USAID
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USAID
CLIMATE CHANGE ADAPTATION PLAN

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ACRONYMS

ARCC	African and Latin American Resilience to Climate Change Program
AREFS	Asia Region Environmental Field Support Program
CCRD	Climate Change Resilient Development Program
CDCS	Country Development Cooperation Strategies
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
COMFISH	Collaborative Management for a Sustainable Fisheries Future
DoE	Department of Energy
DoS	Department of State
E.O.	Executive Order
EPA	Environmental Protection Agency
FEWS NET	Famine Early Warning Systems Network
FY	Fiscal Year
GCC	Global Climate Change
ICT	Information and Communications Technology
IMACS	Indonesia Marine and Climate Support
IPCC	Intergovernmental Panel on Climate Change
MAJIC	Marketing and Agriculture for Jamaican Improved Competitiveness
NASA	National Aeronautics and Space Administration
NEPA	National Environmental Policy Act
NGO	Non-Governmental Organization
NOAA	National Oceanic and Atmospheric Administration
PMI	President's Malaria Initiative
REDD+	Reducing Emissions from Deforestation and Forest Degradation
RIWSP	Rwanda Integrated Water Security Program
STEWARD	Sustainable and Thriving Environments for West African Regional Development
STTA	Short term technical assistance
UNFCCC	United Nations Framework Convention on Climate Change
USACE	United States Army Corps of Engineers
USAID	United States Agency for International Development
USAID/M/CFO/FS	United States Agency for International Development, Bureau for Management, Office of the Chief Financial Officer, Financial Systems Division
USAID/RDMA	USAID's Regional Development Mission for Asia
USDA	United States Department of Agriculture
USG	United States Government
USGS	United States Geological Survey
V&A	Vulnerability and Adaptation
WASH	Water, Sanitation, and Hygiene

EXECUTIVE SUMMARY

The United States Agency for International Development (USAID) prepared this Climate Change Adaptation Plan for 2013 in accordance with Executive Order (E.O.) 13514 "Federal Leadership in Environmental, Energy, and Economic Performance." The plan assesses climate change risks, vulnerabilities, and opportunities for USAID mission, programs, and operations; discusses USAID's current and past adaptation activities; and identifies agency-level actions to understand and address climate change vulnerability. Its structure and content align with the *USAID Climate Change and Development Strategy*.

A. AGENCY VULNERABILITY ASSESSMENT

While in many ways USAID investments and activities promote the resilience of vulnerable populations to climate vulnerability and change, climate change could have a substantial negative impact on USAID's development efforts, given the Agency's extensive investments in climate-sensitive sectors located in climate-vulnerable regions. Ultimately, the impact of climate change on USAID programs and operations could compromise the Agency's ability to achieve its mission.

The type and degree of climate-related impacts and vulnerabilities across USAID's partner countries will be diverse, with consequences for human health, economic growth, livelihoods, and biodiversity, among others. Climate change could significantly affect key program areas, including agriculture and food security; global health; water, sanitation, and hygiene; malaria; infrastructure; and disaster readiness and humanitarian response. A lack of data and capacity in partner countries and regions challenges efforts to reduce vulnerability.

Changes in climate may also jeopardize the continuity and effectiveness of USAID operations. In particular, climate change poses risks for USAID assets; infrastructure and support systems; workforce health, safety, and well-being; and security. These impacts could have serious implications, including: loss of asset value; higher maintenance and operating costs; increased safety concerns; disruption, deterioration, or elimination of services; implications for external coordination and program implementation; or compromised welfare of personnel.

B. CURRENT AND PAST AGENCY ADAPTATION-RELATED ACTIONS

USAID has been investing in actions that help the Agency better understand climate change risks and opportunities and reduce vulnerabilities since 1991. In 2011, USAID created a position of Climate Change Coordinator. In January 2012, the Agency released the *USAID Climate Change and Development Strategy*: 2012-2016, which includes a number of actions to integrate climate change adaptation into the Agency's mission, programs, and operations. USAID is also providing adaptation funding to a number of priority adaptation countries to help address climate change vulnerabilities. In addition to these overarching efforts, USAID has undertaken a number of activities related to *Guidance and Training, Pilot Activities, Research and Information, Evaluation and Learning, Partnerships,* and *Inreach and Outreach*. A number of adaptation activities are also underway at the mission level.

C. PLANNED AGENCY ADAPTATION-RELATED ACTIONS

USAID adaptation planning, implementation, and evaluation will continue to be led by the Agency Global Climate Change Coordinator. To ensure the ongoing achievement of USAID's mission, the Agency will complete in FY2012 an implementation plan to execute the *USAID Climate Change and Development Strategy*, distribute USAID's Adaptation Plan in FY2013, and annually review and update the Agency Adaptation Plan.

In addition, USAID has developed a list of actions to better understand and address climate change vulnerabilities of programs and projects. These programmatic actions are listed in the table below:

Category	FY2012	FY2013	FY2014-2016
Guidance and Training	• Publish Updated Adaptation Guidance Manual and Sectoral Briefs • Develop Country Development Cooperation Strategy (CDCS) Supplemental Guidance • Conduct Climate Change Adaptation Training	• Create Sectoral Project Design Guidance and Training • Conduct Targeted and Skills-Based Climate Change Adaptation Training	• Review Environmental Impact Assessment • Ensure Reporting Requirement Performance
Pilot Activities	• Commence Integration Pilots	• Implement and Evaluate Integration Pilots • Support Additional Integration Pilots	• Compile Lessons Learned & Best Practices from Pilots
Research and Information		• Conduct Survey of Applied Climate Change and Development Research Needs • Develop Climate Change and Development Research Strategy	• Conduct Climate Change and Development Research
Evaluation and Learning	• Design Agency Monitoring and Evaluation Plan for Climate Change Programs • Host Climate Change Adaptation Learning Workshops	• Compile Climate Change Adaptation Lessons Learned • Develop Climate Change Adaptation Help Desk	• Exchange Climate Change Adaptation Lessons Learned
Partnerships		• Develop Climate Change Adaptation Coordination Plan • Form Private Sector Alliance	• Engage Youth Partnership
Inreach and Outreach	*See related activities above.*		

Finally, USAID has identified a number of actions to better understand and address operational vulnerability. Collaboration with the Department of State (DoS) will be critical for addressing operational vulnerability, as a significant portion of USAID operations are co-located or co-implemented with DoS. Operational adaptation actions in FY2013 include exploring an operational Climate Change Adaptation Partnership with DoS and supporting Climate Smart Missions. Actions in FY2014-2016 include seeking opportunities for operational climate change adaptation training and resources.

USAID CLIMATE CHANGE ADAPTATION PLAN FOR 2013

The United States Agency for International Development (USAID) has prepared an Adaptation Plan for 2013 in accordance with Executive Order (E.O.) 13514 "Federal Leadership in Environmental, Energy, and Economic Performance." The E.O. seeks to establish an integrated strategy toward sustainability in the Federal government. Section 8(i) of the E.O. requires that as part of the formal Strategic Sustainability Performance Planning process, each Federal agency evaluate agency climate change risks and vulnerabilities to manage both the short-and long-term effects of climate change on the agency's mission and operations.

The USAID Climate Change Adaptation Plan for 2013 (USAID's Adaptation Plan) is submitted as an appendix to the 2012 Sustainability Plan. USAID's Adaptation Plan focuses on agency-level actions to understand and address climate change risks and opportunities for USAID mission, programs, and operations. Its organization aligns with the *USAID Climate Change and Development Strategy*, and addresses all elements presented in the Council on Environmental Quality (CEQ) document "Preparing Federal Agency Climate Change Adaptation Plans" dated February 29, 2012, is consistent with CEQ guidance, and meets all requirements of E.O. 13514.

