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REGIONAL FACT SHEET

CLIMATE CHANGE RISK PROFILE
SOUTHERN AFRICA

COUNTRY OVERVIEW

Climate extremes are a major impediment to resilience in Southern Africa, where livelihoods and economies are highly sensitive to weather fluctuations. This was evidenced by floods in December 2014 and January 2015 that affected over 100,000 people, damaged homes and critical infrastructure and were linked to outbreaks of cholera. While the region boasts an incredible diversity of ecosystems, natural resources, economic activities and cultures, it is also characterized by rapid population growth, urbanization of coastal areas, encroachment into ecologically marginal areas and poverty. The primary source of income for the region's rural population remains agriculture, much of it rainfed and allocated to cereal production. The region's uneven distribution of resources and changing climate dynamics pose significant challenges as well as considerable opportunities for cooperation across the countries of Southern Africa. Regional cooperation is coordinated mainly through the Southern African Development Community (SADC) and includes transboundary water management, disaster risk reduction and preparedness and market and trade negotiations. As central priority for its member states, climate change adaptation is featured in a number of key SADC initiatives.

COUNTRIES COVERED IN THIS PROFILE

South Africa
Botswana
Namibia
Angola
Malawi
Zambia
Zimbabwe
Mozambique
Lesotho
Swaziland

CLIMATE PROJECTIONS

- Projected increase in temperature between 2°C – 4.2° C by 2100
- More extreme weather, with intense precipitation and floods
- Rainfall changes uncertain, but likely slightly drier conditions on average

KEY CLIMATE IMPACTS

Agriculture
Increased crop losses/failure
More pests, weeds, and pathogens

Water
Increased variability of flows
Reduced water quality
Salinization of coastal aquifers

Human Health
Changing distribution of vector-borne diseases
More death/illness from extreme events

Ecosystems
Changes in species composition
Increased degradation/deforestation
Altered fire regimes

Infrastructure
Damage to roads, bridges, etc.
Reduced efficiency of flood protection mechanisms

Energy
Increased cost and revenue losses
Changing seasonal energy demands
Reduced hydropower generation

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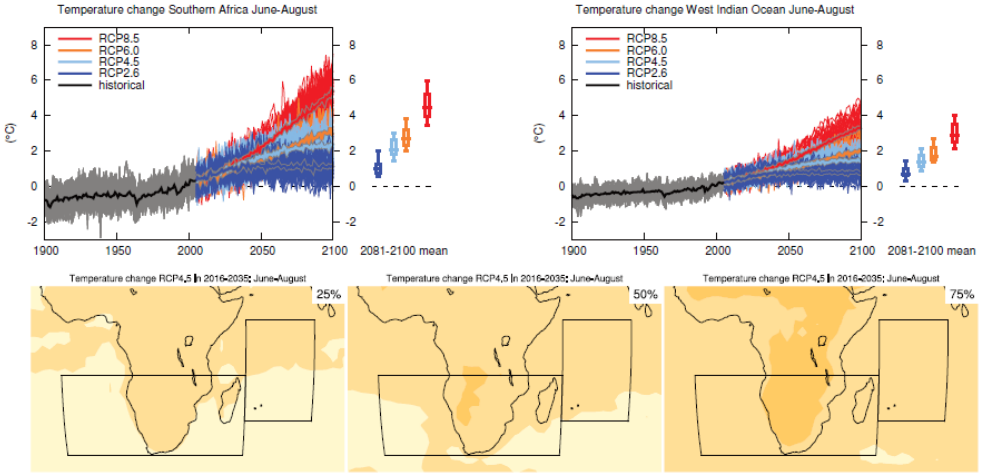
CLIMATE SUMMARY

The climate of Southern Africa varies from arid to humid subtropical regions. It is influenced by topography and large-scale seasonal atmospheric patterns, such as sea surface temperatures in the Indian Ocean (through the Agulhas current bringing additional moisture to the east coast) and the South Atlantic Ocean (through the Benguela current). Rainfall is driven mainly by the migration of the Intertropical Convergence Zone (ITCZ). The majority of the region's rainfall comes during the summer months (November–March) with the exception of South Africa. Temperatures vary significantly, with the highest temperatures recorded in the Kalahari Desert (>40°C) and coastal regions of Mozambique. The lowest temperatures are found in the Lesotho, South Africa and Zimbabwe highlands. Rainfall is highly variable across the region, with a clear east-to-west gradient ranging from very dry conditions along the western Namibian coast to much higher rainfall in the coast of Mozambique. This dynamic is highly variable from wet to dry years. Longer-term variability is closely associated with the El Niño Southern Oscillation phenomenon, with El Niño events linked to warmer and drier conditions and La Niña events linked to cooler and wetter conditions.

