Africa’s Development in a Changing Climate

Key policy advice from
World Development Report 2010
and Making Development Climate Resilient: A World Bank Strategy for Sub-Saharan Africa

Act Now, Act Together, Act Differently
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Over the past ten years, Sub-Saharan Africa has made a great deal of progress in terms of economic growth. In fact, Africa has the potential to emerge as an exciting new center of growth in the evolving global economy. However, to continue on an accelerated growth path, the region needs to tackle climate variability and climate change, which now pose a daunting risk to growth, development, and poverty reduction. Climate is hardly a new factor in the region’s history, but with global warming, Africa’s vulnerability is deepening, making it the most exposed region in the world to the impacts of climate change. The hard-won progress of recent years could be reversed with extreme weather, crop failures, and outbreaks of hunger and disease. Here is a snapshot of why urgent action is needed in the region, particularly on the adaptation front.

The impacts of Africa’s changing climate

**Natural fragility.** Two-thirds of Sub-Saharan Africa’s surface area is desert or dry land, and the region is also home to many fragile terrestrial and coastal ecosystems. Climate projections for Africa presented in the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC 2007) include a likely average temperature increase of 1.5 to 4°C in this century, which is higher than the global average. Anticipated changes in rainfall patterns will be accompanied by an increase in droughts and floods, and sea level rise. Devastating floods have been reported across Sub-Saharan Africa. Flooding in Mozambique in 2000 cost the country an estimated $550 million, lowering national GDP by 1.5 percent.

**Agriculture, food security, and energy.** Rainfed agriculture—the main safety net of poor people in rural areas—employs about 70 percent of the population. Southern Africa will suffer particularly severe drops in yields by 2030 without adaptation measures. One study projects the almost total disappearance of land in Africa suitable for growing wheat by 2080 (Fischer and others, 2005). In fact, by then, as much as 9 to 20 percent of Sub-Saharan Africa’s arable land will become much less suitable for agriculture. Already, crop failure and livestock death are imposing significant losses. Finally, biomass provides 80 percent of the domestic primary energy supply.

**Water and infrastructure.** Sub-Saharan Africa has insufficient infrastructure, even relative to existing needs. There are few water control systems and not much water storage capacity, despite relatively abundant resources. Most rivers cross more than one country, necessitating effective cooperation across borders. Africa’s 63 transboundary river basins together account for 90 percent of its surface water resources. Poorly developed transport, energy, information and communication systems may also hinder adaptation. Also, the region’s rapidly urbanizing population is vulnerable because of ill-defined property rights, weak land use planning, and informal settlements often on land subject to erosion or flooding. Nearly three-quarters of the region’s urban population lives in slums, and the vast majority of the 300 million additional urban residents expected in Africa over the next 25 years may also be faced with similar living conditions.
Health and education. The reach of some diseases is changing as temperature increases. Malaria, already the biggest killer in Sub-Saharan Africa, is spreading to higher altitudes. Climate change is expected to expose 90 million more people in Africa to malaria by 2030—a 14 percent increase (Hay and others, 2006). It also has indirect effects on health through water and sanitation, ecosystems and human habitation. Children will be increasingly susceptible to malnutrition and diarrheal diseases. One study in Ghana estimates the costs associated with malnutrition and diarrheal diseases to be as high as 9 percent of GDP after accounting for long-term productivity losses. Further research in Côte d’Ivoire linking rainfall patterns and children’s education shows that in regions with greater-than-usual weather variability, school enrollment rates declined by 20 percent for both boys and girls (Jensen, 2000).

Conflict. Armed conflict further complicates climate change risk management. For poor people living in weak or unstable states, climate change will deepen suffering, and intensify the risks of mass migration, violent conflict, and further fragility. Young children exposed to drought and civil strife in Zimbabwe suffered from a loss of stature of 3.4 cm, nearly one less grade of schooling, and nearly six months’ delay in starting school. The estimated negative effect on lifetime earnings was 14 percent (Alderman, Hoddinott, and Kinsey, 2006).

