementation where appropriate, while recognizing the context-specificity of NbS projects.
- **Leverage PPP frameworks that promote incentives for climate resilience and adaptation of infrastructure projects.** While PPPs represent a relatively small proportion of infrastructure investments in Africa, they provide a clear entry point for integrating adaptation and resilience into infrastructure design and asset management. A robust PPP framework is imperative to attract private capital for infrastructure, particularly in Africa where market conditions are more sensitive, given the complexity of PPP projects, contract size, and risk exposure.
- **Governments must drive reforms for improved operations and maintenance asset management.** Planning, designing, and financing climate-smart infrastructure represents only one portion of the infrastructure lifecycle. Asset management is often ignored or de-prioritized in the drive to finance and increase infrastructure capacity in Africa. Countries must enhance fundamentals of climate-smart

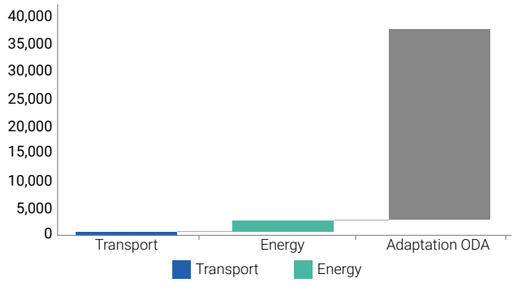

Photo: Travel Stock/Shutterstock

Figure 9: Adaptation official development assistance for transport and energy

(a) Distribution per year



(b) Total between 2010-2019



Source: Authors, with data from OECD (2021). OECD.Stat database

infrastructure governance by reflecting climate change in asset management practices through clearly defined system performance metrics and levels of service. Specific recommendations to integrate climate change into asset management practices include: defining requirements; assessing climate impacts on the asset base; developing climate-smart capital works strategies; integrating climate risk in financial plans; and integrating climate change and hazard data in management information systems (MIS).

Urban Development

The Urban Development chapter reviews the current state, past trends, and projections of urbanization in Africa. It analyzes present and project climate risks in urban areas, focusing on floods, specific risks for low-lying urban centers, the impacts of droughts on water supply services, coastal erosion and its linkage to sea level rise, and heatwaves. The chapter then reviews adaptation options for African cities in three groups: (i) untapped opportunities and early wins; (ii) urgent adaptation actions in the post-COVID recovery; and (iii) medium- to long-term measures after the economic recession caused by the pandemic.

Key Findings

At 4.4 percent, Sub-Saharan Africa is the region with the fastest urbanization rate globally, with about 40 percent of its population living in urban areas, up from 22 percent in 1980. With close to one billion urban residents, the growth will continue and double in number by 2050. On average, 60 percent of Africa's urban residents live in slums.

Urbanization in Sub-Saharan Africa is taking place at lower levels of income. In 2005, the GDP per capita of Sub-Saharan Africa at close to 40 percent urbanization was about $1,000. At that same rate of urbanization, the GDP per capita for the Middle East and North Africa was $1,800, and for East Asia and Pacific was $3,600.

The COVID-19 pandemic is having severe economic impacts in Africa and its cities. Economic activity in Sub-Saharan Africa is estimated to have contracted by 2.0 percent in 2020. The region has seen its first recession in over 25 years, with activity contracting by nearly 5.0 percent on a per capita basis. Local governments could experience a drop in local finances of 30–65 percent, on average.

African cities face rapidly growing climate risks but with large variations across the continent that need targeted responses. Climate risks in urban areas of Sub-Saharan Africa include floods, droughts, sea-level rise, heat waves, and increased risks to diseases like malaria, cholera, and rodent-borne diseases. The urban poor are suffering the worst impacts of the climate crisis due to their lower resilience capacity.

Low-lying coastal areas have specific climate risks due to sea level rise and, in many areas, increased flood frequency. Climate risks are compounded by demographic trends in coastal areas. About half of the African settlements with 1-5 million inhabitants are located in low-elevation coastal zones. By some estimates, Africa's populations in low-elevation coastal zones (LECZ) will rise at more than double the world's average.