In addition to USAID's Adaptation Plan, the Agency has completed the following tasks requested by CEQ as part of E.O. 13514:

- **Adaptation Policy Statement**. USAID has submitted and made publicly available an agency-wide climate change Adaptation Policy Statement, signed by the head of the agency, which commits the Agency to adaptation planning to address challenges posed by climate change to USAID's mission, programs, and operations. The Adaptation Policy Statement can be found in Appendix I. USAID Climate Change Adaptation Policy Statement.
- **High Level Vulnerability Analysis**. USAID has submitted a preliminary high-level analysis of agency vulnerability to climate change to the Chair of the Council on Environmental Quality. This analysis was used to inform the USAID Program Vulnerability Assessment section (Section II.B) of this Plan.

These tasks helped build a foundation for USAID's Adaptation Plan presented below, which is organized into the following four sections: (I) USAID Policy Framework for Climate Change Adaptation; (II) Agency Vulnerability Assessment: Analysis of Climate Change Risk and Opportunities; (III) Current and Past Agency Adaptation-Related Actions; and (IV) USAID Planned Adaptation-Related Actions.

I. USAID POLICY FRAMEWORK FOR CLIMATE CHANGE ADAPTATION

While in many ways USAID investments and activities promote the resilience of vulnerable populations to climate vulnerability and change, climate change could have a substantial negative impact on USAID's development efforts, given the Agency's extensive investments in climate-sensitive sectors located in climate-vulnerable regions. Consideration of climate change in strategic planning, program design and implementation, and operations is essential to the success of USAID's mission, carried out through activities that span the globe. USAID seeks to maximize the sustainability and resiliency of its development investments in the face of climate change-related stressors, and build the capacity of its partners and beneficiaries to prepare for climate impacts. Furthermore, there is an opportunity for USAID to serve as a critical part of the climate change solution by promoting vulnerability reduction through efforts related to governance, disaster preparedness, health, food security, and environment.

USAID's Adaptation Plan lays out a process and identifies actions that will help to achieve climate resiliency in USAID's mission, programs, and operations. The Plan is aligned with the *USAID Climate Change and Development Strategy* published in January 2012, which highlights two strategic objectives that focus on understanding and reducing the impacts of climate change.

- *SO 2 Increase resiliency of people, places, and livelihoods:* 1) improve access to science and analysis for decision making, 2) establish effective governance systems, and 3) identify and take actions that increase climate resilience;

- *SO 3 Integration of climate change into Agency programming, policy dialogues, and operations to build resilience:* 1) integrate climate change across USAID's development portfolio, 2) elevate the role of development in climate change dialogues and policy, and 3) lead by example.

As part of these strategic objectives, USAID's Adaptation Plan focuses on six overarching objectives to facilitate the resilience of USAID mission, programs, and operations. These objectives are aligned with the *USAID Climate Change and Development Strategy* roadmap and include: *Guidance and Training, Pilot Activities; Research and Information; Evaluation and Learning; Partnerships,* and *Inreach and Outreach.* USAID's Adaptation Plan identifies near and longer-term actions for each of these objectives.

The process of Agency adaptation planning, implementation, and evaluation described in USAID's Adaptation Plan will be led by the Agency Global Climate Change (GCC) Coordinator, who will work closely with technical experts and Agency leadership across functional and regional bureaus and Missions to implement the Plan. In accordance with the *USAID Climate Change and Development Strategy* roadmap, the GCC Coordinator will lead a process to more formally identify roles and responsibilities within the Agency for implementation of USAID's Adaptation Plan.

II. AGENCY VULNERABILITY ASSESSMENT: ANALYSIS OF CLIMATE CHANGE RISK AND OPPORTUNITIES

In September 2011, USAID prepared a preliminary high-level analysis of the Agency's vulnerability to climate change. Building on that initial work, this vulnerability analysis identifies the challenges posed by climate change to USAID's mission, programs, and operations. The results of this analysis informed the development of specific actions that USAID will undertake in fiscal year 2013 and beyond to better understand and address the risks and opportunities presented by climate change. The following section presents an analysis of the Agency's vulnerability to climate change, as it may affect USAID's 1) mission; 2) programs; and 3) operations.

A. USAID MISSION VULNERABILITY ASSESSMENT

The mission of USAID is expressed in terms of a twofold purpose: 1) to advance U.S. foreign policy investments and 2) to improve the lives of individuals in the developing world. USAID recognizes that climate change could have a substantial negative impact on development efforts designed to advance this purpose. Climate change is also likely to interact with the goal and objectives of the Foreign Assistance Framework for which USAID is responsible.

The Agency relies on successful implementation of programs and smooth and efficient operations to fulfill its purpose, goals, and objectives. Because the Agency has extensive investments in climate-sensitive sectors located in climate-vulnerable regions across the world, climate change stressors are likely to impact the implementation of programs and smooth operations.

For example, climate changes will impact agriculture programs, ecotourism and biodiversity programs, flood control and sewerage projects in large urban centers, and waterborne and vector-borne disease control efforts around the world. On the operational side, climate impacts may cause structural damage to assets, increase health and safety concerns for staff, disrupt transportation infrastructure or utility services, and undermine the security of facilities and personnel. The risk posed to infrastructure and programs changes over time. Impacts will have the greatest effect on investments and policy decisions with a lifetime of 20 years or more. For shorter time frames, programs and operations generally need to be aware of and resilient to current climate variability rather than long-range climate change impacts.

The following sections provide a detailed discussion of the Agency's programmatic vulnerability and operational vulnerability. Understanding and addressing these vulnerabilities will be central to USAID's ability to fulfill its mission.

B. USAID PROGRAM VULNERABILITY ASSESSMENT

Climate change may have significant implications for the effectiveness of USAID's programming and the sustainability of its investments. As discussed in USAID's September 2011 *High Level Analysis of Agency Vulnerability to Climate Change*, key program vulnerabilities are reflected in larger programming streams. In particular, programs in areas like agriculture and food security, global health, water and sanitation, infrastructure, and disaster readiness and humanitarian response are highly vulnerable to climate change.

In order to more thoroughly understand the vulnerability of its programs, USAID conducted a high-level desk review of climate vulnerabilities for twenty-five of its country and regional Missions.

APPENDIX III. COUNTRY AND REGIONAL VULNERABILITY PROFILES presents a series of Country/Regional Vulnerability Profiles that identify the climate risks and opportunities facing current USAID programs. These profiles summarize:

- The country/regional context,
- Projected weather and climate conditions,
- Key climate impacts and vulnerabilities,
- Actions underway, and
- Challenges in addressing climate risks.

This section presents an overview of USAID's program vulnerabilities, drawing on the lessons learned from these country profiles and incorporating the program-stream assessment presented in the 2011 *High Level Analysis of Agency Vulnerability to Climate Change*.

PROJECTED WEATHER AND CLIMATE CONDITIONS

Climate change is expected to alter current weather and climate conditions around the globe, including temperature, precipitation, extreme events, and sea level. These changes in climate will also cause a series of cascading impacts, such as changes in the frequency and intensity of flooding, drought, and storm surge; and changes in the range and prevalence of disease vectors and related diseases. Because USAID has a global presence, it is important for the Agency to understand how projected changes in climate and other related impacts will differ in different countries, regions, and even specific cities and towns. Regions within countries will have very different changes and vulnerabilities, an important consideration in actions. Table 1 provides a high-level overview of some of the key climate stressors by country, for the twenty-five countries and regions highlighted in the profiles developed for this Plan.

Table 1. Key Climate Stressors by Country/Region[1]

Country/Region	Heat	Drought	Flooding	Sea Level Rise
Africa				
Democratic Republic of the Congo	X			
Ethiopia	X		X	
Ghana	X	X		X
Kenya	X	X	X	X
Mali	X		X	
Mozambique	X	X	X	
Nigeria	X		X	X
South Sudan	X			

[1] Based on Country and Regional Vulnerability Profiles (see Appendix III).