Figure 1: Projected Temperature Increases for Southern Africa

Shown under several emissions scenarios (changing concentrations of greenhouse gases in the atmosphere) starting from the best case on the left to the worst case on the right. Darker shades are indicative of higher temperatures.

Source: IPCC (2014).



HISTORICAL CLIMATE

Key changes in climate observed across the region since the 1960s:

- Increased mean, maximum and minimum temperatures, with more rapid increases in minimum temperatures (1–1.5°C on average), especially in the interior regions (1.6–2°C on average).
- Reduced late summer precipitation (November–March) in Botswana, Namibia, Zimbabwe and Zambia.
- Increased summer rainfall in Lesotho, Namibia and South Africa, and increased variability in Angola.
- Changes in the onset, duration, and intensity of rainfall, including increased frequency of dry spells (breaks in the rainy season of at least five days where no significant rain is received).
- Increase in number of warm days/nights and subsequent decreases in cold days/nights.

FUTURE CLIMATE

Projected Changes in Climate	
Temperature	• Mean temperature rise will exceed 2°C (or more), particularly in arid regions, with projected warming between 3.4°C and 4.2°C above 1981–2000 averages and more pronounced increases in the summer (November–March) • Minimum temperature rise will exceed rise in maximum temperatures • Increased extremes in temperatures and heat waves
Rainfall	• Slightly drier conditions (including potentially increased intensity and duration of dry spells) on average, particularly April to September • Increased frequency of intense rainfall events • Increased frequency of droughts and dry spells

SECTOR IMPACTS AND VULNERABILITIES

AGRICULTURE

Agriculture in Southern Africa is predominantly rainfed (with the exception of wheat-producing areas in South Africa), which makes the region inherently vulnerable to climate variability and change. Grain prices and market dependency are regional, with some countries (e.g., Botswana and Lesotho) relying on imports to meet national demand for maize and sorghum, derived mainly from South Africa, while other normally self-sufficient countries (Mozambique and Malawi) have in recent years relied on imports to meet demands due to losses resulting from recurring floods and droughts. Cereal production, availability and access are key food security issues in Southern Africa. Over 40 percent of the region's land area is allocated to cereals, with maize the predominant crop, followed by millet (Namibia), paddy rice, sorghum (Mozambique) and wheat (South Africa). Climate is only one of many factors that influence the sector's vulnerability, which is already severely limited by poor infrastructure, stagnating farm incomes, reduced support to agricultural extension services, lagging technological innovation and research, poor farming practices and an increase in pests and diseases. Regionally, climate impacts on the sector will be largely detrimental, placing greater emphasis on intra-regional markets and trade to meet food security demands. (6, 8)

Climate Risks and Potential Impacts AGRICULTURE

Climate Risk	Potential Impact
Increased evapotranspiration	Crop failure and reduced yields
	More conducive environment for pests and pathogens
Reduced soil moisture	Changes in areas suitable for agriculture and/or specific crops
Increased heat stress on crops	Changes in the length of the growing season
	Changes in access to food
Decreased water availability	Increased price volatility of food imports and increased food costs

WATER RESOURCES

Changes in water quality and availability will be the dominant changes seen under a new climate. For example, stream flows for the Limpopo and Okavango catchments are projected to decrease by 35 percent and 20 percent, respectively. A more variable rainfall dynamic will also likely increase disasters associated with droughts, floods and waterborne diseases. As such, transboundary water management presents a unique opportunity and challenge to the region. Southern Africa's water resources cut across a number of transboundary river basins and are unevenly distributed, both seasonally and geographically. A majority of the region has supply deficits during at least part of the year, presenting a limiting factor for development. Rising demands and increasing levels of pollution across shared water resources are a critical problem. Droughts and floods are normal events in the region's climate context, as are a number of natural cycles of climate variability that cause flood pulsing (variability between low and high flows). Infrastructural developments intended to safeguard water supplies have increased the geographical unbalance of water resources, as many dams have been built to store water during the unpredictable and often long dry periods, particularly in South Africa and Zimbabwe. The region's water resources are marked with contrasts, with significant and untapped hydropower potential in countries such as Mozambique and no potential to expand water storage capacity in others (South Africa). Inadequate extent and maintenance of existing water infrastructure, unclear mandates for shared watercourse institutions and limited institutional capacity all hamper transboundary water management. (1, 2, 8, 11, 13, 14)