One of the urban services that will be most affected by climate change is water supply. Access to piped water supply has progressively increased in Africa (from 82 million urban dwellers with piped water in 2000 to 124 million in 2015). However, given the rapid urban population growth, the percentage actually declined from 40 percent in 2000 to 33 percent in 2015. Most of the increase came from increased access to piped water off premises and self-supply. As informal settlements have grown quickly, informally, and without adequate urban planning or space, the provision of water infrastructure is complex. Droughts are expected to become stronger in many parts of Africa, as discussed in the Present and Projected Climates in Africa chapter. They will have significant impact on water utility services.

The impact data of heatwaves is limited in Africa, but trends are worrisome. Combining temperature and population growth projections for 150 large African cities, a recent study showed that the number of people that will be subject to dangerous and lethal heat conditions will be 20 to 52 times higher at the end of the century compared to current conditions.

The rapid population growth of African cities and the current and projected climate risks compound economic risks. A combined analysis of population growth projections and climate vulnerability in cities worldwide, shows that cities in Africa are growing the fastest (86 of the 100 fastest growing cities), and 79 of these cities fall in the "extreme risk" category of their climate index.


Photo: Nikolay Antonov/Shutterstock

The early stages of urbanization in most Sub-Saharan African cities provide a unique opportunity. The low levels (40 percent) of urbanization of the region and the low-density of its large cities offer opportunities for low-cost actions that can prevent locking-in errors of other highly urbanized regions of the world.

Policy Recommendations

Given the limited financial resources African cities currently have, it is important to prioritize the adaptation actions that are feasible and have the greatest impact. Our GCA analysis has grouped these possible avenues in two groups: (i) the untapped opportunities and early wins; and (ii) the urgent options in the recovery.

African cities can undertake a range of opportunities that require fewer financial resources and can generate immediate and significant adaptation benefits or set up the planning basis for enhanced adaptation measures as part of the post-COVID recovery. The first group of measures includes:

- **Rapid climate risk assessments** that gather recent disaster information, infrastructure bottlenecks, and information gaps for a rapid evaluation of critical weaknesses of the city.
- **Community engagement,** including the youth and women, for resilient action in the low-cost measures identified in the rapid climate risk assessments.
- **Basic urban planning** to reduce uncontrolled sprawl in areas of high climate risk.
- **Early warning systems** by connecting the city to the national warning systems and hydrometeorological agencies to ensure that the information on upcoming climate disasters is received by the municipality, transmitted to the communities, and acted upon.
- **Individual and community resilience,** including behavior change, climate risk communications, childrens' education, and women and youth empowerment for resilience and disaster preparedness.
- **Maintenance of existing infrastructure** and enhanced safety measures for non-networked water and informal waste solutions.
- **Land and property rights** and urban planning are indispensable elements of a resilient city. The first basic steps of mapping and data collection can be done at low cost and serve as the basis for a long-term transformation process.
- **Leverage the resilient power of nature** by protecting existing buffers like mangroves, wetlands, and floodplains. These green spaces are rapidly disappearing in African cities and the cost of building gray infrastructure in future years to compensate for the disappearance of the natural buffers will be expensive.

A second group of adaptation and resilience measures requires more financial resources, but their


Photo: Rich T Photo/Shutterstock

urgency resides on the avoidance of growth patterns that will lead to the need for retrofits, or in the high benefit to cost ratios in terms of lives saved or assets protected. These measures include:

- **A comprehensive urban resilience and adaptation master plan** that considers the various climate risks of the city, combines them with the urban growth needs, and provides a climate-smart development path in the medium-term.
- **Prioritized infrastructure retrofits and enhancements** that solve the critical bottlenecks and priority risks for the city for the more recurrent climate shocks, such as floods and related landslides.
- **Resilience business market opportunities** associated with the infrastructure actions above, designed to support the creation and growth of SMEs that would generate new jobs for adaptation and resilience.
- **Continuous capacity strengthening of city officials,** both municipal staff and delegated staff of national agencies, in the areas of climate adaptation and resilience.
- **Climate adaptation project preparation,** to ensure engineering designs and bidding documents for the most critical medium- and large-size projects are ready when the economic conditions recover after the COVID pandemic.