Tanzania	X	X	X	X
Uganda	X	X	X	
Zambia	X	X	X	
Latin America & the Caribbean				
Barbados & the Eastern Caribbean	X	X	X	X
Colombia	X	X	X	X
Guatemala	X	X	X	X
Haiti	X	X	X	X
Peru	X	X	X	X
Asia				
Bangladesh	X	X	X	X
Indonesia			X	X
Nepal	X	X	X	
Pakistan	X	X	X	
Philippines	X		X	X
Regional Development Mission Asia	X		X	X
Middle East				
Egypt	X	X	X	X
Jordan	X	X	X	
West Bank and Gaza	X	X		

KEY CLIMATE IMPACTS AND VULNERABILITIES

The type and degree of impacts and vulnerabilities across USAID's partner countries will be as diverse as the projected changes in climate, with consequences for human health, food security, economic growth, livelihoods, and biodiversity, among other objectives. For example, extreme heat events and changes in vector-borne diseases will stress human health. Changes in temperature, precipitation, and flooding will likely have consequences for people whose livelihoods depend on rain-fed crops and for countries in which agriculture is a key economic sector. Drought and, in coastal locations, salt water intrusion could limit the availability and quality of freshwater supplies. Furthermore, climate change may threaten coastal and forest ecosystems that populations rely on, through erosion and landslides, salt water intrusion, forest fires, and the arrival of new invasive species. Finally, more intense flooding, storm surge and rising sea levels may inundate communities and damage infrastructure. Table 2 provides an overview of the vulnerabilities facing the profiled countries/regions, by key sectors.

Table 2. Key Sectoral Vulnerabilities by Country/Region[2]

Country/Region	Human Health	Agriculture	Freshwater Resources	Biodiversity	Ecosystems
Africa					
Democratic Republic of the Congo		X	X		X
Ethiopia	X	X	X	X	X
Ghana	X	X	X	X	X
Kenya	X	X	X	X	X
Mali		X		X	X
Mozambique		X	X		X
Nigeria					X
South Sudan		X		X	X

[2] Based on Country and Regional Vulnerability Profiles (see Appendix III).

Country/Region	Human Health	Agriculture	Freshwater Resources	Biodiversity	Ecosystems
Tanzania		X	X		X
Uganda	X	X	X		X
Zambia	X	X	X		X
Latin America & the Caribbean					
Barbados & the Eastern Caribbean		X	X	X	X
Colombia	X	X			
Guatemala		X			X
Haiti		X	X		X
Peru	X	X	X		X
Asia					
Bangladesh		X	X		
Indonesia		X	X		X
Nepal		X	X		
Pakistan		X	X		
Philippines		X	X		X
Regional Development Mission Asia	X	X	X	X	X
Middle East					
Egypt	X	X			X
Jordan		X	X		
West Bank and Gaza	X	X	X		

KEY USAID PROGRAM VULNERABILITIES

This section provides a high-level overview of the risks and opportunities that climate change poses to some of USAID's major programming streams, as reported in the September 2011*High Level Analysis of Agency Vulnerability to Climate Change.*

AGRICULTURE

- *USAID FY10 investment[3]: $1,005,876,872*
- *USAID FY11 investment[4]: $ 1,013,194,362*

Most countries where USAID works depend on agriculture as a primary livelihood sector. USAID invests significant funding in increasing agricultural productivity, particularly under the new presidential initiative, Feed the Future. At the G8 Summit in L'Aquila, Italy in July 2009, President Obama pledged $3.5 billion for agricultural development and food security over three years. In FY10 and FY11, USAID spent over $1 billion each year on agriculture programs. Some of USAID's agriculture programs offer opportunities to help people adapt to climate variability and change, while others may be undermined in delivering on their objectives without factoring in climate.

[3] "Where does USAID's money go?" With data from USAID/M/CFO/FS as of March 31, 2011
[4] "Where does USAID's money go?" With data from USAID/M/CFO/FS as of September 30, 2011 http://www.usaid.gov/policy/budget/money/

Climate change is a critical cross-cutting issue that can affect the sustainability of investments in agricultural development and food security. Agricultural productivity is already being adversely impacted by increased temperatures, increased rainfall variability, and more extreme weather events.

The focus countries for US food security programming include Ethiopia, Ghana, Kenya, Liberia, Mali, Malawi, Mozambique, Rwanda, Senegal, Tanzania, Uganda, and Zambia in Africa; Bangladesh, Cambodia, Nepal, Tajikistan in Asia; and Guatemala, Haiti, Honduras, and Nicaragua in Latin America. These countries are also highly vulnerable to the adverse impacts of climate change. By 2020, yields from rain-fed agriculture could be reduced by up to 50 percent in some countries in Africa.[5] A one-degree Celsius change in temperature will reduce rice productivity by 10 percent; currently, maize production in Africa is seeing as much as 75 percent losses due to two-degree increases in peak temperatures. By the 2050s, freshwater availability in much of Asia is projected to decrease substantially.[6] In Latin America, changes in precipitation patterns and the disappearance of glaciers will significantly affect water availability for agriculture. In small island states, deltas, and low-lying coastal zones, salt-water intrusion from rising sea levels will reduce the supply of freshwater and threaten the viability of land for agriculture.

Expanding and intensifying agricultural productivity on a large scale in order to increase food security could also adversely affect water resources and aquatic ecosystems, fisheries, and forests, reducing the resiliency of people and the environment to climate stresses and natural disasters. USAID's Feed the Future guide recognizes the need to "integrate environmental and climate change concerns into our investments and support and build the capacity of partner countries to take advantage of opportunities in effective resource management and proactive adaptation to climate change." This should include assessing potential climate risks that could undermine the performance and sustainability of a proposed investment and incorporating measures into the project to reduce the vulnerability of the project to these risks. As noted in Section II.A, impacts will have the greatest effect on investments and policy decisions with a lifetime of 20 years or more. For shorter time frames, programs and projects generally need to be aware of and resilient to current climate variability rather than long-range climate change impacts.

GLOBAL HEALTH

Climate change and variability can impact programs within each of USAID's Global Health Initiative technical areas, including maternal and child health, malaria, neglected tropical diseases, nutrition, and water supply and sanitation. More broadly, climate change can also have profound adverse impacts on health systems and gender inequality, important cross-cutting issues for USAID Global Health programs. While some of USAID's health programs may be undermined in delivering on their objectives without factoring in climate, others offer opportunities to help people adapt to climate variability and change.

Climate change and variability can impact health programs both directly, through heat stress, changes in the hydrologic cycle that drive droughts and floods, increased ground-level ozone, and enhanced pollen production; and indirectly, through impacts on natural and human systems that curtail access to water and food, shift the movement of disease vectors, or interrupt health-care delivery. Changes in air quality

[5] IPCC Fourth Assessment Report
[6] IPCC Fourth Assessment Report

associated with climate change can have significant health impacts, particularly for children and pregnant women. Climate change will increase the severity and frequency of droughts and floods; the subsequent displacement and clustering of people creates unhygienic conditions that are conducive to the spread of cholera and other water-borne diseases. The urban poor, who predominately live in high-risk areas like floodplains, are particularly susceptible to diarrheal disease due to poor sanitary conditions and episodic flooding; climate change will exacerbate these problems. More frequent or more severe extreme weather events may also result in more event-related deaths, injuries, and infectious diseases. Changing temperatures alter the geographic range and seasonality of infectious vector-borne diseases like malaria, yellow fever, and dengue fever. Along with changing agricultural conditions, diet and nutritional status may be impacted; however, the impacts could be positive, negative, or neutral, depending on local conditions.

USAID will need to ensure that it takes climate change impacts into account in the design and implementation of health programs in these areas, in order to anticipate emerging risks, target efforts, ensure the sustainability of programs, and maximize the effectiveness of Agency investments.

MALARIA

- *USAID FY10 investment[7]: $500 million*
- *USAID FY11 investment[8]: $578 million*

Rising temperatures will shift and expand disease transmission zones, alter seasonality, and increase the activity of vectors that transmit diseases like malaria, dengue fever, and yellow fever. In some cases, rising temperatures lead to a decreased incubation period for the parasite, hastening the point at which the mosquito can transmit disease. Whether these changes will actually lead to a greater incidence of the disease will be complicated by factors including control measures, the availability of drugs, population changes, changes in forest cover, migration, and urbanization. USAID's existing malaria programs will need to assist their health partners to be prepared to anticipate changes and possibly respond in new geographic locations.