Climate Risks and Potential Impacts WATER RESOURCES

Climate Risk	Potential Impact
Increased temperatures	Increased variability of river flows, decreased stream flows
	Increased evaporation and reduced runoff
More variable rainfall (increased intensity, changing seasonality and duration)	Increased frequency and occurrence of floods, droughts
	Reduced water quality
	Compromised irrigation potential and expansion plans
Rising sea levels	Increased evaporation rates of existing water storage facilities
	Reduced freshwater resources due to rising sea levels and salinization of coastal aquifers

HUMAN HEALTH

Changing temperature and precipitation patterns are likely to exacerbate multiple negative health outcomes, reversing the progress made in the region over the last 10 years. Indicators of human well-being related to health for the region show improvement, but are still relatively poor compared to other regions in Africa. The region faces a heavy disease burden largely due to poor waste management practices, inadequate drinking water and sanitation, limited access to health care facilities, scarce financial resources (less than 15 percent of GDP in the region is spent on health services) and poor governance. This in turn affects multiple health outcomes including malnutrition, diarrheal disease, malaria and other vector-borne diseases. Changing climate patterns including increasing temperatures and increased intensity, frequency and duration of extreme events pose an additional threat to these challenges, through changes in agricultural productivity and water availability, and increased distributions of disease-carrying vectors. Recent estimates suggest that implementing adaptation measures in the health sector could reduce the number of children at risk from chronic under-nutrition by 10 million in Sub-Saharan Africa, through improved disaster risk reduction measures that reduce vulnerability to extreme events such as flooding and droughts. A particular challenge from a climate perspective for the sector is the scant data available on the links between climate variables and disease patterns, which makes it difficult to design appropriate intervention and surveillance methods. Nevertheless, the most effective measures to reduce vulnerability to climate in the health sector in the near term are (a) promoting programs that implement and improve basic health system measures, such as the provision of safe water and improved sanitation, (b) securing essential health care, (c) increasing capacity for disaster preparedness and response, and (d) alleviating poverty. (4, 8)

Climate Risks and Potential Impacts HUMAN HEALTH

Climate Risk	Potential Impact
Increased frequency, intensity and duration of extreme events	Fatalities due to extreme events
	Reduced health status of vulnerable populations
	Increased incidence of malnutrition
Reduced water quality and quantity due to changing rainfall patterns	Reduced water quality
	Spread/altered distribution of vector- and waterborne diseases
	Increased urban migration in search of basic services

ECOSYSTEMS

Under a changing climate future, impacts are expected to be substantial, negatively affecting important economic sectors such as fisheries, forestry and others. Southern Africa has unique and diverse terrestrial, freshwater and coastal ecosystems, including forests (the miombo woodlands, the mopane woodlands, the baikiea woodlands, acacia woodlands, montane and tropical moist forests and mangrove forests), which cover 41 percent of the total land area of the 15 SADC countries. These ecosystems provide a multitude of services to rural communities including employment, shelter, food, energy, construction materials for use, and other products. They also regulate core ecological processes on which people and livelihoods depend, including soil maintenance, water filtration, groundwater recharge rates and stream and river flows. Nevertheless, they face a number of pressures from human activities, including deforestation and degradation, due to increased demand for agricultural land, energy and urbanization. Deforestation in the SADC region is a major concern, with net forest loss from 2005–2010 recorded at 1.8 million hectares annually. Emerging evidence suggests that these ecosystems have already experienced shifting species ranges and reduced services. (5, 7)

Climate Risks and Potential Impacts ECOSYSTEMS

Climate Risk	Potential Impact
Droughts and prolonged dry periods	Increased soil erosion, land degradation and deforestation
Increased frequency of extreme events	Changes in species composition and phenology
	Reduced “regulating” services such as soil water maintenance, base flows and filtration
Increased temperatures + increase in very hot days >35°C	Increased frequency of pests in commercial plantation forests
	Altered fire regimes