In the medium- to long-term, our GCA research indicates that African cities need to undertake a more comprehensive adaptation and resilience strategy based on the following nine areas:

- **Strengthen the capacity of all city stakeholders to minimize the economic impact of disasters** through early planning, preparedness programs, community engagement, and rapid reconstruction using "build-back-better" principles.
- **Deepening the resilience of the private sector,** as discussed in the Private Sector chapter. The municipality can take an active role to encourage and support the building of that capacity through information and capacity building.
- **Explore new financial mechanisms for enhanced resilience,** beginning with simple ones such as insurance for the most critical municipal assets, PPPs for resilient infrastructure, land-value capture to finance flood control infrastructure, and others described in the Finance chapter of the report.
- **Scenario planning,** based on continuous data collection and partnership with scientific bodies and network of cities with more experience in robust planning and climate projections at the local level.
- **Multi-level government coordination,** as many of the climate risks of the city require coordination and action with other jurisdictions such as neighboring municipalities in metropolitan areas, or river basins for watersheds providing water to the city or flood protection.
- **Progressive institutional reform** and continuous capacity building that approaches adaptation and resilience as a cross-departmental platform.
- **Leverage new technologies** and bring the best elements of smart cities and disruptive digital technologies.
- **New alliances** to ensure adaptation and resilience are seen as everybody's job and not only a responsibility of the municipal government.
- **Inclusive approaches to adaptation** to ensure that socially vulnerable groups, from persons with disabilities to unemployed youth, women, migrants, and internally displaced populations, are all part of the resilience plans and programs of the city.

Water resources management, floods and disaster risk management

The Water Resources Management, Floods and Disaster Risk Management chapter brings together two areas that connect several previous chapters. These areas are, first, disaster risk management (and the closely associated issue of flood risks) and, second, integrated water resources management. The most important manifestation of climate change in Africa is through water. This chapter reviews the state of flood risks in Africa, the implication of floods on poverty, current projections of climate change and their impact on poverty, and policy recommendations on flood risk management for the continent. Finally, it discusses how three major international agreements reached in 2015 connect to climate adaptation and resilience: the Sendai Framework for Disaster Risk Reduction (SFDRR), the Sustainable Development Goals (in particular, Goal 6.5 on integrated water resources management), and the Paris Agreement.

Key Findings

Disaster Risk Reduction (DDR) and the Sendai Framework: In 2015, the Sendai Framework for Disaster Risk Reduction 2015–2030 (SFDRR) was endorsed by the UN General Assembly. All 55 African countries signed up for the Sendai Framework. The African Union and its member countries identified five additional targets specific to the region. A key target of the SFDRR is the development of national and local disaster risk reduction strategies with a deadline of 2020. In Africa, 18 countries have validated strategies or policies aligned to the SFDRR, and seven more countries are developing or validating their strategies. 101 countries worldwide have reported the existence of national DRR strategies in the SFDRR framework monitor used to measure progress. Africa is not too far behind the global average of developing regions.

Two other major international agreements were reached also in 2015: the SDGs and the Paris Agreement. Since then, there have been concerted efforts to coordinate these agreements at the country level. Climate adaptation and resilience are at the center of these agreements. However, the different institutional arrangements for DRR and CCA lead to mismatches in governance, data and information, and funding streams.

Our review of the various assessments of the state of DRR in Africa shows that financial resources are still insufficient to develop DRR and resilience programs. In addition, the national planning and development processes have not yet fully mainstreamed DRR. The level of domestic financial resources dedicated to DRR activities is insufficient in most African countries. On average, 4 percent of national budgets, at the planning stage, are related to DRR, but only 1 percent is directly dedicated to DRR interventions. A wide range of instruments can be combined and leveraged in a multi-layer financial architecture for DRR and climate-related disasters together (Figure 10). A key objective of this architecture is to mobilize as fast as possible the resources needed for post-disaster reconstruction and recovery.

Floods: In Africa, over the period 2008–2018, floods accounted for 65 percent of events and caused 24 percent of deaths. The 2018–2019 cyclone season caused the most considerable flood damage seen in the region. The leading cause was Cyclone Idai, which primarily affected Mozambique and Zimbabwe with at least 900 deaths and infrastructure damage estimated at more than $1 billion.

The rainfall and river basin flows in the continent have a wide range of variability, which poses significant challenges for managing floods. These challenges range from managing floods in large transboundary river basins, understanding the extreme floods in ungauged catchments with minimal information, and reducing the vulnerability of low-income informal settlements in African cities.