Need for “climate-smart” policies

As the World Bank’s World Development Report (WDR) 2010: Development and Climate Change says, lives and livelihoods can be preserved and improved if we act immediately and collaboratively to protect past gains; ensure that future development is climate-resilient; help people to adapt to new weather patterns and cope with extreme events; find new economic opportunities in a changing climate; and work toward meeting energy needs sustainably.

Climate change has made growth and poverty reduction more complicated and difficult, but it also presents tremendous opportunities. “Climate-smart” policies of the future would, for instance, pay more attention to land and water management and diseases like malaria—steps which would be good for growth and prosperity. There is a growing realization that the cost of building climate resilience into existing development programs is far less than the cost of emergency relief, rehabilitation, and recovery associated with disasters.

While Africa accounts for only 4 percent of global carbon dioxide emissions, more than 60 percent of the region’s emissions are due to deforestation and land degradation. Therefore, with improved land, water and forest management practices, mitigation and adaptation go hand in hand for Africa.

Sub-Saharan Africa could leapfrog past outdated technologies and move forward with untapped hydropower, wind power, solar power, and other renewable sources of energy. The region has only utilized 8 percent of its hydroelectric power potential, compared, for example, to 30 percent in Latin America.

To discuss development in a changing climate, visit the World Bank’s climate change blog: http://blogs.worldbank.org/climatechange
The Global Context: A Crisis of the Commons

Nobody is immune to climate change, regardless of where they live, or whether they contributed to it. In fact, climate change is nothing short of a crisis of the commons, and tackling it effectively will require all the ingenuity and collaborative spirit of the human race. As countries meet in December 2009 in Copenhagen to shape a new international response to climate change, the price of delay or inaction appears very high.

WDR 2010 notes that developing countries everywhere—from Africa to Asia to Latin America—will be disproportionately affected by the climate crisis. The developing world already faces greater climate risks, even as it is preoccupied with trying to help one in four people living in extreme poverty, over a billion hungry, and 1.6 billion without access to electricity. Attaining the Millennium Development Goals and ensuring a safe and sustainable future beyond 2015 become more difficult as the planet warms, rainfall patterns shift, and climate-related natural disasters become more frequent.

Global warming of 2°C above pre-industrial temperatures could result in permanent reductions in annual per capita consumption of 4 to 5 percent for Africa (Nordhaus & Boyer, 2000; Stern, 2007). These losses would be driven by impacts on agriculture. WDR 2010 argues that the world must act now, act together, and act differently, before costs go up and avoidable hardships are needlessly endured by poor and vulnerable people.

Act now

The world has a brief window of time in which to find the technologies and the funds to combat climate change. What we do today shapes tomorrow’s climate and imposes limits on the choices that are available to future generations.

- Staying close to 2°C—likely to be the best that can be done—requires a global energy revolution with an immediate deployment of energy efficiency and available low-carbon technologies, and massive investments in new technologies. Once greenhouse gases are emitted, they remain in the atmosphere for decades or even centuries, trapping heat and affecting climate patterns for a very long time. Power plants, cities, and reservoirs that we build today will last for at least fifty years.

- New technologies and climate-resilient crop varieties that are piloted today could determine the energy and food sources of growing populations in many developing countries.

- Acting now could help save the 10 to 15 percent of species that will otherwise likely be lost in an Africa that is 2°C warmer than pre-industrial levels (Parry and others, 2007).

Act together

Rich countries must take the lead by reducing their own carbon footprints at home and by helping developing countries to finance adaptation to climate change as well as mitigate further global warming.

- As the graph opposite shows, actions by rich countries to adopt ambitious targets could free up some “pollution space” for the unmet energy needs of millions of people.
in developing countries. Strong action by rich countries would stimulate innovation and demand for green technologies that can be rapidly scaled up. This would also help create a sufficiently large and stable carbon market.

- National and international support is essential to protect the most vulnerable people through social assistance programs, to develop international risk-sharing arrangements, and to promote the exchange of knowledge.
- In Africa, disaster risk reduction and climate change adaptation should largely be managed as one integrated agenda.
- Africa’s transboundary rivers are an example of why cooperative action is critical to manage the water and food security challenges posed by climate change and population pressures.

### Act differently

Instead of planning for yesterday’s climate, policymakers must heed a variety of climate futures.

