COMBATTING CLIMATE CHANGE

An urgent call for comprehensive global and local action

Africa can play a leading role in the fight against climate change

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At the end of this year, world leaders are expected to come forward with updated, more ambitious national climate plans under the Paris Agreement. Though buried deep within the legalese of the Paris Agreement, this point of process is both a critical test and a once-in-a-lifetime opportunity.

Research from the New Climate Economy shows that bold climate action could deliver at least $26 trillion in global economic benefits between now and 2030. It could also generate over 65 million new low-carbon jobs by 2030, a number equivalent to the combined workforces of the United Kingdom and Egypt today; avoid over 700,000 premature deaths from air pollution compared with business-as-usual; and generate an estimated $2.8 trillion in government revenues in 2030 through subsidy reform and carbon pricing alone.[1]

Delivering the benefits of a new climate economy requires ambitious action across key economic systems, creating the conditions for the phase-out of coal and rapid scale-up of renewables in the energy sector; investing in shared, electric, and low-carbon transport in cities; scaling up sustainable food and land use systems, including forest landscape restoration; targeting investment to resilient water infrastructure; and reducing emissions from key industrial value chains, such as plastic.

However, if the world fails to step up climate action, continuing on our current climate trajectory could force 100 million people into extreme poverty by 2030.[2] Africa is the most-exposed region to the adverse effects of climate change despite contributing the least to global warming.

The region is already disproportionately feeling the impacts related to a changing climate. Devastating cyclones affected 3 million people in Mozambique, Malawi, and Zimbabwe in the spring of 2018.[3] GDP exposure in African nations vulnerable to extreme climate patterns is projected to grow from $895 billion in 2018 to about $1.4 trillion in 2023—nearly half of the continent's GDP.[4]

If fairness was the only goal, the impetus to act would lie solely with developed economies. Make no mistake, the big emitters absolutely must step up their domestic climate action, and quickly. But building the new climate economy is also a once-in-a-lifetime opportunity that every African nation should prioritize and claim a stake in.

This opportunity is why, despite historically negligible carbon emissions, despite only accounting for 2 percent of world coal demand, and despite the lack of leadership from some developed countries, many African countries are now making serious efforts to transition

1 Global Commission on the Economy and Climate, *Unlocking the Inclusive Growth Story of the 21st Century: Accelerating Climate Action in Urgent Times* (Washington D.C.: New Climate Economy, 2018).

2 Stephen Hallegatte et al., *Shock Waves: Managing the Impacts of Climate Change on Poverty* (Washington D.C.: World Bank, 2016).

3 Mark Yarnell and Devon Cone, *Devastation and Displacement: Unprecedented Cyclones in Mozambique and Zimbabwe a Sign of What's to Come?* (Washington D.C.: Refugees International, 2019).

4 Abdi Latif Dahir, "Africa's fastest-growing cities are the most vulnerable to climate change globally," *World Economic Forum*, December 21, 2018.

towards low-carbon technologies, low-carbon and resilient infrastructure, and low-carbon tax systems.

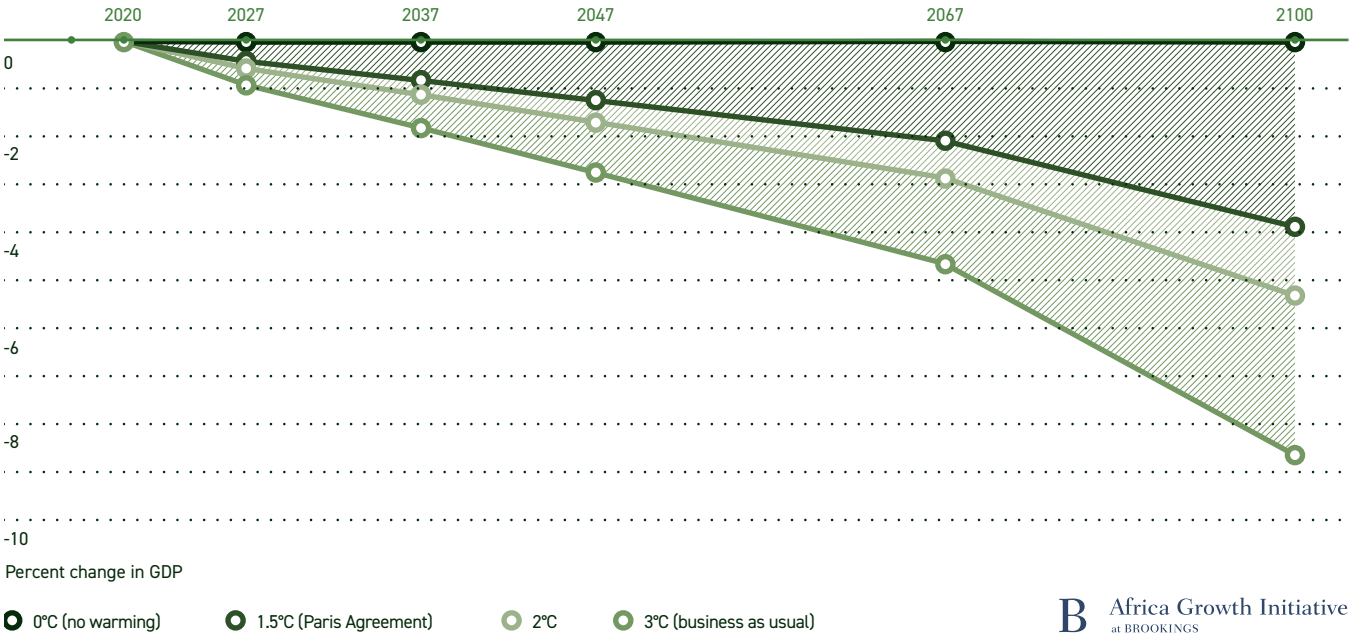
Morocco has built the world's largest concentrated solar facility to help achieve the country's goal of 52 percent renewable energy mix by 2030. The advanced 6,000-acre solar complex, Noor, serves as a clean energy source for around 2 million Moroccans, and provides pivotal job opportunities as the country transitions away from the fossil fuel industry.[5] The solar complex is also offering training programs for women for entrepreneurial and agricultural activities and is recruiting women in decision-making roles to guide project activities.[6]