Partly driven by population increase, the number of people exposed to river flooding in Africa is predicted to rise to 23.4 million by 2050, with a projected 57 percent increase in fatalities if global average temperatures increase by 1.5°C. Without additional flood protection, and following the projected substantial increase in economic value in flood-prone areas, the projected economic damage in the region could reach $266 billion per year by 2050.

Populations living in poverty are particularly vulnerable to climate shocks such as floods. This means that the poor lose proportionally more when such shocks hit them due to factors that are particularly relevant for Africa, such as: (i) lower-quality housing that is more vulnerable to damage and loss; (ii) greater income dependence on climate-dependent agricultural and ecosystems; and (iii) less resilient infrastructure services.

Integrated water resources management (IWRM) is a holistic framework used to address the diverse demands and pressures on water resources across sectors and at different scales—from the local to the transnational—in an equitable, sustainable manner. Even though IWRM has traditionally included flood and drought risk management through water storage infrastructure solutions, the IWRM and DRR programs and policies have not been well coordinated. A rapidly changing climate requires a change of this situation.

Policy Recommendations

Current and projected flood risks in Africa are significant and growing. Our analysis suggests that the following policy recommendations bring together regional and international good practices applicable to Africa: (i) Flood risk management requires not only understanding the types, causes, and likelihood of flood events but also the population and assets in potentially affected areas and their vulnerability and understanding of floods; (ii) traditional structural flood reduction infrastructure is expensive and needs careful targeting; (iii) the most essential and cost-effective non-structural flood risk management measures are planning and preparedness; (iv) land use planning and management, and nature-based solutions, are as important as non-structural measures; and (v) rapid changes in Africa (from urbanization to land use change and development of floodplain areas) combined with climate change make flood prediction in the short- and medium-term challenging.

Figure 10. Multi-layer financial architecture for DRR and climate disasters

Source: GCA (2020), *State and Trends in Adaptation*, adapted from World Bank (2016), Colombia: *Policy strategy for public financial management of natural disaster risk.*

IWRM has traditionally included flood and drought risk management through a combination of water storage solutions and water availability information for decision-making under stress conditions. Generally, IWRM and DRR have not coordinated actions and programs under different institutions with different approaches and areas of focus. Our analysis shows that the growing urgency of climate adaptation actions makes this coordination even more critical.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SECTION 3 – CROSS-CUTTING THEMES

Health

Health indicators and services in Africa have made substantial progress in recent years before the COVID-19 pandemic, but still lag behind the rest of the world. Approximately 615 million people do not receive the health care services that they need. When the quality of services is considered, the coverage scores are even lower. Every year, 15 million people (1.4 percent of the region's population) are pushed into poverty due to out-of-pocket health care expenses. The Health chapter reviews the impacts of climate change on various health factors in Africa, projected trends, and possible climate adaptation solutions. It also examines progress towards mainstreaming adaptation in health systems.

Key Findings

Climate change is a modest factor today in the overall burden of disease and health indicators in Africa. However, the trends are of concern, and decisive action is needed to mainstream practical adaptation strategies in health services and sectoral factors that impact health outcomes. Population health is impacted by climate change through multiple exposure pathways including heatwaves; infectious diseases; hunger and malnutrition, particularly due to the impact of climate shocks on agricultural production; water- and food-borne diseases linked to climate shocks; long-term health and developmental challenges on children; injuries, disabilities and deaths resulting from floods; damage to health facilities and access disruptions caused by floods; and inequality and vulnerability as amplifying factors.

The risks are unevenly distributed, with poor and marginalized communities at higher risk, and the health services they can access are of poorer quality. This combination already results in higher health impacts of climate shocks today to climate shocks and, if no adaptation actions are taken, worse health outcomes in the future.

Improved health outcomes for the population of Africa will not depend only on health systems, but also on investments to make progress on the SDGs in


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ways that are adapted to a changing climate. These investments range from safe water and sanitation to food security, and from basic services in low-income urban communities to early warning systems.