WATER, SANITATION, AND HYGIENE (WASH)

- *USAID FY10 investment[9]: $520.4 million*
- *USAID FY11 investment[10]: $360.1 million*

USAID's WASH programs seek to increase access to drinking water supply or sanitation services, improve the quality of those services, and/or promote hygiene. Some of USAID's WASH programs offer opportunities to help people adapt to climate variability and change, while others may be undermined in delivering on their objectives without factoring in climate.

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[7] "Fast Facts: The President's Malaria Initiative (PMI)", April 2012, http://www.pmi.gov/resources/reports/pmi_fastfacts.pdf
[8] Staff Communication
[9] "Safeguarding the World's Water: 2011 Report on USAID Fiscal Year 2010 Water Sector Activities", July 2011. http://www.usaid.gov/our_work/cross-cutting_programs/water/WaterReport_2011.pdf
[10] Staff communications

Climate variability and change place stress on water supply, sanitation, and hygiene systems that are often already under considerable stress from a variety of sources in developing countries. Climate-related stresses might include more intense severe weather events, less predictable rainfall and water flows, and increasing evaporation rates. Combined with increased temperatures, these stresses could lead to an increase in water-borne diseases.

Climate and weather impact water supply and sanitation services both directly and indirectly. Potential climate change impacts will vary based on local geography, climate and vulnerability to climate stresses. Table 3 lists some of the potential impacts on WASH-related objectives.

Table 3. Potential Climate Change Impacts on WASH-Related Objectives

Direct Climate Change Impacts	Indirect Climate Change Impacts
Damage to infrastructure due to extreme weather events, coastal inundation, or increasing flows due to melting snowpack and glaciers **Contamination of water supplies** through saltwater intrusion or contaminated runoff resulting from high intensity rainfall events or saltwater intrusion due to sea level rise, land subsidence, and/or lowering of water tables **Flooding** due to increasing rainfall over shorter periods of time **Changing inputs to water storage** due to changes in volume and timing of rainfall, or surface and groundwater flows **Increased evaporative losses** as temperature rises	**Lost productivity** due to disruptions in piped water and sewerage services if infrastructure is damaged **Spread of waterborne diseases** if treatment systems fail or flooding occurs **Increasing competition for water** among sectors if supplies become more scarce and/or demand rises **Unhygienic conditions** in the event of storms or flooding and due to decreased quantity of available water **Higher operating costs and/or shorter lifetime** of water systems, potential for rising water prices **Displacement of populations** if water resources shift or are impaired **Increased travel distances to collect water** if supplies are no longer safe and productive **Conflict** over scarce water resources

Water and sanitation programming addresses many disease vectors and circumstances, including diarrheal diseases, cholera, dengue, and hepatitis. Almost a billion episodes of child diarrhea are treated with lifesaving oral rehydration therapy each year, reducing child deaths from diarrheal disease by more than 50 percent. Breastfeeding, improved water supplies and sanitation, zinc supplementation, and continued feeding of children with diarrhea are other integral components of USAID's strategy to reduce diarrheal diseases and their effects. Integration of climate change information and early warning systems could improve targeting assistance and effectiveness.

INFRASTRUCTURE

- *USAID FY10 investment[11]: $1,073,873,676*
- *USAID FY11 investment[12]: $690,006,767*

[11] "Where does USAID's money go?" FY10

Climate change can affect infrastructure of all types, including transportation systems, water and waste systems, buildings, and communication networks. Because infrastructure often has long lifetimes, it is especially vulnerable to climate changes. Climate change threatens infrastructure ranging from rural roads in floodplains to urban buildings on the coast.

Urban areas are especially vulnerable to climate change impacts, including increased flooding, storm surges, and sea level rise. This vulnerability is critical, as urban areas are home to over half of the world's population and much of its economic activity. Because many cities have naturally developed in coastal zones and flood plains, urban areas are often highly exposed to these impacts. For example, low-lying coastal areas are on average more urbanized than the rest of the world. The vulnerability of cities is compounded by characteristics that increase the severity of climate change impacts. These factors include: concentrated populations, large informal settlements built without regard to official land-use controls and building standards, high concentrations of solid and liquid wastes, large areas of impermeable surfaces that accelerate runoff and disrupt natural drainage, and the potential for interaction between natural disasters and industrial disasters (such as cyclone damage to oil refineries leading to contamination of water supplies). Without specialized urban programming on climate change, developing country cities will be hard-pressed to cope with these unprecedented challenges.

Infrastructure projects conducted by USAID increasingly consider climate change impacts in their design and construction. However, this planning is typically carried out in an ad-hoc fashion at the project level, rather than being a consistent and routine practice in all urban infrastructure projects.

DISASTER READINESS

- *USAID FY10 investment[13]: $62,298,134*
- *USAID FY11 investment[14]: $106,263,764*

USAID already allocates significant resources to help vulnerable countries and communities prepare for extreme weather events such as droughts, floods, and hurricanes. In the development context, the extent of damages from these extreme events is a function of variables such as development pressures, poverty, and lack of capacity. Climate change threatens to exacerbate this situation, by increasing the severity of these events. The success of disaster readiness programming therefore will increasingly depend on consideration of climate change impacts in risk assessment, planning, and implementation.

Climate change may necessitate new protective measures for coastal homes and infrastructure; updated zoning codes; expanded early warning systems; new livelihood alternatives; and in some cases even mass evacuations or permanent migration. It will become even more important for policymakers and public

[12] "Where does USAID's money go?" With data from USAID/M/CFO/FS as of September 30, 2011 http://www.usaid.gov/policy/budget/money/
[13] "Where does USAID's money go?" FY10
[14] "Where does USAID's money go?" With data from USAID/M/CFO/FS as of September 30, 2011 http://www.usaid.gov/policy/budget/money/

officials, farmers, businesses, service providers, vulnerable households, and other stakeholders to be able to access forecasts and information about how they can prepare for and cope with extreme events.

Adaptation efforts can be highly cost-effective: A study presented at a United Nations Framework Convention on Climate Change (UNFCCC) workshop found a positive benefit-to-cost-ratio of 7:1 for improved weather information availability for farmers. USAID has estimated that disaster risk reduction efforts have a similar 7:1 benefit-to-cost-ratio, and the Department of Energy's weatherization program estimated a 7:1 benefit-to-cost-ratio for improved insulation and building-shell maintenance.

CHALLENGES TO ADAPTATION

While the specific challenges that populations, countries, and regions face in reducing vulnerability are dependent on the local context, some overarching themes emerge; the most prominent common challenges relate to a lack of data and capacity.

- *Lack of data*. A lack of localized climate data results in a gap in understanding climate impacts and vulnerabilities, thus making it difficult for place-based response strategies to be developed. More location-specific and accurate data, particularly related to the timing and frequency of precipitation extremes, is required to inform USAID's investments in climate-smart agriculture, infrastructure, and risk reduction activities related to disaster preparedness. Continuing scientific research, monitoring, and technical capacity may help address this challenge, along with attention to data access and management over time.

- *Lack of capacity*. USAID partner countries require greater capacity to understand and address climate change risks and opportunities. Vulnerability assessments and adaptation strategy development and implementation require scientific, technical, planning, financial, and coordination capacity, which many countries cannot provide. Furthermore, many countries must direct time and resources into dealing with more immediate development challenges and defer considering adaptation actions. This challenge can begin to be addressed through increased capacity building for government officials and civil society to mainstream climate change into sectoral plans and incorporate it into the mandate and capabilities of relevant national and local authorities.

C. USAID OPERATIONS VULNERABILITY ASSESSMENT

USAID depends on smooth operations, dependable infrastructure, and a safe and healthy workforce to achieve the agency's purpose, goals, and objectives and to successfully implement its development programs and projects. Changes in climate may jeopardize the continuity and effectiveness of some USAID operations and assets. Climate change impacts could also have financial implications, by increasing the cost of operating, maintaining, and replacing assets and infrastructure.