South Africa's Carbon Tax Act, which places specific levies on greenhouse gases from fuel combustion and industrial processes and emissions, came into effect in June 2019.[7] By 2035, the carbon tax could reduce the country's emissions by 33 percent relative to the baseline.[8] Furthermore, South Africa's recent renewable energy auctions have led to solar and wind prices lower than those of the national utility

Figure 4.1

The impact of climate change on sub-Saharan Africa's GDP

Climate change is predicted to significantly decrease Africa's GDP through mechanisms such as lowered crop yields, reduced agricultural and labor productivity, and damage to human health. Assuming no major changes in the world's social, economic, and technological trends, climate change resulting in a 3°C temperature increase will decrease Africa's GDP by as much as 8.6 percent per year after 2100. If climate change is limited to the 1.5°C agreed to in the Paris Agreement, the decrease in GDP will be significantly less—only 3.8 percent per year after 2100.



Source: Tom Kompas, Van Ha Pham, and Tuong Nhu Che, "The Effects of Climate Change on GDP by Country and the Global Economic Gains From Complying With the Paris Climate Accord," Earth's Future 6, no. 8 (2018): 1153-73.

5 Climate Investment Funds, "Solar plant the size of San Francisco powers Morocco's sunlit ambitions," *Climate Home News*, January 22, 2019.

6 African Development Bank, *Ouarzazate Solar Complex Project – Phase II (NOORo II and NOORo III Power Plants)* (Abidjan: African Development Bank, 2014).

7 Republic of South Africa, *Act No. 15 of 2019: Carbon Tax Act, 2019* (Cape Town: Government of South Africa, 2019).

8 Sifiso M. Ntombela, Heinrich R. Bohlmann, and Mmatlou W. Kalaba, "Greening the South Africa's Economy Could Benefit the Food Sector: Evidence from a Carbon Tax Policy Assessment," *Environmental and Resource Economics* 74, no. 2 (2019): 891-910.

or from new coal plants.[9] Often regarded as the continent's clean energy trailblazer, much of what has been learned through South Africa's renewable energy procurement process can influence similar developments across Africa.

My own country, Nigeria, which struggles with electricity access for a majority of its population, has set a renewable energy target of 30 percent by 2030.[10] This goal underscores the potential for both grid-based and decentralized renewable energy investments to deliver energy access and climate change benefits simultaneously. Notably, off-grid solutions—like M-Kopa and Lumos that deliver electricity to thousands of households on the continent—and mini-grids are important options in both unserved rural areas and underserved urban areas. Natural resource-rich African countries, like Nigeria, should see renewables as a central part of achieving universal energy access while setting themselves on a pathway for low-carbon and resilient development.

The biggest energy companies see this future too and are working to diversify their global portfolios. As of September 2019, the world's major oil companies had made about 70 clean-energy deals, putting them on track to surpass the total for 2018.[11] Shell, for instance, has invested in SolarNow, which sells high-quality solar solutions in Uganda and Kenya. Since its inception in 2011, SolarNow has supplanted 210,000 tons of greenhouse gas emissions.[12] More African countries should insist upon being recipients of this 21st century investment.

While the private sector is driving the shift into renewables, state-owned enterprises (SOE) in the energy sector—in Africa and globally—are lagging behind.[13] African governments need to support reform in the SOE sector by, for example, introducing competitive procurement for electricity supply. This strategy could open African institutions and markets to emerging opportunities in the renewable sector, and even drive down the price of renewables.[14] Efforts such as South Africa's Renewable Energy Independent Power Producer Procurement (REIPPP) program and the World Bank and International Finance Corporation's Scaling Solar program have resulted in solar prices as low as $0.05/kilowatt-hour.

With an abundance of solar, wind, and geothermal resources, African countries already have a comparative advantage in renewables. The falling costs of green technologies provide a propitious moment to be on the delivery end of the new energy revolution. And while it may seem counterintuitive, Africa's most oil- and gas-rich countries should be leading the energy revolution. Beyond the energy sector, food and land use systems—including the agriculture and forestry sectors—are integral to sub-Saharan Africa's economy, accounting for 70 percent of livelihoods

> Whether driven by opportunism or a sense of moral justice, the world's developed and emerging economies must take action at home and help Africa deliver the investments that will bring the goals of the Paris Agreement within reach.