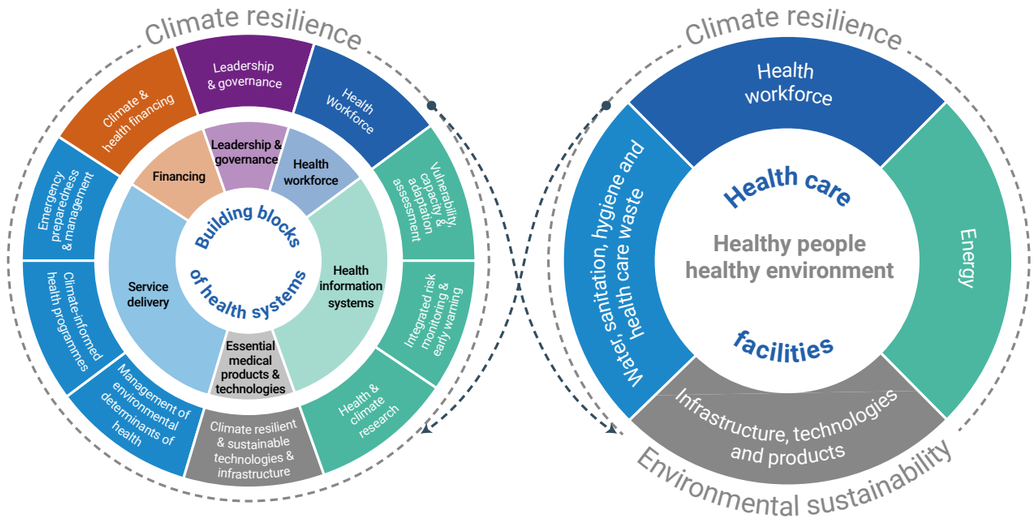
An analysis of the NDC's to evaluate how public health was incorporated, including impacts, adaptation, and co-benefits, concluded that most countries in Africa referred to health in their NDC. Nearly 100 percent of countries in the African region had a mention of health in theirs, and more than 40 percent had a section on health.

Policy Recommendations

A first policy recommendation is to ensure health systems are resilient to climate shocks. Figure 11 shows, on the left, the components of climate resilient health systems, and on the right, the components of climate-resilient and environmentally sustainable healthcare facilities.

Becoming resilient to today's disasters is a step towards making health systems better adapted to climate change. The interlinkages with emergency response systems and infrastructure planning are equally important. These principles are designed not only for climate disasters, but also to support health systems respond better to a wide range of shocks and stresses. Table 4 summarizes these pillars and recommendations for government action.

Figure 11. WHO guidance for climate-resilient and environmentally sustainable healthcare facilities



Source: World Health Organization (2020)

Table 4: Five pillars of resilient health systems and associated priority actions

Resilience in health systems	Objectives	Examples of policy actions
Resilient health facilities	Enhanced capacity and resilience of facilities by:	• Understanding climate risks today and in the future • Upgrading structures to withstand climate shocks • Enhancing staff capacity to deal with climate shocks and emergencies • Preparing crisis protocols, business contingency plans, and emergency stocks of essential supplies
Resilient health systems	Integrate individual health facilities into a coordinated network by:	• Using data-driven decision-making process to optimize resources during climate shocks • Improving communication and cooperation between diverse entities of health system • Leveraging facilities outside the health system to delivery emergency services • Deploying mobile clinics to underserved and disaster-hit areas to boost capacity during crisis
Integrated emergency response	Integrate health care into climate shock response systems by:	• Coordinating closely with search and rescue agencies to manage health needs • Establishing inter-agency communication channels and coordination before climate shocks • Clearly defining roles and mandates for crisis response • Enhancing early warning systems and disseminating information to the health system • Integrating health system needs in climate risk finance strategies
Resilient infrastructure	Ensure resilience of critical infrastructure systems on which health facilities depend by:	• Upgrading transport, water, electricity and telecommunications assets vulnerable to climate shocks, especially those needed for health systems operations • Identifying redundancy in infrastructure assets • Leveraging new technologies for service and supply delivery