This section serves as an initial, high-level assessment of the vulnerability of USAID operations, infrastructure, and human resources to projected climate change. To conduct this high-level assessment of vulnerability, four operational areas were considered. These areas focus on operational factors most important to USAID, and incorporate the 13 areas identified in the CEQ guidance. The four areas are:

- **Assets—**Buildings, equipment, facilities, and vehicles owned by USAID or upon which USAID operations depend. This includes assets that are both rented and owned; both independently operated and co-located with the Department of State; and both domestic and overseas.
- **Infrastructure and Support Systems—**Including information and communications technology, transportation, and utilities.
- **Health and Safety—**Including workforce welfare.
- **Security—**Including potential implications of climate change on civil unrest and evacuation needs.

ASSETS

USAID operates from more than 100 offices, including 97 missions located around the world, seven leased offices in Washington, DC, and a training center in Arlington, Virginia. Few facilities are directly owned by USAID; approximately 85 percent of USAID offices are leased or co-located on U.S. Department of State (DoS) property. For example, 75 of the 97 missions are co-located with a U.S. Embassy or Department of State facility. Globally, USAID owns a total of 13 offices, warehouses, and facilities. In addition, USAID invests in new facilities using the Capital Investment Fund. USAID also relies on rented residential properties, particularly for employees located overseas.

Changes in climate will require buildings and other assets to operate over a different range of weather and climatic conditions; these changes may push the boundaries of the design standards of some facilities. USAID should consider this changing stress when signing long-term leases, particularly in older buildings. Changes in temperature, precipitation, sea level, storm surge, and extreme events will also affect facility infrastructure and operations. For example, more frequent or more severe extreme events may increase deterioration or damage to building exteriors, office interiors, or equipment and vehicles, and reduce the lifetime for facilities and assets. High temperatures and heat waves may raise internal cooling demands or building temperatures. More humid weather may affect buildings in warm weather climates through increased mold, fungi, or insect infestations. Increased precipitation (both in terms of average rainfall and the number of intense rainfall events) may lead to greater risk of flooding. Table 4 provides several examples of potential climate change impacts to USAID assets.

These impacts can have serious implications for infrastructure, operations, and services, such as loss of building value, higher repair and maintenance costs, increased safety concerns, elimination or interruption of services, or compromised worker well-being.

Table 4. Examples of Potential Climate Change Impacts on USAID Assets

Stressors	Primary Impacts
Temperature Change	Premature deterioration of building materials due to thermal stress, biochemical activity, freeze-thaw, etc. Changes in the dimension or shape of building materials and equipment from cracking and fissuring Insect infestations, e.g., termites, impacting building structures
Precipitation Change	Increased precipitation may result in: • Seepage and flooding in building interiors • Destruction of building due to landslides • Physical changes to building materials and finishes and increased prevalence of molds and fungi • Corrosion of metals • Sewage overflow Decreased precipitation may result in: • Increased soil cracking and subsidence in areas with clay soils and reduced soil moisture • Inadequately functioning and/or stressed water and waste systems caused by inadequate water supplies
Sea Level Rise & Storm Surge	Closure and/or diminished access to buildings in low-lying coastal areas due to permanent inundation or temporary flooding Waste containment problems
Extreme Events	Reduced durability of exterior surfaces due to erosion and weathering Accelerated deterioration of building shell due to increase in dust, particular matter, and smoke

INFRASTRUCTURE AND SUPPORT SYSTEMS

USAID's operations depend on a variety of infrastructure and support systems. These include information and communications technology, transportation infrastructure, and utilities.

INFORMATION AND COMMUNICATIONS TECHNOLOGY

Information and communications technology (ICT) includes information technology systems, infrastructure, and architecture. Key USAID ICT systems include USAID's knowledge management system; small, automated information management systems; the Foreign Assistance Coordination and Tracking System (joint system with the Department of State); the Global Acquisition and Assistance System; worldwide telecommunications operations; and centralized network, server, and security platforms in DC and overseas. These systems are fundamental for coordination of USAID activity, including external coordination; for communications with missions and partner countries; and for transferring funding for program activities. Without reliable ICT, communications and coordination could break down and missions, programs, and partner countries could lose access to funding.

ICT is vulnerable to a variety of climate change impacts. Below-ground infrastructure could be affected by flooding, sea level rise, subsidence caused by changes in precipitation, and damage to surface infrastructure (such as roads). Above-ground infrastructure could be affected by changes in precipitation, extreme wind, and ground instability. Wireless-, radio-, or satellite-based services could be affected by increasing temperatures, increasing precipitation, and changes in vegetation due to changes in climate. Table 5 provides additional examples of climate stressor impacts on ICT. These impacts could degrade infrastructure; disrupt service; reduce service availability and quality; and change operating, maintenance, and customer support costs.

Table 5. Examples of Potential Climate Change Impacts on ICT Infrastructure and Services[15]

Stressors	Transmissions Infrastructure	Wireless Signals	Buildings and Equipment
Temperature Change	Sinking and tilting of telecommunications towers due to unstable soil	Decreased range of wireless signal transmission, resulting in the location / density of wireless masts becoming sub-optimal	Overheating of data centers, exchanges, base stations, etc.
Precipitation Change	Flooding of low-lying / underground infrastructure and access-holes, particularly in coastal areas, flood plains, and cities Exposed cables / trunk routes due to erosion or damage of transportation infrastructure	Reduced quality and strength of wireless service due to increased rainfall	Changes in requirements to maintain internal environments of system devices due to changes in humidity
Sea Level Rise / Storm Surge	Increased flooding and saline corrosion of infrastructure in low-lying/coastal areas	Changes in reference datum for telecommunication and satellite transmission calculations	Closure or reduced access to low-lying coastal buildings due to permanent or temporary flooding
Changes in Extreme Storms and Wind	Fallen cell towers, telephone poles from extreme wind or fallen trees Increased damage to above-ground infrastructure	*Minimal impact*	*Minimal impact*

TRANSPORTATION

USAID relies heavily on transportation systems to facilitate international travel that is critical for operations. In 2011, USAID employees took 7,401 business trips, not including trips by contractors. Most of these trips were overseas. USAID travel includes operational travel to development sites, to host countries, for training, and in response to disasters, as well as mandatory travel to post assignments, for home leave, for rest and recuperation, and for shipment of equipment. To facilitate this movement of people and goods, USAID relies on air transportation; ground transportation, including roads and rail; and shipping. As with communications, disruptions in transportation and travel could have significant implications for external coordination and program implementation.

Some aspects of the transportation systems upon which USAID relies are vulnerable to climate changes, including changes in temperature, precipitation, sea level rise, and extreme weather events. Many climate-related impacts are already seen today and could increase in frequency or severity due to climate change. Increases in extreme weather can ground flights, damage infrastructure, and increase hazards due to debris. Extreme temperatures can expand and buckle railway tracks and bridge joints, as well as overheat electrical systems. Flooding can wash out culverts and track supports; disrupt travel on roads, rail, and runways; and increase soil erosion and silt deposition. In the longer-term, sea level rise can permanently inundate coastal transportation networks, rendering roads, airports, and ports unusable. Table 6 provides examples of

[15] Table is largely based on Table 4.1 of AEA, 2010. Adapting the ICT Sector to the Impacts of Climate Change: Final Report. _http://archive.defra.gov.uk/environment/climate/documents/infrastructure-aea-full.pdf

potential climate change impacts on transportation infrastructure. These impacts are likely to cause interruptions in transportation services, which USAID relies on and may ultimately affect the ability for USAID operations to function reliably.