9 "Advancing Africa with Renewable Energy Auctions," *International Renewable Energy Agency*, May 16, 2018.
10 Jan Corfee-Morlot et al., *Achieving Clean Energy Access in Sub-Saharan Africa* (Paris: OECD/Financing Climate Futures, 2019).
11 Timothy Abington and Kelly Gilblom, "Shell Leads Big Oil in the Race to Invest in Clean Energy," *Bloomberg*, September 4, 2019.
12 See https://www.solarnow.eu.
13 Andrew Prag, Dirk Rottgers, and Ivo Scherrer, "State-Owned Enterprises and the Low-Carbon Transition," *OECD Environment Working Papers* 129 (2018).
14 Andrew Herscowitz, "The Unintended Consequences of Falling Solar Prices in Africa," *Medium*, May 23, 2018.

and almost one-quarter of regional GDP. In fact, new business opportunities in sustainable food and land use systems could deliver $320 billion each year by 2030 across sub-Saharan Africa.[15] These opportunities include $120 billion in forest ecosystem services and restoration of degraded land, $100 billion in increased agricultural yields, and $100 billion in supply chain efficiency improvements and enhanced value-adding capacity. Concerted landscape restoration efforts in Ethiopia's Tigray region, for example, are enhancing farmers' resilience, water availability, and livelihoods.[16] Such sustainable food and land use approaches can deliver multiple co-benefits, from reducing rural poverty, to boosting food security and improving population health, to protecting and regenerating natural capital.

Africa's transition to a new climate economy is underway in many places. The question is: Will developed countries create a tail-wind or a head-wind? How they answer this question will determine whether Africa is positioned to fully capitalize on this opportunity. While it may not be polite to say so, African countries need money—both to build a cleaner more prosperous future for themselves and to avoid the worst impacts of climate change created largely by others.

The pending replenishment of the Green Climate Fund (GCF) acts as both a mechanism and a barometer for this challenge. The good news is that in October 2019, 27 countries confirmed their pledge to the GCF's replenishment, bringing the total raised so far to $9.7 billion.[17] The GCF is critical for maintaining momentum behind the Paris Agreement by supporting developing countries to enhance their climate action. But, so far, some major contributors have been silent. We need to hear from them.

African leaders cannot do this alone. And nor should they. Whether driven by opportunism or a sense of moral justice, the world's developed and emerging economies must take action at home and help Africa deliver the investments that will bring the goals of the Paris Agreement within reach.

15 Food and Land Use Coalition, *People, Health and Nature: A Sub-Saharan African Transformation Agenda* (London: Food and Land Use Coalition, 2019).
16 Cathy Watson, "Landscape restoration in Ethiopia brings watershed to life," *Agroforestry World*, June 6, 2017.
17 "Countries step up ambition: Landmark boost to coffers of the world's largest climate fund," *Green Climate Fund,* October 25, 2019.

Viewpoint

Confronting the challenges of climate change on Africa's coastal areas

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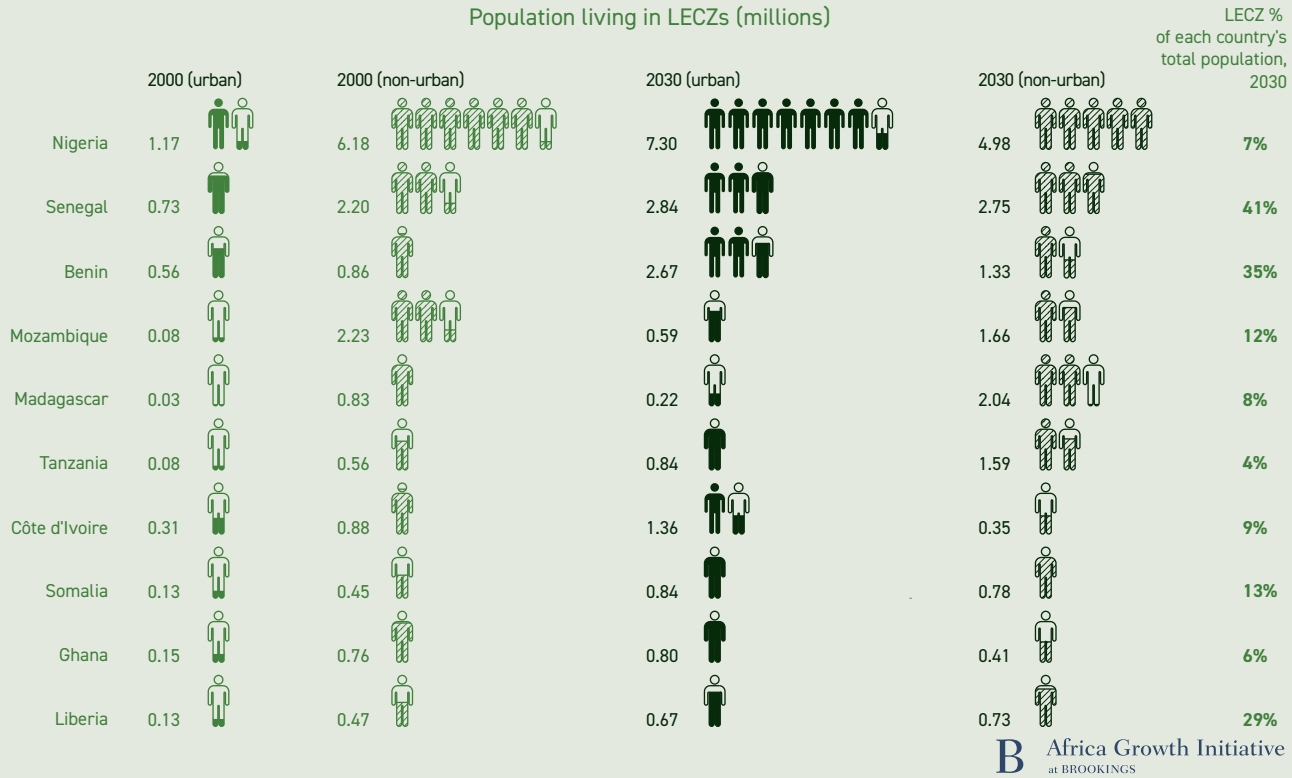
Climate change will undoubtedly present one of the most significant risks to Africa's sustainable development objectives over the next decade, and nowhere is the threat more imminent than on its coastlines. Indeed, recent estimates show that sea levels could rise 100 cm by 2100,[1] further compounding the many hazards threatening the region.