Source: Adapted from World Bank (2021), *Frontlines*

Gender

Climate change and gender inequalities are linked in complex ways. On the one hand, climate change can be a barrier to progress towards gender equality. But equally, gender inequality can exacerbate the effects of climate change. Women and men are not only affected differently by climate change, they also contribute differently to climate action. Women and men experience different levels of exposure, vulnerability and resilience to climate risk and climate change impacts as a result of gender differences in rights, responsibilities and opportunities. They experience differing vulnerabilities because of differences in workloads, in access to and control over productive assets and resources, and in participation in household decision-making and access to information and technology. Their vulnerability varies not only because of gender, but also disability, sexual orientation, ethnicity, religion, class, location and age. Rural women in particular are at high risk of being negatively affected by climate change, due to household responsibilities, increased agricultural work resulting from climate impacts, and male out-migration—with consequences on family nutrition, childcare, and education. The feminization of marginal agriculture, given the migration of young men to cities, is a problem that requires particular attention and solutions. The gender chapter analyses these issues.

Key Findings

Barriers to resolving gender inequalities in climate change mitigation and adaptation processes continue to persist and still need to be addressed. Many climate change interventions prioritize productivity at the expense of issues such as gender, social inclusion, and equity. This trend must be checked. Further, for effective assessment of progress towards gender equality in climate action and to adequately report on instruments, well-structured and robust monitoring and evaluation (M&E) systems, with sex-disaggregated data and sufficient funding support, are a must.

Women remain largely absent from climate change politics and policymaking. This is because climate change debates have been shaped by stereotypically masculine discourses that work to exclude or alienate women and their concerns in climate change issues. Further, climate change is widely represented as a techno-scientific problem requiring technical solutions, yet women with expertise continue to be sidelined from participating in the development of such solutions. Without women's inputs on climate change policy, climate change could itself become another barrier to gender equality.

Women's awareness and agency should be harnessed for gender-responsive and sustainable climate action. Their unique knowledge, skillsets and perspectives, borne out of how they interact with food systems, technology, and institutions, can improve the effectiveness of climate action.

There are many groups and institutions doing significant work at the intersection of gender and climate change in Africa, and a range of proven and potential adaptation actions and strategies suitable for the continent that focus on bringing women into the mainstream of climate action.

Policy Recommendations

Promoting women's voice in policy, planning and implementation needs to be supported by funding. Further work is needed to prioritise funding for grassroots and women's organisations to empower local civil society and to complement the large financing mechanisms. The implementation of gender actions in projects requires dedicated funding; hence it is a good practice to allocate a sufficient budget for the project to support activities promoting gender equality. If the funds are not allocated or the implementing project does not have funds to implement specific actions, the gender mainstreaming process will be adversely impacted and delayed. This is the case in most African countries.

Most NDCs do not address structural causes of gender inequalities and mentions of gender in many tend to be brief. Only 10 countries have developed gender and climate change plans (GCAPs) in the last few years, half of which are in Africa: Kenya, Mozambique, Nigeria, Tanzania, and Zambia.

It is crucial to have women represented in decision-making at all levels to be able to influence innovative, sustainable solutions to climatic challenges. Gender balance in national delegations to the UNFCCC should be encouraged and women supported to maximize their voice, confidence, and negotiation skills while 'at the table'. Where women are excluded from governance, decision-making processes are more likely to result in policies that ignore the unique needs, knowledge, and contributions of women. In addition to strengthening women's skills and decision-making ability, it is important to promote women's access to knowledge related to climate change across all the relevant sectors.

It is essential to develop tools, methodologies, guidelines and indicators for the monitoring, reporting and verification of the development and implementation of gender-responsive climate policies and strategies in Africa to facilitate tracking of progress in this area. Data collection tools such as the Women's Empowerment in Agriculture Index (WEAI) and the Gender Empowerment Index for Climate-Smart Agriculture (GEI-CSA) provide a good starting point to measure the impact of climate interventions on women and men and address areas of disempowerment.

Governments need support to build their capacity to integrate gender into national adaptation and mitigation plans and Present and Projected Climates in Africa, and into sectoral plans and programs through training in gender-responsive policy analysis, policy development, planning, budgeting, implementation, monitoring and evaluation. In addition, there is need to strengthen the capacity of farmers' groups for gender-responsive service delivery in the face of climate change, for example through access to resources and services such as land, fertilizers, seeds, and markets.