Table 6. Examples of Potential Climate Change Impacts on Transportation Infrastructure

Stressors	Roads	Railways	Ports	Airports
Temperature Change	More rapid road asphalt deterioration Increased maintenance and construction costs due to thawing permafrost	Expansion and buckling of railway tracks, joints Overheating of rail electrical systems and communications equipment	Thermal expansion of bridge joints, paved surfaces Higher land-side electricity consumption to meet increased refrigeration needs	Asphalt deterioration on runways Length of runways inadequate due to decreasing air density
Precipitation Change	Increased flooding of roadways Increased soil erosion and washout of road- and tunnel-supporting culverts during flash floods	Increased flooding on tracks and stations Washout of track supports (ballast)	Changes in scour rates in response to increased peak stream flow Channel closures due to increased silt deposition	Travel disruptions due to runway flooding Damage to airport infrastructure due to inundation
Sea Level Rise	Erosion of road base	Flooding of underground pathways and tunnels	Diminished access due to rising sea levels	Erosion of coastal airport runways
	Permanent inundation of road, rail, port, and airport infrastructure			
Storm Surge	Temporary flooding of and diminished access to roadways, rails, ports, and airport facilities Closure of facilities due to debris (e.g., cranes) and damage to infrastructure (e.g., clogging of drainage systems)			
Extreme Wind	Damage to road-side signage and lighting Road closures and increased safety hazards due to debris	Service disruption due to damage and debris Damage to railway stations	Damage to port structures Disruption of operations due to extreme wind	Disruption to air travel and freight services due to flight grounding Damage to aircraft service equipment, hangars, etc.

UTILITIES

USAID relies on energy, water, and sewage utilities to maintain day-to-day operations. In the large majority of missions consolidated with the U.S. Department of State, these functions are managed by the State Department.

Climate changes could result in less reliable and more expensive utility services. Impacts on supply systems could increase energy prices. Increasing temperatures may cause additional cooling requirements resulting in further increased energy costs. Increased demand and extreme weather events could increase the frequency, severity, and reach of energy blackouts. Increased temperatures, extreme flooding, and drought could all degrade water quality and availability. In areas with no increase in precipitation, increased temperatures would

also increase evaporation in reservoirs and potable water supplies. Elevated evapotranspiration rates would further diminishing surface and ground water supplies, and, therefore, overall availability of water for human consumption. Water purification systems may be stressed by the degraded water quality experienced from storm surge, sea level rise, and flooding. The same is true of sewage systems, which are subject to overflow. Table 7 presents a sample of potential climate change impacts on utilities that support USAID operations and programs. It is likely that these impacts will cause disruptions in utility services or result in higher utility service costs, ultimately affecting USAID's operations.

Table 7. Potential Climate Change Impacts on Utilities

Stressors	Energy	Sanitation	Solid Waste Management
Temperature Change	Increased capital costs for building new generation, transmission, and distribution infrastructure to support greater demand Changes in hydropower (e.g., changes in snowpack melt) and biomass potential	Lower water quality from increased algal blooms, pathogens, and lower dissolved oxygen	Increased odor and pest activity requiring more frequent waste collection Overheating of collection vehicles and sorting equipment Increased risk of fire at disposal sites
Precipitation Change	Disruptions in fuel transportation through damage to infrastructure (e.g., flooding, pipeline damage)	Inundation of outfall causing discharge to back-up Damage to collection systems and treatment facilities by flooding	Flooding of collection routes and landfill access roads, making them inaccessible Increased need for enclosed or covered sorting facilities
Sea Level Rise & Storm Surge	Permanent and/or temporary inundation of extraction infrastructure, refineries, power plants, renewable energy systems, and transmission and distribution lines, resulting in disruptions to energy services	Inundation of low lying sanitation facilities and systems requiring relocations Rising water tables decreasing effectiveness of latrines, septic systems, and leach field systems	Permanent and or/ temporary inundation of collection, processing, and disposal infrastructure Deterioration of impermeable lining
Extreme Events	Disruption of operations (e.g., temporary shutdown) Change in capacity for solar and wind power Damage to power lines	Prolonged drought leads to lower flows in receiving streams, reducing the capacity of water resources to absorb and dilute pollution, impacting treatment performance	Extreme wind leads to dispersal of waste from collection sites, collection vehicles, processing sites, and landfills

HEALTH AND SAFETY

The USAID workforce, including contractors, is fundamental to the successful operation of USAID programs. USAID has almost 9,500 employees, not including contractors. About 70% of these employees are stationed overseas. USAID must ensure the health, safety, and well-being of their employees and contractors located both in the United States and overseas.

Climate changes may threaten worker well-being in numerous ways. Flooding and extreme weather events currently affect commutes, decreasing safety and reducing the ability of people to get to the office; severe

weather events can be life-threatening. Changing patterns of severe weather due to climate change are therefore likely to have impacts on worker well-being as well as on their ability to fulfill work assignments. In addition, changing patterns of disease could compromise the health of workers in some locations, particularly in locations with poor health services. For example, more USAID staff may be exposed to malaria and need to use anti-malarial drugs, while Foreign Service Nationals (FSNs) may be increasingly exposed to contaminated water. Increasing temperatures could require additional energy to increase air conditioning and might contribute to heat stress on the job (i.e., if increasing energy demands result in energy outages). Worsening conditions in overseas locations could require USAID to increase the number or dollar amount of "difficult-to-staff incentives." Table 8 lists a number of the impacts climate change may have on the health and safety of USAID workers.

Table 8. Examples of Potential Climate Change Impacts on Health and Safety of USAID Workers

Stressors	Examples of Impacts on Health and Safety of USAID Staff
Temperature Change	Heat stress/ stroke or hyperthermia Respiratory diseases due to changes in ground-level ozone, particulate matter (PM), and allergens Increased risk of diseases due to changes in the ranges and activity of vectors and parasites
Precipitation Change	Reduced water availability Flooding contaminates water and food supplies with pathogens Increased risk of diseases due to changes in the ranges and activity of vectors and parasites
Extreme Events	Increased injuries from flying debris during storms with high winds Reduced water and food availability Interruption of communication, utility, and health care services

SECURITY

Finally, climate change could exacerbate the conditions for unrest in USAID's partner countries, by further reducing already limited resources like food and water, by forcing temporary or permanent migration of communities, or by fostering unsafe situations if government services are disrupted in the event of disaster, particularly for marginalized populations. Such unrest could require USAID to implement additional security measures and contingency planning, including for USAID facilities and workers.

III. CURRENT AND PAST AGENCY ADAPTATION-RELATED ACTIONS

USAID has been investing in actions that help the Agency better understand climate change risks and opportunities and reduce vulnerabilities since 1991. For example, USAID created a position of Climate Change Coordinator in 2011. This section presents examples of how the Agency has been developing its understanding of climate change impacts and is taking steps to build a more resilient world. These examples illustrate activities underway at USAID headquarters and the Missions.

A. USAID HEADQUARTERS CURRENT AND PAST ADAPTATION-RELATED ACTIONS

USAID headquarters is already committed to working on reducing program vulnerabilities. Two overarching actions include development of the *USAID Climate Change and Development Strategy* and programming of adaptation funding, which are described below.

Climate Change and Development Strategy 2012-2016. In January 2012, USAID released the *2012-2016 Climate Change and Development Strategy*, which describes USAID's goal of enabling countries to transition to climate-resilient low emission sustainable economic development. The *USAID Climate Change and Development Strategy*, as part of the broader Presidential Global Climate Change Initiative, describes several strategic objectives and associated immediate results to accomplish this goal (see Page 6 for more information).

The *USAID Climate Change and Development Strategy* also provides a roadmap for implementation which has just begun. The roadmap highlights the most critical steps needed for integrating climate change into the Agency's mission, programs, and operations. The actions described in the roadmap are described in Section IV.B.