- Agricultural productivity and water management need to improve to feed millions more people while protecting already stressed ecosystems. Long-term, large-scale integrated management will help meet increased demands on natural resources while conserving biodiversity and maintaining terrestrial carbon stocks.
- Infrastructure must withstand new extremes and support more people.
- Adaptation should be based on new information about changing patterns of temperature, precipitation, and species.

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**Rebalancing act**

Switching from SUVs to fuel-efficient passenger cars in the U.S. alone would nearly offset the emissions generated in providing electricity to 1.6 billion more people

Emission reductions by switching fleet of American SUVs to cars with EU fuel economy standards.

Emission increase by providing basic electricity to 1.6 billion people without access to electricity.

Estimates are based on 40 million SUVs (sports utility vehicles) in the United States traveling a total of 480 billion miles (assuming 12,000 miles a car) a year. With average fuel efficiency of 18 miles a gallon, the SUV fleet consumes 27 billion gallons of gasoline annually with emissions of 2,421 grams of carbon a gallon. Switching to fuel-efficient cars with the average fuel efficiency of new passenger cars sold in the European Union (45 miles a gallon; see ICCT 2007) results in a reduction of 142 million tons of CO₂ (39 million tons of carbon) annually. Electricity consumption of poor households in developing countries is estimated at 170 kilowatt-hours a person-year and electricity is assumed to be provided at the current world average carbon intensity of 160 grams of carbon a kilowatt-hour, equivalent to 160 million tons of CO₂ (44 million tons of carbon). The size of the electricity symbol in the global map corresponds to the number of people without access to electricity.

Source: WDR team calculations based on BTS 2008.
Exposure to Climate Change Risk

**Floods**

- Low
- Moderate
- High

**Sea level rise**

- Moderate
- High

**Droughts**

- Moderate
- High

**Cyclones**

- Moderate
- High

A Climate Strategy for Africa

With a view to acting now, acting together, and acting differently, the World Bank has a new strategy to make development more climate-resilient in Sub-Saharan Africa. This strategy is grounded in an assessment of the diverse climate profile and vulnerabilities of the region (see maps on the left), and takes into account identified knowledge gaps, expected impacts, work already underway by countries and partners, and key actions to be taken over time. Here is a look at how World Bank support to Sub-Saharan Africa will be mainstreamed into country and regional programs:

**Make adaptation and climate risk management core development elements.** While adapting to climate change and climate variability will push up the cost of development, for most African countries adaptation is fundamentally about sound, resilient development. Key focus areas include: disaster risk reduction; sustainable land, water, and forest management; coastal and urban development; watershed management; increased agricultural productivity; health; and social issues.

**Take advantage of mitigation opportunities.** Most of Sub-Saharan Africa’s mitigation opportunities are linked to more sustainable land and forest management, clean energy use and development (such as geothermal or hydropower), and the creation of sustainable urban transport systems. Some opportunities exist to access carbon finance by reducing emissions from deforestation and forest degradation, and through renewable energy and energy efficiency. This will help African countries to commit to the mitigation agenda while furthering development.

**Focus on knowledge and capacity development.** While there is unequivocal evidence that the climate is changing, there is a lot of uncertainty regarding the pace and extent of change and the impacts on different sub-regions and sectors. This uncertainty makes policy decisions more complex, and magnifies the need for Africa to build its knowledge and analytical base and strengthen the capacity of country and regional institutions for weather forecasting, water resources monitoring, land use information, disaster preparedness, risk management, and planning and coordination.

**Scale up financing.** In addition to IDA’s programmatic financing, incremental financing to build the knowledge base, strengthen institutions, and climate-proof investments will come from both existing instruments — for example, carbon finance, Global Environment Facility (GEF) — and new ones, some of which will help to leverage private investment.