INFRASTRUCTURE

Damage to infrastructure results from rising sea levels, high intensity rainfall events and extreme heat, all of which are projected to increase for the region. Increased losses from these events have the potential to undermine economic development goals. Studies on the potential costs of not implementing climate change adaptation measures in the Zambezi basin, for example, suggest cumulative damages as large as US$45 billion to existing infrastructure. Regional transport, communications and energy infrastructure are insufficient and unreliable, and clearly limit the region's potential for cooperation. Although investments in the sector are growing through SADC initiatives and donor support, they remain a regional challenge due to costly and unpredictable transport and logistics (especially for landlocked states); limited access to information and communications; inadequate information on meteorology and climate to guide planning and management of existing water resources; and a high number of people without access to potable water, adequate sanitation facilities and water for irrigation. A more variable climate clearly impacts this fragility by damaging limited infrastructure resources. (13)

Climate Risks and Potential Impacts INFRASTRUCTURE

Climate Risk	Potential Impact
Increased heat stress and reduced water availability from rainfall	Infrastructure damage
	Reduced power production, power outages
Rising sea levels and increased storm surges	Reduced potential irrigation capacity
Changing evaporation rates in water bodies	Reduced efficiency of existing flood protection mechanisms

ENERGY

Energy and water are closely linked in Southern Africa. Water drives the turbines of hydroelectric power plants; coal processing and cooling in thermal and nuclear power plants require water; and energy is required to lift, treat and distribute water. This places climate at the forefront of the region's energy sector: projected changes to the water sector, such as a more variable and changing climate, will have a negative impact that could pose large potential revenue losses for some hydropower-exporting countries and increase costs to consumers in countries reliant on energy imports. Access to and production of energy is a critical limiting factor to meeting development objectives in Southern Africa and energy is a resource that, among others, remains unequally distributed. Only 25 percent of the region's residents have access to electricity overall, and only 5 percent in rural areas have access. Energy directly impacts individual livelihoods, communities and countries in terms of economic growth, employment, health, security and education. Energy storage lags behind most other regions in Africa, as does generation due to limited infrastructure, regulatory frameworks and financing in the sector. Nevertheless, cooperative agreements (including basin management plans and inter-basin transfers through regional coordination mechanisms) and an integrated view of available energy resources could offer a buffer against climate risks at the regional scale. For example, several electricity companies, organized under the SADC Southern African Power Pool (SAPP), are working to improve the common regional power grid by redistributing abundant resources in some countries to those with limited supplies, with the ultimate goal of increasing access to electricity across the region. (2, 8, 13)

Climate Risks and Potential Impacts ENERGY

Climate Risk	Potential Impact
Reduced runoff and surface water availability	Reduced hydropower generation potential
Increased evaporation rates of existing water storage facilities	Increased production costs, increasing prices for consumers
Increased temperatures	Changing seasonal demands for energy with increased demand for peak loads during hotter summers; projected increased net electricity use
Increased variability of river flows	Revenue loss from overbuilt and undersupplied hydropower

DISASTERS

USAID lists climate extremes as a major factor affecting resilience in Southern Africa. The region is vulnerable to a wide range of natural disasters including floods, droughts and cyclones. Vulnerability to the impacts of these events is a function of complex social, political and environmental factors likely to be exacerbated by current and projected changes in climate. For example, a decline in economic opportunities in rural areas has increased urban migration, leading to the establishment of informal settlements in areas at significant risk of flooding. Other key challenges include outdated or lack of risk assessments in critical areas, poor governance and institutional frameworks for disaster risk management, and lack of financial resources. Under SADC, a regional Disaster Risk Reduction Unit was established to help promote and coordinate preparedness and response programs for trans-boundary disasters. Additionally, the SADC Climate Services Center provides operational regional services and training for monitoring and predicting extremes in climate conditions for member states through the use of meteorological and hydro-meteorological products. (12, 13)

Climate Risks and Potential Impacts DISASTERS

Climate Risk	Potential Impact
Cyclical shocks including floods and droughts, sometimes in a single year **Increased intensity of shocks, e.g., extreme rainfall or prolonged dry periods/droughts** **Increased frequency/intensity of tropical cyclones and heavy rains**	Erosion of adaptive capacity/ increased fragility of communities
	Increased food insecurity
	Increased livestock and human disease outbreaks
	Rising food and fuel prices, deeper poverty and reduced household resilience
	Increased instability and social tensions
	Increased waterborne diseases (cholera, diarrheal disease)
	Displacement and asset loss

POLICY CONTEXT

INSTITUTIONAL FRAMEWORK

Alongside the discrete actions of national governments, SADC coordinates policy discussions at the regional level, including consideration of a range of climate change initiatives.