Priority Adaptation Country Funding. The Global Climate Change Initiative has identified priority countries where USAID Missions will receive adaptation funding to help the country address climate change vulnerabilities. Under this designation, the annual adaptation funding request for each priority country during fiscal years 2011 and 2012 ranged from $2 million to $5 million, and was higher for some island regions. The priority adaptation countries were identified according to criteria related to exposure, sensitivity, and capacity and willingness to respond to climate change. In addition, the selection focused on least developed countries, small island developing states, and glacier-dependent countries. The countries that were selected were Bangladesh, Barbados and the Eastern Caribbean, Cambodia, Colombia, Dominican Republic, Ethiopia, Guatemala, India, Indonesia, Jamaica, Kenya, Malawi, Maldives, Mali, Mozambique, Nepal, Peru, Philippines, Rwanda, Senegal, Tanzania, Timor-Leste, Uganda, and Vietnam, and the priority regional platforms were East Africa, Southern Africa, West Africa, Regional Development Mission Asia, and Regional Development Mission – Pacific. Each of these countries is using this priority adaptation country funding to implement programs to reduce the specific vulnerabilities in-country. For example, in Ethiopia, funding is being used for adaptation initiatives related to disaster risk management, agriculture, and ecosystem conservation. The USAID adaptation actions in Ethiopia aim to develop early-warning systems related to drought, prevent overexploitation of water resources, and build capacity to adapt food production systems to changing climate conditions.

The remainder of the section provides an illustrative list of actions undertaken at USAID headquarters organized by six overarching objectives that are consistent with the roadmap outlined in the *USAID Climate Change and Development Strategy* and include *Guidance and Training*, *Pilot Activities*, *Research and Information*, *Evaluation and Learning*, *Partnerships*, and *Inreach and Outreach*. These actions represent only a fraction of USAID's current and past adaptation-related activities.

GUIDANCE AND TRAINING

Country Development Cooperation Strategy Supplemental Guidance. In September 2011 USAID issued final guidance for developing Country Development Cooperation Strategies (CDCS). A CDCS is a five-year strategy that focuses on USAID-implemented assistance—and related USG non-assistance tools—that is developed collaboratively with a range of stakeholders in a given partner country. These stakeholders

include the USAID Mission, the host country government and citizens, civil society organizations, the private sector, multilateral organizations, other donors, the State Department, and other USG agencies. Subsequently, in January 2012, USAID issued the CDCS Supplemental Guidance for Integrating Global Climate Change. All Missions are required to fully consider climate change—both climate change mitigation and adaptation—during the country-level strategic planning process. The Supplemental Guidance provides guidance to USAID Operating Units on how to approach this integration and is immediately mandatory for all Missions launching the CDCS process.

More specifically, the Supplemental Guidance helps all operating units consider how climate change should be integrated by requiring them to address four questions in their CDCS related to climate change impacts on the specific country, citizens, government, and USAID strategies and operations. The document also provides Missions with 10 Guiding Principles for climate change analyses and strategic program planning. Lastly, the guidance document poses additional required questions for Missions receiving Global Climate Change Initiative funding, including funding for adaptation programs.

Adapting to Climate Variability and Change: A Guidance Manual for Development Planning. USAID published "Adapting to Climate Variability and Change: A Guidance Manual for Development Planning" in August 2007. The goal of the manual is to help project planners in Missions assess the vulnerability of projects to climate impacts and identify and implement climate change adaptation options (the V&A approach). The V&A approach can be adapted to different types of projects in various sectors and can apply to a range of climate concerns. The V&A steps can be incorporated at any stage of a project cycle. The guidance also incorporates real-life examples by describing adaptation-related pilot activities (mentioned below) and links to other sources of information. The GCC Office also conducted a number of pilot activities—in Honduras, Mali, South Africa, Thailand, Madagascar, the Marshall Islands, and Peru—to develop and test the V&A approach laid out in this manual.

Climate Change Training. To enhance USAID's capacity to meet the climate change related objectives laid out in the Agency's recently released *Climate Change and Development Strategy*, USAID has developed for its staff an online introductory course to global climate change (GCC-101) as well as more in-depth classroom courses on integrating climate considerations into USAID's work, mitigation (clean energy and REDD+), and adaptation. In fiscal year 2011, the full suite of classroom training courses were offered in Bangkok, Thailand and Washington, DC, with a total of 267 participants. During the same time period, 168 people completed the online GCC-101 course. More recently, training courses have been offered in Addis Ababa, Ethiopia and Bangkok, Thailand. The training courses will also be offered again in Washington, D.C. to ensure that relevant USAID staff have the opportunity to gain the knowledge and skills needed to understand how climate change may affect their work, how to respond to it, and how to effectively program direct climate change funding. With the successes of the last three years of training, future training efforts will evolve to mission-targeted and skills-based training, and rely on self-paced modules for 101-level learning.

Adapting to Coastal Climate Change. USAID's "Adapting to Coastal Climate Change: A Guidebook for Development Planners," published in May 2009, aims to help project planners in Missions assess climate change impacts and vulnerabilities to coastal programs, plans, and projects, and develop and implement adaptation options (the V&A approach). The Guidebook serves as a companion document to "Adapting to

Climate Variability and Change: A Guidance Manual for Development Planning," which covers a range of sectors.

New Adaptation Mainstreaming Guidance. USAID is in the process of developing new guidance focused on mainstreaming climate concerns into development and sector planning of USAID Bureaus and Missions' programs and projects. The mainstreaming guidance, to be released in 2012, will update the V&A approach in the previously released General Guidance Manual and the Coastal Climate Manual. The updated guidance will have a broader focus and better account for financial, technical, organizational, and capacity constraints. It is expected to feature more practical tips on tailoring V&A steps to the specific needs of adaptation planning, provide guidance on integrated assessment of climate and non-climate stressors, and provide information on comparative analysis of development and adaptation measures.

Climate Resilience Guidance Briefs. USAID is developing climate resilience guidance briefs with the goal of providing USAID Bureaus and Missions with knowledge and references on climate impacts in an effort to motivate them to consider climate change in program and project design. These briefs are expected to be completed during 2012. The 9 to 10 page guidance briefs will focus on priority USAID funding areas that may be vulnerable to climate change. The GCC Office has already drafted briefs on water, sanitation, and hygiene and global health. Additional briefs will likely focus on disaster risk management and urban climate variability issues.

Sectoral Adaptation Guidance. USAID is also in the process of developing sector-specific adaptation guidance in the form of Climate Annexes that support the mainstreaming guidance document. They are expected to be completed in 2012, will cover sector vulnerability and adaptation in greater detail than the climate guidance briefs, and are oriented to a broader audience, including USAID and decision makers and practitioners in developing countries. The Annexes will focus on methods for mainstreaming climate change considerations into water, coastal and marine, gender and vulnerable populations, and governance issues.

USAID Climate Change Adaptation Programming Guidance. USAID is also developing USAID-specific climate change adaptation programming guidance that will be disseminated to USAID staff. The guidance will help USAID staff understand how climate change affects their development work and how to design climate-resilient programs in line with the Climate Change and Development Strategy advantageously and appropriately. This guide explains the rules surrounding Adaptation funding and provides guidance on how to fulfill strategic planning, project management, and reporting requirements for adaptation.

PILOT ACTIVITIES

Integration Pilots. USAID is supporting a series of climate change integration pilot activities to deepen USAID's experience with integration of climate into other development sectors. The pilots will seek to increase the impact, effectiveness, and sustainability of development interventions by addressing climate-related risks, vulnerabilities, and opportunities in sectoral programs. Seven pilots, proposed by USAID Missions, have been selected, while an additional six to seven projects will be awarded.

Climate Smart Missions. USAID is soliciting interest from Missions interested in becoming "climate smart." One element of this initiative is focused on reducing the vulnerability of the Missions' programs and

operations. These Missions will receive funding and technical support for integrating climate considerations into their activities. For example, participating Missions will be provided technical assistance in screening all programs and operations for their sensitivity to climate change impacts.

RESEARCH AND INFORMATION

Research and exploration are required in many instances to more thoroughly understand the problems associated with climate change and to identify effective ways of addressing them. The following actions seek to fill to a number of identified information and/or data gaps.

Climate Services Partnership. The Climate Services Partnership seeks to improve understanding and application of climate services among decision makers and practitioners in developing countries, including USAID Missions and their partners. The program will compile and disseminate current climate services knowledge, conduct case studies and assessments of climate services, explore economic valuation of climate services, develop a climate information guidebook, and pilot nation-level climate services analysis.