Conflict and migration

Globally, the link between climate change, conflict and migration is gaining academic and policy salience. In 2007, the United Nations Security Council first established the link between climate change and security across policy arenas, recognizing it as a 'risk multiplier' which exacerbates existing vulnerabilities. However, the evidence attesting to the causal link, and to the mechanisms through which climate change may affect conflict and/or migration, remains weak and often contradictory. Whilst our analysis indicates that climate change is not the sole cause of violent conflict or migration, a growing evidence base supports the 'threat multiplier' discourse. The Conflict and Migration chapter aims to unpack the climate-

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conflict-migration nexus in Africa and the nuanced pathways in which they interact, to better understand the role of climate adaptation and resilience in addressing these risks.

Key Findings

Africa is the only continent that witnessed an increase in political violence by state and non-state actors in 2020, even as the pandemic contributed to a slight decrease of conflict in the rest of the world. Increasing inequalities laid bare by COVID-19 appear to have contributed to drivers of conflict, further deepening the 'conflict trap'. Currently, 26 out of the 54 African countries which are highly vulnerable to climate change are considered fragile or extremely fragile. Out of the ten most vulnerable countries to climate change, eight are in Africa, and six are currently facing armed conflict. The year 2020 also marked the highest number of internal displacements recorded, the majority of which were in North and Sub-Saharan Africa. New and repeated displacements were also recorded when conflict overlapped with extreme weather events, triggering an estimated 4.3 million new displacements in Sub-Saharan Africa alone.

Our analysis shows that climate and environmental change are never the sole causes of conflict and migration. Instead, they interact in highly complex and context-dependent ways. There is a variable relationship between disasters and conflict. While some countries did record conflict events following the onset of a disaster, others reported increased cooperation and trust as a post-disaster outcome. Some countries appear to be more vulnerable to climate-related conflict than others if they experience (i) ethnic fragmentation; (ii) high dependence on rainfed agriculture; (iii) low human development; and (iv) political and economic marginalization. Mediating factors such governance and institutions, adaptive capacity, and existing vulnerabilities also play an important role in shaping conflict outcomes. Despite the abundance of climate-conflict studies one main concern highlighted frequently across the literature is the lack of robust analysis of climate variables.

We also found that there is limited evidence about the viable role of adaptation and disaster risk reduction (DRR) in conflict settings. However, there is a consensus that poorly designed adaptation and DRR interventions can compound existing inequalities and exacerbate the risk of conflicts. Moreover, people living in conflict-prone settings are highly vulnerable to climate change.

Policy Recommendations

There are important opportunities to tackle the challenges of climate change, conflict, and migration in a coordinated manner through investments, governance and institutional capacity-building, and national and regional plans.

In the area of investments, it is important to: (i) Promote holistic and multi-sectoral investments in adaptation and resilience, which integrate climate hazards and pre-existing vulnerabilities; (ii) invest in robust databases with more consistent monitoring of climate variables, as well as migration and conflict triggers and trends; (iii) invest in key areas of research such as localized and context-specific research on the climate-conflict-migration nexus; and (iv) invest in early warning systems, preparedness, and combined management systems for climate change, conflict, and migration.

In the area of governance and institutional capacity, it is recommended to: (i) build the capacity of institutions to create an enabling environment for peace and sustainability while promoting inclusive and participatory governance, with a specific lens towards climate change; (ii) promote climate resilience solutions which foster social dialogue and cohesion by recognizing existing social, political and economic inequalities in communities; and (iii) build the capacity of national statistical systems to collect better quality data on climate-related conflict and migration.

Finally, **in the area of national and regional plans,** it is key to: (i) conduct localized climate-conflict assessments and include them in countries' NDCs and NAPs as well as regional cooperation agreements; (ii) consider planned migration as an adaptation strategy, especially when it aims to alleviate poverty and reduce vulnerability to climate change; and (iii) embed migration (in its three phases: before, during, and after movements) into regional, national and local development planning, as well as into NAPs and NDCs.

Sustainable development goals

In 2015, two major international agendas were agreed: the Paris Agreement and the 2030 Agenda for Sustainable Development. The adaptation component of the Paris Agreement focuses on building adaptive capacity, reducing vulnerability to climate change, and enhancing resilience. The 2030 Agenda seeks to progress social, economic, and environmental dimensions of development through 17 Sustainable Development Goals (SDGs). Despite apparent differences in primary objectives, the two agendas overlap considerably. There are significant opportunities for catalytic synergies and linkages between the two—along with the significant danger that lack of progress in one could heavily compromise progress in the other. The SDGs chapter explores these synergies and linkages; identifies opportunities to strengthen links between SDG strategies, plans, and actions and the NDCs; and explores the multiple negative impacts of climate disasters on SDGs.