1 Robert J. Nicholls et al., "Sea-level scenarios for evaluating coastal impacts," *WIREs Climate Change* 5, no. 1 (2014): 129-150.

Figure 4.2

Population in low-elevation coastal zones by 2030

The number of Africans living in low-elevation coastal zones (LECZs) is projected to significantly increase by 2030, particularly due to high rates of population growth and urbanization in coastal zones. Coastal population growth is projected to be highest in East and West Africa. This rapid coastal development could exacerbate the already high levels of vulnerability of many coastal African countries.



Note: The projections for the additional population that will live in LECZs in 2030 are based on a scenario where Africa's population reaches 1.6 billion; global economic growth is high; and political, social, and economic governance is exclusive, with limited benefits for the very poor.
Source: Barbara Neumann et al., "Future Coastal Population Growth and Exposure to Sea-Level Rise and Coastal Flooding - A Global Assessment," PLoS ONE 10, no. 3 (2015).

Particularly worrisome is that demographic trends are interacting with climate change in coastal areas, generating a unique set of development challenges. Coastal areas in Africa, like elsewhere in the world, tend to be more densely populated due to the economic opportunities there. For example, in Nigeria's low-elevation coastal zones (LECZs),[2] the population density is 491 inhabitants per km^2, compared with 134 inhabitants per km^2 nationally.[3] By some estimates, Africa's populations in LECZs will rise at an annual rate of 3.3 percent between 2000-2030, which is more than double the world's average. In many cases, individual countries will experience even more extreme changes: For example, in Senegal, the share of the LECZ population is projected to skyrocket to 50 percent by 2060, up from 20 percent in the early 2000s.

As sea levels rise, so too does the likelihood that the success of these burgeoning regions will be washed away as food production will decrease, access to clean water will be curtailed, catastrophic storms will become more prevalent and more harmful, acidification will spread, and the region's already limited ability to mitigate these and related disasters will falter.

2 LECZs are areas located at an elevation level of 10 meters or less above mean sea level.

3 Henrike Brecht et al., "Sea-Level Rise and Storm Surges: High Stakes for a Small Number of Developing Countries," *The Journal of Environment and Development* 21, no. 1 (2012): 120-38.

Extreme weather events will become less predictable and more damaging

By substantially increasing sea surface temperature, climate change brings about more violent cyclone activity and storm surges on coastlines, generating higher wind speeds and heavier precipitation, which make disaster forecasting, preparedness, and management more challenging. Indeed, an increase in the temperature of tropical sea surface by 1°C increases wind speed by 3 to 5 percent.[4]

About 30 million Africans live within the flood hazard zone around the Atlantic and Indian Oceans, out of which 2 million are likely to be flooded ***each year***. Abidjan is a case in point: It is ranked among the world's top 20 cities in term of population exposure to floods, and its asset exposure is similarly high at $42 billion.[5]

Natural defenses to extreme events will erode

Mangroves offer an effective buffer against coastal vulnerability to storm surges by obstructing the flow of water and hence attenuating inundation. Therefore, they can play the same role as infrastructure designed to protect coastal areas from such extreme events as storm surges and cyclones. Notably, mangrove rehabilitation projects can be two to six times cheaper than other protection infrastructure. However, mangroves have varying tolerance to salinity, depending on the species. Flooding, deforestation, and increases in ocean surface temperature that raise the salinity of inland water are increasingly putting mangroves in jeopardy and further weakening the already fragile adaptive capacity of African coastlines. According to some estimates, vulnerable populations exposed to the risk of mangrove destruction are projected to increase by 103 percent and losses in GDP by 233 percent from the baseline scenario.[6]

Increased salinity will cause clean water availability to dry up and infrastructure to falter

Beyond its damaging effects on mangroves, saltwater intrusion into inland coastal areas negatively impacts river salinity, hence available drinking and irrigation water, making both off-season agriculture and freshwater fishing more challenging. Saline water intrusion into inland water also increases the risk of high blood pressure in pregnant women and increases infant mortality.[7] Africa's already weak infrastructure will also suffer, as salinity stemming from sea-level rise impacts roads through land subsidence, progressive blistering, cracking, and pulverization, resulting in higher maintenance costs.