- **Directorate of Infrastructure and Services** houses the Climate Services Center. The center is currently setting up a processing center that will consist of a climate data management, processing, and production system for climate data, extreme weather monitoring and an integrated early warning system. The Water Division under this Directorate is responsible for coordinating implementation of regional water-related activities.
- **Directorate of Food, Agriculture and Natural Resources**, along with the **Directorate of Policy Planning and Resource Mobilization**, supports institutionalization of international agreements on climate change, as well as facilitates the Climate Change Inter-sectoral Technical Working Group that supports regional climate policy development.
- In 2011, SADC established the **Disaster Risk Reduction Unit.**

REGIONAL STRATEGIES AND POLICIES

- The SADC Policy Paper on Climate Change (2011) highlights the current and projected impacts of climate change on the region and suggests possible adaptation options.
- The SADC Climate Change Adaptation Strategy (2011) recognizes that water issues will impact a range of sectors, including energy, health and agriculture. Adaptation measures identified are water governance and management and infrastructure development.
- The **Disaster Risk Reduction Strategic Plan** (2006–10) sets out the strategic direction to achieve the long-term goal of building resilience of SADC nations and their communities.
- A **Regional Climate Change Strategy and Action Plan** is under development and was in the final validation stage as of June 2015. (12)
- The Framework of Sub-Regional Climate Programs (2010), developed under the African Ministerial Conference on the Environment (AMCEN), maps programs and actors working on climate change adaptation in Southern Africa and identifies gaps or focus areas that are not being addressed in terms of adaptation.

Some climate change research priorities for the region include:

- Building research capacity and strengthening platforms for research innovations.
- Contextualizing information at more localized scales.
- Understanding better what would engender the transformations to move societies to a resilient and low-carbon development pathway.

SECTOR-SPECIFIC INTEGRATED PLANS

A number of existing strategies support the adaptive capacity of the SADC region on climate variability and extremes, yet were not specifically developed for climate change adaptation. The most prominent and pertinent for climate change is the SADC Shared Watercourses Protocol (2003), complemented by the Regional Water Policy (2005). (10) The objective of the Protocol is to "foster closer cooperation for judicious, sustainable and coordinated management, protection and utilization of shared watercourses and advance the SADC agenda of regional integration and poverty reduction." (3) Additionally, protocols on energy (1998), fisheries (2003), forestry (2009) and health (2004) are particularly relevant in the context of climate change negotiations and response initiatives. The Protocol on Energy, for example, provides that one of the objectives in the region is to cooperate in the adaptation and transfer of low-cost energy technologies. (9)

NATIONAL STRATEGIES AND PLANS

In addition to regional strategies, several member countries have identified other priorities in national strategies and plans. Every country has submitted at least one National Communication to the UNFCCC. Most have submitted National Adaptation Plans and all either have or are developing a national climate change strategy (see table below). Countries also have climate change integrated into sectoral strategies. For example, in Malawi climate change adaptation is covered in the Food Security Policy, the National Agricultural Policy, the Agriculture Sector-Wide Approach, the Water Policy and the Disaster Risk Management Policy.

Country	National Communication	National Adaptation Plan
Angola	2012	2011
Botswana	2013	not available
Lesotho	2013	2007
Madagascar	2010	2006
Malawi	2012	2006
Mozambique	2006	2008
Namibia	2015	not available
South Africa	2011	not available
Swaziland	2012	not available
Zambia	2014	2007
Zimbabwe	2013	not available

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SELECTED ONGOING EXPERIENCES