Key Findings

Sustainable development and climate change adaptation are inextricably intertwined. Climate change can undermine sustainable development efforts without adequate adaptation responses to support food security, poverty alleviation, human health, and other determinants of sustainable development for Africa. Adaptation and resilience actions, meanwhile, can lower the risks of climate change and variability, and help deliver sustainable development. Similarly, robust sustainable development measures can help build adaptive capacity and reduce vulnerabilities.

The sustainable development, adaptation, and resilience-building agendas are mutually reinforcing, and their convergence presents a significant opportunity to deliver mutual benefits. Despite this opportunity for alignment, only 13 SDG targets and 21 indicators (8 percent) of the 169 targets and 232 indicators include an explicit reference to adaptation and resilience (mentioning adaptive capacity, vulnerability, hazards, exposure, and/or resilience). A further 27 SDG targets that contribute to resilience and adaptive capacity for disaster risks, and enable inclusion and accessibility through good governance, have been identified by the UN Office for Disaster Risk Reduction (UNDRR). Other SDG targets may also be relevant to climate change adaptation, depending on the underlying vulnerability contexts.

Our analysis shows that failure to integrate the adaptation and resilience agenda into sustainable development action will therefore substantially hinder progress towards the SDGs, especially for developing countries. Parallel agendas can increase the risks of negative outcomes (maladaptation) to additional target groups and actors (rebounding vulnerability); compromise the ability of other groups to respond to climate change (shifting vulnerability); and result in constraints on or failure of sustainable development.

Climate disasters like drought, floods, hurricanes, and cyclones have multi-dimensional impacts, affecting several SDG indicators at the same time. The SDG chapter presents the analysis of seven recent climate-related disasters in Africa related to water scarcity (drought), and excess water (floods and cyclones). The analysis shows how these disasters have slowed progress toward achieving SDGs, and the multi-dimensional impacts they cause. Climate disasters can reverse the progress achieved in SDG indicators at the sub-national level, and even at the national level for small countries. Mainstreaming adaptation and enhancing the resilience of SDG investments can reduce the impact and avoid such reversals. There is an opportunity to better integrate the SDG framework in post-disaster assessments to map impacts across different socioeconomic systems.

Policy Recommendations

A climate risk-blind pursuit of the SDGs can exacerbate climate-related impacts in Africa, whereas an integrated approach to achieve the SDGs and build climate resilience at the same time can significantly reduce systemic vulnerability, optimize the use of resources, and enable transformational adaptation.

The current adaptation ambition of NDCs in Africa may not be sufficient. African NDCs should strengthen SDG-related adaptation action, related to SDG 3 (health); SDG 4 (quality education); SDG 5 (gender equality); SDG 9 (infrastructure); SDG 10 (reducing inequalities); and SDG 11 (sustainable cities). Measures that target national vulnerabilities, build the resilience of human systems, and deliver multiple SDGs should be prioritized to optimize the use of resources and synergize efforts.

Single climate disasters can negatively impact multiple SDGs through, for instance, loss of life; an increase in malnutrition and disease; and the destruction of water sources, arable land, infrastructure, and the natural environment. The only way to stop this cycle of negative synergies is to accelerate effective action to achieve the SDGs and adapt to climate change.

Unlike adaptation, the SDGs are supported by a robust set of indicators and targets to measure progress. Identifying the links between the SDGs and adaptation can therefore help track progress on adaptation, and to identify gaps.

Africa needs more international cooperation and South-South exchanges of practical adaptation solutions with demonstrated results at scale.

Future topics for research

This report has analyzed in detail six focus sectors that are fundamental for African economies and communities, and four cross-cutting themes. We recognize there are many other important adaptation topics for the African continent. Some examples include education and training, research and development, locally-led adaptation, governance, coastal erosion, and blue economy. These topics require further analysis and will be part of the future analytical work for the Global Center on Adaptation in coming years.

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