Food production will suffer

In Africa, artisanal fishing is a predominant economic activity. For example, in Ghana, 2.2 million people depend on fishing for their livelihoods, including nearly 125,000 artisanal fishermen.[8] Rises in water temperature and acidification levels damage many fish species' physiology, including their

4 Ibid.

5 Nicholls, "Sea-level scenarios"

6 Brian Blankespoor, Susmita Dasgupta, and Glenn-Marie Lange, "Mangroves as protection from storm surges in a changing climate," *Ambio* 46, no. 4 (2017): 478-91.Susmita Dasgupta et al., "Facing the Hungry Tide: Climate Change, Livelihood Threats, And Household Responses in Coastal Bangladesh," *World Bank Policy Research Working Paper* 7148 (2014).

7 Susmita Dasgupta, Mainul Hug, and David Wheeler, "Drinking Water Salinity and Infant Mortality in Coastal Bangladesh," *World Bank Policy Research Working Paper* 7200 (2015).

8 "Safety and Sustainability for Small-Scale Fishers in West Africa," *World Bank, May 16, 2016.*

size and reproductive capacity, and, therefore, their market value. Relatedly, changes in water temperature cause species to migrate and diminish the number and size of catches. Indeed, local fishermen in West Africa have, in recent years, reported that some types of previously abundant fish are increasingly scarce, even disappearing.[9] For example, the sardinella fish species, which used to be highly abundant in Senegalese sea waters have now disappeared.[10]

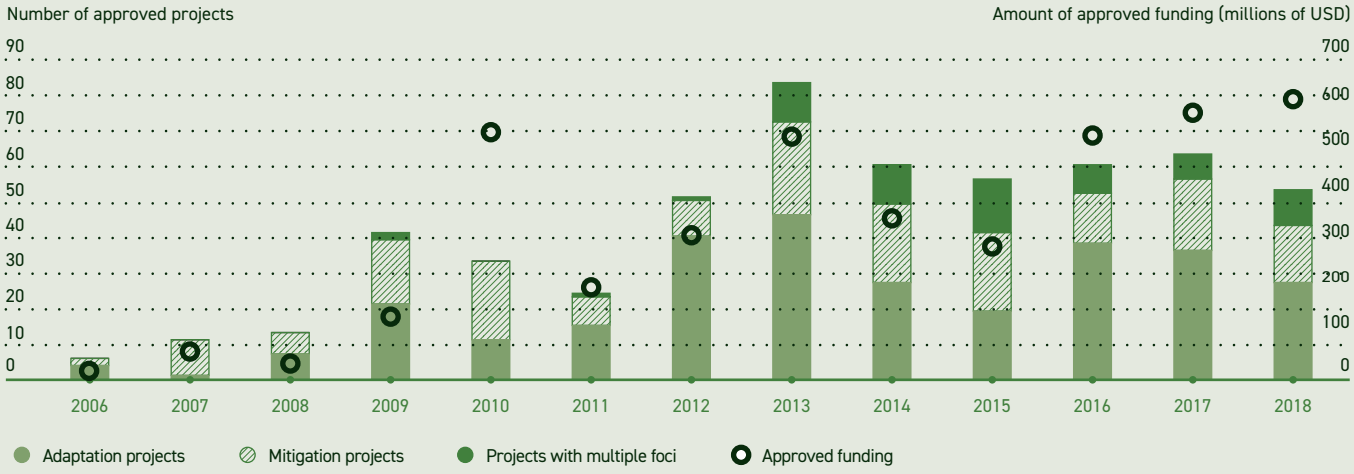
Strategies for adaptation and financing

Adaptation is paramount for withstanding the effects of climate change, especially since inaction will be costlier. Estimates show that adaptation costs range from less than 5 percent (in Niger) to 60 percent (in Kenya) of the costs of inaction.[11] Crucial strategies for adaptation include infrastructure construction and maintenance, beach nourishment, and diversification away from activities vulnerable to climate change. If governments undertake some of these strategies, population exposed to flooding could be halved by 2100.[12] Without adaptation, the annual costs related to flooding alone could range between $5 billion and $9 billion.[13]

Figure 4.3

Financing projects for adaptation to and mitigation of climate change

The number of climate change-related projects in Africa has significantly increased since 2006, from only 6 projects approved to a peak of 83 projects approved in 2013. Funding peaked in 2018, when a total of $612.6 million of funding for 53 projects was approved to address climate change on the continent. Since 2006, the greatest increase has been in projects dedicated to adaptation—the process of adjustment to actual or expected climate and its effects.



Source: "Climate Change: OECD DAC External Development Finance Statistics," OECD, 2017.