New instruments include:
- the Adaptation Fund of the United Nations Framework Convention on Climate Change (UNFCCC).
- the Climate Investment Funds (Pilot Program for Climate Resilience; Clean Technology Fund).
- two new Carbon Fund instruments — the Forest Carbon Partnership Facility and the Carbon Partnership Facility.
Helping People Help Themselves

Integrating adaptation to climate change into development is a high priority in Sub-Saharan Africa. Climate change threatens to overwhelm local efforts to adapt, and now requires more national and global support. Better management of physical, social, and financial risk will go a long way to assist people, because there is now much more cause for concern. For example, a major storm can cause far worse damage today than in the past, when fewer people lived in coastal areas.

Build climate-smart cities. Sub-Saharan Africa’s urban population is set to exceed the rural by 2030. Moreover, cities and towns face increasing risks from water scarcity and floods, and, in coastal areas, also from sea level rise, even as population pressure is increasing. For example, 40 percent of new rural migrants entering Dakar, Senegal crowd into zones with high relative flood potential. Hazard risk management needs to be mainstreamed into land use planning.

Help people stay healthy. Climate-linked diseases such as malaria are an increasing health burden in Sub-Saharan Africa. Surveillance often fails to anticipate new disease pressure, even as malaria is spreading into urban settlements. Remote-sensing and biosensors can improve the accuracy of testing and prevent disease outbreaks through early detection. New mechanisms are needed for collaboration between health authorities, hydrological and climate surveillance agencies.

Prepare for extreme events. Unless disaster impacts are systematically reduced, Africa’s past development gains will be at risk. Information is urgently needed about where extreme weather events are most likely to happen (for example, flood-risk maps), as well as about changes in land use and demographics. Satellite and GIS technologies provide powerful means to quickly and economically generate physical and socio-economic information.

Provide layers of insurance protection. Risk management should be based on layered responsibilities. A minor drought can be managed by households through community-based risk sharing. A more severe one can be managed through risk transfer instruments in the private sector. For the most severe events, governments need to function as insurers of the last resort. However, governments are not always prepared, and need to step up financial planning for catastrophic climate impacts and maintenance of essential services after disasters.

Malawi is a good example of strong action. Its pioneering weather-based index insurance scheme protects the country against droughts that lead to maize production shortfalls and food insecurity.

Build resilient communities. While many communities in Sub-Saharan Africa may be well adapted to today’s climate, they may be unable to adapt to future climate change. The local nature of adaptation means customized approaches rather than a one-size-fits-all prescription. For example, the Arid Lands Project in Kenya implements community-focused adaptation strategies and district-level planning.

Provide safety nets for the most vulnerable. As poor people are exposed to climate change, they become more vulnerable to hunger, malnutrition, and loss of productive assets for longer stretches of time. If a flexible social protection system already exists, it can be ramped up when needed.

Ethiopia’s Productive Safety Net combines permanent social assistance through a workfare program targeted at 6 million food-insecure households with scalable safety nets that can be rapidly expanded to serve millions of transitory households during a major drought. However, in most countries, these systems will need to be strengthened substantially where they exist, and developed if they are lacking.
Managing Land and Water

By 2050, Sub-Saharan Africa will need to feed more people in a harsher climate. Agriculture will simply have to become more productive, getting more crop per drop while protecting ecosystems. In addition, sustainable land management practices are needed to control erosion and conserve soil moisture in rainfed fields.

Get more from agriculture. The region must adopt climate-resilient technologies and practices to increase its crop yields and protect its livestock. Countries need to accelerate research, extension services and market infrastructure, while helping farmers benefit from integrating biodiversity into the landscape and reduce carbon emissions from soil and deforestation. They must also hedge against climate risk by diversifying income sources and genetic material in crops.

Manage water. Water resources can be managed better even in poor countries and among small farmers through a combination of new and existing technologies, good information, and stronger policies. In Sub-Saharan Africa, measures should include: scaling up of existing infrastructure and systems such as those to manage watersheds and rainfed agriculture and protect forests; planning for storage, power transmission, and irrigation; screening investments for climate risks; and developing mechanisms for collaboration across sectors and countries.

Protect ecosystems. Sub-Saharan Africa has some of the most important biodiversity, both terrestrial (for example, Fynbos biome in Southern Africa) and aquatic (such as Lake Victoria). Forest, grassland, coastal, freshwater, and agricultural ecosystems provide food, clean water, storage of atmospheric carbon, biodiversity, and tourism opportunities. Climate change will weaken these ecosystems, already stressed by overfishing, creeping desertification, deforestation and coral reefs. An example of an international agreement is the Benguela Current Commission, set up by Angola, Namibia, and South Africa to protect a large marine ecosystem.