Selected Program	Countries, Year(s)	Description
Programme on Climate Change Adaptation and Mitigation in Eastern And Southern Africa	All SADC countries 2010–2014	Launched with US$100 million in funds from the Norwegian Government, the European Union Commission and DfID. Novel cooperation that brings together international donors alongside three Regional Economic Communities in support of a single program focused on addressing the impacts of climate change, particularly scaling up climate-smart agriculture.
SADC Regional Environmental Education Programme (SADC REEP)	All SADC countries 2013–2014	This program facilitated climate change education in a number of universities and colleges through the Mainstreaming Environment and Sustainability in African Universities (MESA) programme between 2009 and 2013; co-facilitated the writing of a book on Climate Change Education in schools in SADC to be published by UNISA in 2013; and is currently facilitating a climate change adaptation and mitigation training course in SADC Trans-frontier Conservation Areas through a project funded by GIZ (2013–2014).
Southern Africa Regional Environmental Program (SAREP)	Angola, Botswana, Namibia 2010–2016	USAID-funded project working with SADC and the Permanent Okavango River Basin Water Commission to implement strategies integrating biodiversity protection, increased access to water and sanitation, climate change and HIV/AIDS prevention and treatment.
Resilience in the Limpopo Basin (RESILIM)	South Africa, Botswana, Mozambique 2012–2017	USAID-funded project that improves transboundary management of the Limpopo River Basin. The program supports equitable access to water that balances urban and rural needs with ecosystem requirements under a changing climate.
Climate Resilient Infrastructure Development Facility (CRIDF)	Malawi, Mozambique, South Africa, Zambia, Zimbabwe 2013–2017	DfID's new flagship water infrastructure program for Southern Africa. The facility will deliver sustainable small-scale infrastructure across 11 SADC countries. The demand-driven program focuses on water services, water resource management and agriculture, creating a lasting impact on the region's water, food and energy security.
Transboundary water management in the Southern African Development Community (SADC)	All SADC countries 2005–2015	Implemented by GIZ, this program operates at 1) the SADC region, 2) transboundary river basins and their organizations, and 3) local municipalities and water utilities. At each level, GIZ advises and assists its partners in the strategic areas of water governance and management and infrastructure development.
African Resilient Landscapes Initiative	All SADC countries Launched in 2015	Led by the African Union New Partnership for Africa's Development (NEPAD), World Bank and World Resources Institute, this initiative is implemented through forest and ecosystem restoration, biodiversity conservation, climate-smart agriculture and rangeland management.
Gender Climate Change and Agriculture Support Programme (GCCASP)	Malawi 2012–2017	Supports the implementation of regional and country-level interventions to empower rural women and other vulnerable sections of communities to better cope with the adverse effects of climate change. Pilot Phase includes Ethiopia, Cameroon, Malawi, Niger and Rwanda.
Zambezi River Basin Management Project	Most SADC countries	Objective is to strengthen Zambezi Water Course Commission's (ZAMCOM) role in promoting cooperative management and development within the Zambezi River Basin through institutional strengthening, improved information sharing and decision support,

	2015–2018	and strategic planning. The financing for the project will be provided through a US$4 million grant, hosted by the World Bank.
Regional Climate Change Programme (RCCP)	All SADC countries 2007–2012	DfID-funded project aiming to increase regional participation in globally funded adaptation projects and to improve resilience.
Research Institute Programme on Climate Change	All SADC countries	JICA-funded project focuses on adaptation research on the impact of climate change; measures for community adaptation; and mitigation research, focusing on carbon dioxide emissions.
SADC Climate Risk Capacity Building Programme	All SADC countries 2011	USAID-funded project seeks to build the capacity of planners to understand and address climate risk in their planning and decision-making processes at regional, national and subnational levels.
Climate Change Adaptation in Africa (CCAA)	Most SADC countries 2006–2012	A research and capacity development program led by IDRC and funded by DfID; it was designed to significantly improve the capacity of African countries to adapt to climate change in ways that benefit the most vulnerable.
Adaptation Learning Program for Africa (CARE)	Mozambique 2010–2017	Aims to increase the capacity of vulnerable households in Sub-Saharan Africa to adapt to climate variability and change through Community-Based Adaptation (CBA). Additional countries include Ghana, Kenya and Niger.
Climate Change Adaptation and Development Initiative (CC-DARE)	Mozambique, Malawi 2008–2012	Implemented by UNEP and UNDP, CC-DARE seeks to build technical, analytical and institutional capacity for integrating climate change risks and opportunities into national development planning and decision making. Also in nine other countries in Sub-Saharan Africa.
Future Climate for Africa (FCFA)	Most SADC countries Ongoing	Aims are to 1) improve scientific understanding of climate variability across Africa and the impact of climate change on development decisions, 2) demonstrate flexible methods for integrating improved climate information and tools in decision making, 3) improve medium- to long-term decision making, policies, planning and investment.
IFAD's approach to addressing climate change in Eastern and Southern Africa	Most SADC countries Ongoing	IFAD works with governments and communities to introduce appropriate measures and adaptive technologies that reduce the vulnerability of poor rural communities to climate variability and longer-term climate change.