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9 Ibrahima Ly, Ahmadou Aly Mbaye, and Papa Gora Ndiaye, *Gestion des risques induits par le changement climatique dans la pêche artisanale en Afrique de l'Ouest* (Dakar: GIZ, ENDA, University of Dakar, and REPAO, 2017).

10 Timothee Brochier et al., "Complex small pelagic fish population patterns arising from individual behavioral responses to their environment," Progress in Oceanography 164 (2018): 12-27.

11 Ephraim Nkonya et al., "Economics of Land Degradation: The Costs of Action versus Inaction," *IFPRI Issue Brief* 68 (2011).

12 Paul Watkiss, Thomas E. Downing, and Jillian Dyszynski, *AdaptCost Project: Analysis of the Economic Costs of Climate Change Adaptation in Africa* (Nairobi: United Nations Environment Program, 2010).

13 Jochen Hinkel et al., "Sea-level rise impacts on Africa and the effects of mitigation and adaptation: An application of DIVA," *Regional Environmental Change* 12, no. 1 (2012): 207-224.

A key challenge to the implementation of adaptation strategies in Africa is financing. Costs of adequate adaptation could reach $300 billion for Africa,[14] plus $3 billion per year for maintenance—numbers that sharply contrast with the limited resources currently devoted to adaptation in Africa. While developed countries have pledged to double funding for adaptation projects over the 2014-2020 period, the cumulative funding flowing to developing counties reached only $4.4 billion in 2018, with around 43 percent of this amount going to Africa.[15] Scaling up financing to adaptation is critical to avoid further disrupting already fragile economic and social infrastructure. Notably, financing adaptation must not use the same pipeline and modalities as standard official development assistance. So far, climate funding is highly unpredictable and depends solely on the good will of donor countries. Considering the increasingly robust scientific evidence linking levels of emission to economic losses, health, peace, and security in Africa, the "polluter pays" principle should be used to channel funds for adaptation financing in African countries. This funding should be specifically earmarked to climate change-related projects to ensure that investments are fast-tracked, and that disaster responses are timely and effective.

14 Ibid.
15 Charlene Watson and Liane Schalatek, "Climate Finance Thematic Briefing: Adaptation Finance," *Climate Finance Fundamentals* 3 (2019).

Viewpoint

Policy priorities for achieving food and nutrition security by 2030

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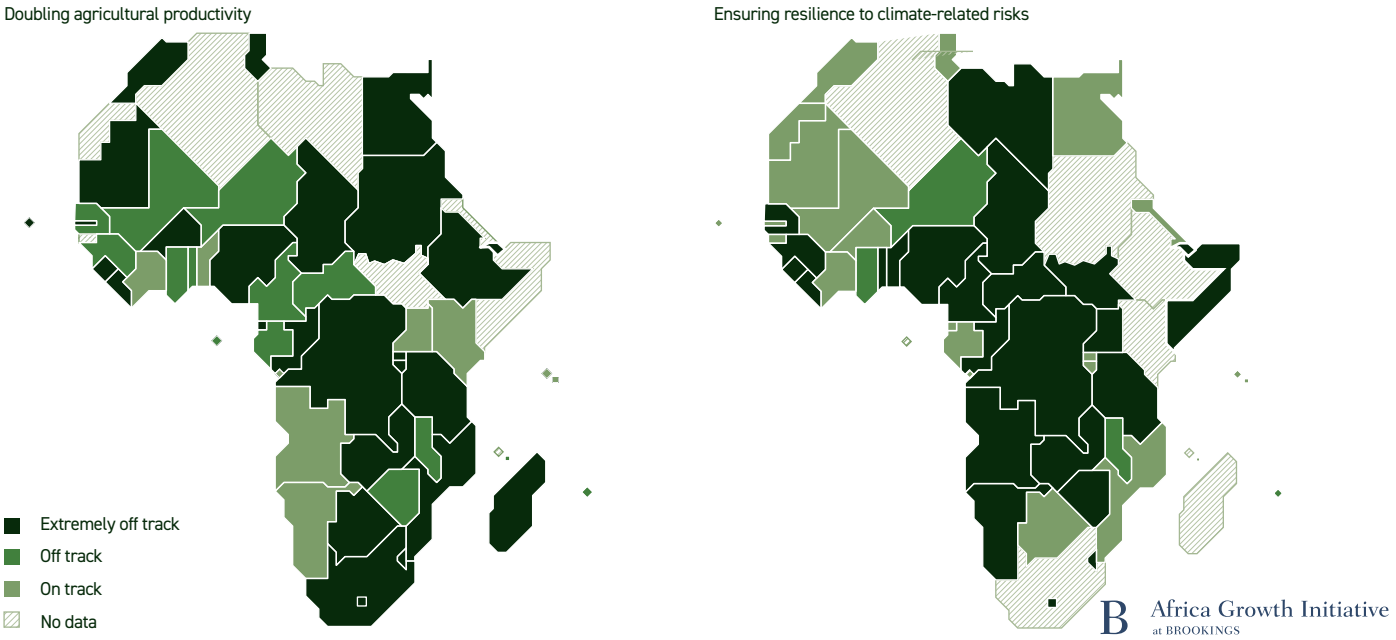
A key priority for Africa over the next decade should be to address a deteriorating food security situation that is compounded by the effects of climate change, declining agricultural productivity, and rapid population and urbanization growth. Encouragingly, this priority is reflected in initiatives shared by Africa and the world. Already, the African Union member states are committed to ending hunger by 2025 under the Comprehensive Africa Agriculture Development Program (CAADP). Similarly, United Nations Sustainable Development Goal 2 calls for ending hunger and all forms of malnutrition by 2030. Despite these and other commitments, though, progress has been modest with only 9 out of 55 African countries currently on track to reduce undernutrition to 5 percent or less by 2025. This insufficient progress underscores the need to redouble efforts. Going forward, policy priorities centered around leveraging science and digital technology, and addressing fragility hold the greatest promise.