Invest in information services. Reliable information is fundamental for good natural resource management. For example, flood warnings can reduce damage by up to 35 percent (UN, 2004). Africa is in dire need of better monitoring and forecasting systems. According to the World Meteorological Organization, Africa has only one weather station per 26,000 sq km—one-eighth the recommended minimum (Science and Development Network, 2006).

**Agricultural carbon finance piloted in Kenya**

Early results from two projects in western Kenya show that smallholder agriculture can be integrated into carbon finance. One involves mixed cropping systems across 86,000 hectares, using a registered farmers association as the aggregator. Another covers an initial 7,200 hectares, and is aggregated by a farmer cooperative. Carbon sequestration activities include reduced tillage, cover crops, residue management, mulching, composting, green manure, targeted application of fertilizers, reduced biomass burning, and agroforestry. The projects use activity-based monitoring. The World Bank’s BioCarbon Fund is purchasing the carbon credits. Emerging lessons: a good aggregator is essential, especially one that can also advise on agricultural practices; and the monitoring method must be simple, accessible and transparent. The projects demonstrate that agricultural emissions reductions are real and measurable and can be part of a win-win solution offering carbon storage assets for investors, enhancing soil fertility and agricultural productivity while providing income to small farmers.
Improving Access to Energy

Access to energy is a major challenge in Africa, where only 24 percent of the region’s 800 million people have access to electricity, and 25 countries are in a state of power crisis.

Replacing the biomass that supplies cooking fuel is critical, as more than 60 percent of the region’s greenhouse gas emissions come from land-use change and deforestation, and household air pollution is a major health hazard.

The potential for Sub-Saharan Africa to develop a low-carbon trajectory by harnessing various sources of renewable energy is huge, but largely untapped in the absence of technology and finance. For example, the region exploits only 8 percent of its hydropower potential. For many countries, regional hydropower trade could provide the least-cost energy supply with zero carbon emissions.

However, to reduce critical “energy poverty” in the short term, some countries, in the absence of any other economically viable alternative, will need to draw on non-renewable resources, including coal. No country in the world has developed its economy without access to modern energy.

While adaptation is Sub-Saharan Africa’s main priority in tackling climate change, mitigation is also important. As economies develop, energy production and CO₂ emissions will soar. Clean energy is critical, so that unlike rich countries, Africa does not have to clean up later. Governments need to improve their policy and regulatory frameworks to attract private investment for energy.

South Africa, which accounts for two-thirds of Sub-Saharan Africa’s CO₂ emissions produced in the energy sector, has a significant role in global mitigation efforts and has developed a strategy to move towards low-carbon growth. Priority mitigation measures include industrial energy efficiency, imported hydroelectric power, renewable energy, clean coal technologies, vehicle fuel efficiency improvements, and shifts in transport modes.
While the innovative technologies that are so important for efficient adaptation and mitigation are likely to come from high-income countries, developing countries need to build the capacity to identify, evaluate, and integrate them. Domestic policies in Sub-Saharan Africa will need to support the knowledge infrastructure of universities, research institutes, and firms.

**Universities and innovation**

Calestous Juma, Director of the *Science, Technology, and Globalization* Project at Harvard’s Kennedy School, notes in the *WDR* that most donor assistance to Africa does not address the need to harness the world’s existing fund of knowledge for long-term development.

Higher education enrollments in Africa average close to 5 percent, compared with typical figures of more than 50 percent in developed economies. The challenge, however, is not only to increase access to African universities but also to make them function as engines of development.

There are opportunities for universities to forge closer links with the private sector, train more graduates for professional careers, and diffuse knowledge into the economy. As a model, the United States has a long tradition of land grant colleges, which since the 19th century have been working directly with their communities to diffuse agricultural knowledge. The task ahead requires qualitative change in the goals, functions, and structure of universities. As part of this process, fundamental reforms will be needed in curriculum design, teaching, location, student selection, and university management.