Figure 4.4

Improving food and nutrition security depends on increasing agricultural productivity and resiliance

Progress in agriculture and food security in Africa remains modest: Only seven countries are on track to meet the Comprehensive Africa Agriculture Development Program (CAADP) goal of doubling agricultural productivity by 2025, and only 19 are on track to ensure resilience to climate-related risks. Furthermore, only two countries—Côte d'Ivoire and Seychelles—are on track to reach both of these goals.



Source: African Union, Inaugural Biennial Review Report of the African Union Commission on the Implementation of the Malabo Declaration on Accelerated Agricultural Growth and Transformation for Shared Prosperity and Improved Livelihoods (Addis Ababa: African Union, 2018).

Leveraging science to adapt agriculture to climate change: Climate change is already affecting agricultural production in Africa, and future projections suggest even worse outcomes. The frequency of droughts has dramatically increased, from an average of once every 12.5 years over 1982-2006 to once every 2.5 years over 2007-2016. These droughts have also become more severe and prolonged, diminishing the productive capacity of the land. Farmers face other climate risks, including lower and erratic rainfall, shorter rainy seasons, and a higher incidence of pests and diseases.[1] By some estimates, Africa could face a near double-digit reduction in crop yields and production volumes over the next decade, as well as rising food prices by similar margins (Figure 4.5).[2] The impacts of these and other indicators are projected to be even larger by 2080.

In places where climate-smart agriculture is practiced today, farmers are seeing increased food security and resilience. In Rwanda, for example, the Land Husbandry, Water Harvesting, and Hillside Irrigation project has helped control erosion, intensify yields on existing land, and provide greater protection from droughts. Under this program, maize yields increased 2.6 times between 2009 and 2018, with even larger increases for beans, wheat, and potatoes.

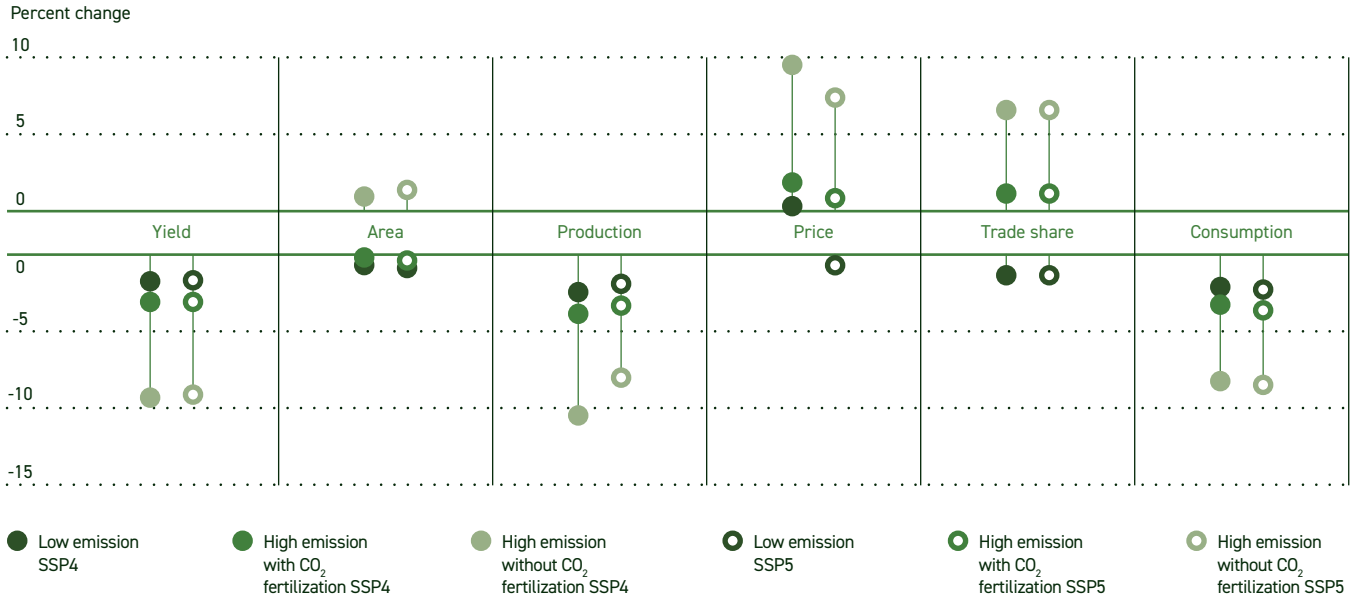
1 Stephane Hallegatte et al., *Shock Waves: Managing the Impacts of Climate Change on Poverty* (Washington, D.C.: World Bank, 2016).