Training will have to become more interdisciplinary to address the interconnected problems that transcend traditional disciplinary boundaries. South Africa’s Stellenbosch University offers a shining example of how to adjust curricula to the needs of R&D organizations. It was the first university in the world to design and launch an advanced microsatellite as part of its training. The program aimed to build competence in new technologies in the fields of remote sensing, spacecraft control, and earth sciences. Uganda’s Makerere University has new teaching approaches that allow students to solve public health problems in their communities as part of their training. Similar approaches can be adopted by students in other technical fields, such as infrastructure development and maintenance.

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**Knowledge priorities in Africa**

- Invest in engineering, design, and management skills.
- Increase funding to research institutions for adaptation research, development, demonstration, and diffusion.
- Increase links between academic and research institutions, the private sector, and public planning agencies.
- Redefine knowledge-based institutions, especially universities, as loci of the diffusion of low-carbon practices.

The Climate for Development in Africa Programme (ClimDev-Africa) is one example of an effort to integrate climate risk management into pertinent policy and decision processes across the continent. Its objective is to strengthen the climate resilience of economic growth and the MDGs.
Moving toward Climate-Resilient Growth

Over 60 World Bank projects in Africa have taken into account the critical importance of combating climate change. The Bank’s Africa Region is tackling adaptation by beginning to address climate risks within project design. It is also emphasizing access to energy for all, while taking advantage of opportunities for clean energy development and efficiency gains. Here is a small sample of the efforts underway to move toward climate-resilient growth.

**Madagascar: Climate and Disaster Risk Management.** Madagascar suffers severe losses from cyclones, especially in its housing, agriculture, and transport sectors. Since 2006, this project has been carrying out hydro-meteorological risk assessment for agriculture, cyclone impact modeling, updating of infrastructure norms and standards, vulnerability analysis for drought-prone areas, an analysis of historical and projected climate change, and technical assistance and capacity-building for local entities. It is funded by several partners.

**Mozambique: Zambezi Valley Market-Led Smallholder Development.** This project is trying to limit land degradation and improve ecosystem resilience to climate change in five districts in the Central Zambezi Valley. It will invest in sustainable agriculture, agroforestry, and forestry; promoting sustainable land management practices and measures that address environmental benefits and adaptation to climate variability. It will also focus on capacity building with rural communities, local government staff and NGOs, and the private sector.

**Rift Valley: Geothermal Development Facility.** There is huge unused geothermal energy potential in Africa’s Rift Valley, which stretches across Kenya, Tanzania, and Malawi. While there are enormous benefits of tapping this potential, such as mitigating climate change by avoiding fossil fuels, there is also the need for a major financial commitment as well as risk-sharing arrangements for geothermal exploration. In order to move this agenda forward and attract more private investment, the World Bank is preparing a new GEF-funded project that will help bring down the cost of developing the technology.

**Kenya: Adaptation to Climate Change in Arid Lands.** This project aims to reduce vulnerabilities to climate risks in arid and semi-arid lands encompassing several districts, is linked to the Arid Lands Management Project, and is jointly executed with United Nations Development Programme. Besides identifying risks, vulnerabilities, and community-focused adaptation strategies, the project focuses on institutional capacity building and access to early warning information.
World Development Report 2010: Development and Climate Change

This World Bank report includes these chapters:

- Understanding the Links between Climate Change and Development
- Reducing Human Vulnerability: Helping People Help Themselves
- Managing Land and Water to Feed Nine Billion People and Protect Natural Systems
- Energizing Development without Compromising the Climate
- Integrating Development into a Global Climate Regime
- Generating the Funding Needed for Mitigation and Adaptation
- Accelerating Innovation and Technology Diffusion
- Overcoming Behavioral and Institutional Inertia

The report can be purchased online or downloaded free of cost at:

http://www.worldbank.org/wdr2010
“If nothing is done, we shall lose our beloved planet. It is our collective responsibility to find ‘unselfish’ solutions and fast before it’s too late to reverse the damage caused every day.”

—Maria Kassabian  
Nigeria, age 10

Anoushka Bahri, Kenya, age 8