2 Petr Havlik et al., "Climate Change Impacts and Mitigation in the Developing World: An Integrated Assessment of the Agriculture and Forestry Sectors," *World Bank Policy Research Working Paper* 7477 (2015).

Figure 4.5

Estimated effects of climate change on crop production, prices, trade and consumption in Africa, 2030

Crop yields and production volumes in Africa are likely to take a hit as climate change intensifies. The figure shows two alternative plausible future scenarios, known as "Shared Socioeconomic Pathways," or SSPs. Under SSP4, emissions can be kept low through development of new technologies but least advanced countries experience very limited growth, and a significant rise in inequality increases the poorest regions' vulnerability to climate change. SSP4 is also characterized by decreased collaboration between regions of the world. Under SSP5, there is much more investment in human capital as well as a decrease in inequality and vulnerability to climate change. In this case, though, high economic growth is based on conventional technologies with high carbon and resource intensities, which increase the challenge for mitigation. International cooperation is high and characterized by strong trade relations. However, a lack of environmental consideration leads to patterns of consumption putting higher pressure on natural resources, particularly in terms of diets. Estimates by Havlik et al. (2015) find that, by 2030, Africa could face an up to 8 percent reduction in crop yields and production volumes with prices possibly rising by more than double digits. The impacts on these and other indicators are projected to be even larger by 2080.



Source: Havlik et al., "Climate Change"

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In Senegal, the West Africa Agricultural Productivity Program has developed new high-yielding, early-maturing, drought-resistant varieties of crops such as sorghum, millet, groundnuts, and cowpeas. These varieties are being widely disseminated to farmers and have raised yields by an average of 30 percent, even with less and more erratic rainfall. Despite the late onset of rains in 2014, with only half the average total rainfall, yields for farmers of improved sorghum and millet varieties increased.

Science offers enormous potential to provide sustainable solutions for food security, including innovations to improve adaptation to climate change, science-based management of productive resources (land, soil, and water), and the storability and transportability of foods to reduce food waste and loss. Leveraging science effectively requires the translation of scientific solutions into packages that can be disseminated and adopted by farmers at scale, both at the farm and landscape levels. This task calls for effective linkages between international, regional, and national science organizations with farmers and extension systems. The solutions should be co-generated between researchers and farmers so that local resilience challenges can be addressed in a demand-driven and knowledge-intensive manner.

Harnessing digital technologies: Sorely needed extension services, which impart new skills to farmers and enhance labor and land productivity, currently are often inadequate and may not always respond to farmers' changing needs—and so digital technologies can help.[3] Digital tools for monitoring climate risks can identify the onset of climatic shocks before they happen, and facilitate responses for building resilience. Automated irrigation systems, soil sensors, and drones can boost the efficiency of production. Digital tools can enhance food availability and accessibility, as well as improve food utilization and safety through effective monitoring of food hazards. E-commerce platforms can integrate smallholder farmers into value chains and enable them to eliminate the transaction costs of locating demand, determining prices, and improving efficiency in service delivery.

There are several examples from across the globe that highlight the role of technology in transforming the lives of farmers. For example, today, through Hello Tractor, which connects tractor owners with farmers over text message, farmers in Nigeria, Ghana, and Kenya can seamlessly rent machines that they previously had to buy or could not access at all. Over 500,000 farmers have been reached with tractor services. About 60 percent of the farmers report higher productivity and more than 90 percent report overall improvement in quality of life. Platforms such as Digital Green or Plantix can dramatically increase agricultural productivity by making it easier for farmers to acquire new skills for monitoring the quality of their crops. Plantix provides a diagnostic and monitoring tool that allows users to share pictures of sick plants, identify diseases, pests, and nutrient deficiencies, and then send the information back to the community. Such technologies directly help improve productivity along the food value chain.

Preventing fragility and addressing its consequences on food security: The prevalence of undernutrition is about twice as high in conflict-affected areas. The effects of conflicts on food security include disruption of agricultural production activities at the farm level, disruption of post-harvest management functions such as marketing and storage, and the weakening of the ability of poor households to recover from shocks. Conflicts create stress on local and national institutions, leading to weak delivery of agricultural services and public infrastructure and low investments at the farm level and in downstream parts of the food system.

Africa cannot address food insecurity without addressing the agriculture-related drivers of conflict and fragility and their consequences. In this context, there is need to manage competition for natural resources in fragile areas, especially between herders and crop farmers. Fragile and conflict-affected areas can be difficult to reach for outsiders. Therefore, it is important to build capacity in local institutions to enable design and implementation of community-based approaches.

Despite the challenges of climate change and state fragility in parts of Africa, the continent has the potential to not only achieve food and nutrition security, but to leverage the food sector for its overall development.

3 The possibilities are comprehensively reviewed in World Bank, *The Future of Food: Harnessing Digital Technologies to Improve Food System Outcomes* (Washington, D.C.: World Bank, 2019).