Famine Early Warming Systems Network. The USAID-funded Famine Early Warning Systems Network (FEWS NET) provides early warning and vulnerability information on food security issues; monitors agriculture, climate, and market data; and helps decision-makers mitigate food insecurity. FEWS NET reduces the risk of food insecurity in part by refining and applying climate data. It is an example of effective scientific analysis of food security and climate change. FEWS Net has been operating since 2005 and its USG implementing partners include USGS, NASA, NOAA, and USDA.

SERVIR. SERVIR, the Regional Visualization and Monitoring System, builds capacity of decision-makers to access and utilize satellite, observation, monitoring, and visualization tools and other geospatial data to help inform decision-making on issues including agriculture, water, health, and disaster response. Three hubs in Central America, East Africa and the Himalaya region currently collect and process climate information and apply it to help reduce regional vulnerability and develop adaptation and mitigation strategies. Currently 12 of USAID's priority adaptation countries are served by the SERVIR network. Efforts are underway to apply the SERVIR model in other regions to support climate-resilient development. SERVIR began operation in 2004 and is primarily supported by USAID and NASA.

EVALUATION AND LEARNING

Evaluation Plan for Climate Change Programming. USAID is currently working on improving methods for monitoring and evaluating climate change adaptation to ensure that the results of adaptation programs and projects can be captured and communicated. As part of this initiative, USAID is working on developing a monitoring and evaluation plan to be used for implementation of the *USAID Climate Change and Development Strategy*, as well as an Agency Global Climate Change Evaluation Agenda.

PARTNERSHIPS

Adaptation Partnership Workshops. The Adaptation Partnership was created by the Governments of Costa Rica, Spain, and the United States at the Petersberg Ministerial Climate Dialogue in 2010. Since then, over 50 developing and developed countries have participated in the Partnership to identify common adaptation priorities and improve coordination of efforts to scale up action and financing for adaptation. In

this context, USAID and other countries have supported a series of workshops for donors, developing country governments, NGOs, and others. The workshops convene practitioners to address adaptation challenges that are either regionally- or sector-based, and to share good approaches to adaptation. In addition to workshops, the Adaptation Partnership supports follow-on research and pilots and facilitates communities of practice.

These workshops have proven to be useful to USAID in a number of ways. The workshops help USAID understand the key climate vulnerabilities facing partner countries and where these countries struggle to address climate challenges; ultimately this helps to facilitate USAID's research efforts and generate information that can be used to reduce the vulnerability of USAID programs and projects. The Partnership has promoted the exchange of lessons learned and best practices so USAID can share as well as build from experiences of partners across the world. A sample of Adaptation Partnership activities includes:

- Himalayan Workshop, Knowledge Exchange Field Expedition & Workshop: September 2011
- Workshop on the Climate Services Partnership: New York, October 2011
- Assessing Climate Change Vulnerability and Building Resilience in the Agriculture Sector to Promote Economic Development and Food Security: Costa Rica, March 2012
- Tracking Successful Adaptation – Smart Monitoring for Good Results: Germany, May 2012

INREACH AND OUTREACH

Individual USAID functional and regional bureaus have also developed integrated programs, where a series of actions are focused on better understanding and addressing climate change risks and opportunities. While the programs listed below are described as more overarching in their approach to climate change adaptation, a number of the actions described above also fall under these programs.

Global Climate Change (GCC) Office: Climate Change Resilient Development. The GCC Office's Climate Change Resilient Development (CCRD) project is designed to enhance resilience of developing country peoples, assets, and livelihoods through improved design of USAID programs and increased capacity to respond to climate change impacts. This goal is supported by three objectives: 1) provide support to USAID Missions and bureaus to mainstream climate change into development programs and projects; 2) coordinate with other USG Agencies to support global mainstreaming of adaptation; and 3) identify and respond to emerging issues and provide knowledge management assistance for design, planning, and implementation of climate resilient development programming.

Africa Region: African and Latin American Resilience to Climate Change. USAID Africa Bureau's Office of Sustainable Development is providing project assistance and capacity-building to promote adaptation to climate change under the African and Latin American Resilience to Climate Change (ARCC) Project. The project will develop assessment methodologies to guide USAID adaptation programming, create a vulnerability assessment tool specifically for Feed the Future planning, and provide support and technical assistance for field Missions in the Africa region, as well as the Latin American and Caribbean region.

Asia Regional Bureau: Asia Region Environmental Field Support (AREFS). The project is designed to provide support to USAID Missions in the Asia-Pacific region to enable them to plan, implement and evaluate climate change adaptation programs and projects. AREFS is currently working on: 1) surveying Asia Missions to identify short-term technical assistance (STTA) needs in climate adaptation and providing STTA; 2) monitoring and evaluating climate change statistics and implications for Asian countries; 3) monitoring resiliency and the need for adaptation in prioritized infrastructure, extractive industry, and industrial agriculture projects; and 4) providing outreach and communications, including the development of a website and training courses.

B. USAID MISSION-LEVEL CURRENT AND PAST ADAPTATION-RELATED ACTIVITIES

Country and regional Missions are integrating adaptation into some of their key programs to build resilience to climate change and variability and safeguard USAID investments. This section provides an illustrative overview of adaptation-related activities being undertaken by USAID Missions but does not capture the full spectrum of on-the-ground adaptation activities that are reducing climate-related vulnerabilities.

Rwanda Mission: Rwanda Integrated Water Security Program. USAID/Rwanda's Rwanda Integrated Water Security Program (RIWSP) is a five-year sub-program that began in 2011 under the Global Water for Sustainability Program consortium. The goal of RIWSP is to improve human health, food security, and resiliency to climate change for vulnerable populations in Rwanda by improving the sustainable management of water quantity and quality.

Senegal Mission: Collaborative Management for a Sustainable Fisheries Future (COMFISH). The URI-USAID COMFISH project is a five-year initiative which began in February 2011. Among other activities aimed to promote sustainable fisheries management, COMFISH will address climate change vulnerabilities of fishing communities by producing a guide on vulnerability assessments and adaptation strategies, demonstrating effective V&A methods, and mainstreaming climate considerations into policies, plans, and decision making.

Indonesia Mission: Indonesia Marine and Climate Support. The USAID/Indonesia's four-year Indonesia Marine and Climate Support (IMACS) project began in December 2012 and is designed to improve marine resource management. Among other focus areas, IMACS is working to provide technical assistance to communities and local governments regarding a regulatory framework for coastal adaptation practices, tracking of vulnerabilities and impacts, and land use and sea use planning.

Regional Development Mission-Asia (RDMA): Asia-Pacific Regional Climate Change Adaptation Assessment Report. USAID released the "Asia-Pacific Regional Climate Change Adaptation Assessment – Final Report: Findings and Recommendations" in April 2010. The report assesses the priority climate change vulnerabilities and adaptation challenges of the Asia-Pacific region. The assessment conducted a gap analysis of adaptation needs in the region and is designed to inform the planning process for possible future activities funded by USAID/RDMA to address the needs.

Sri Lanka Mission: Enhance Climate Resiliency and Water Security. USAID's Enhance Climate Resiliency and Water Security project aims to increase Maldives' national capacity to adapt, and is also designed to create two climate-resilient islands to serve as a model for future development efforts. The project is providing assistance by building government capacity to undertake long-term and integrated planning; ensuring continued access to safe water, sanitation, and solid waste services; and working with stakeholders on multiple levels to collaborate on planning for and adjusting to climate change impacts.

Jamaica Mission: Marketing and Agriculture for Jamaican Improved Competitiveness (MAJIC). The goal of the MAJIC project, a three-year project which began in 2010, is to transform Jamaica's agriculture sector into a market-driven, competitive industry and to help strengthen food security. An assessment examined the vulnerability of MAJIC's activities, key crops, and beneficiary's livelihoods to climate change. The results informed plans for future work and provided targeted strategies to address challenges associated with climate change.

IV. USAID PLANNED ADAPTATION-RELATED ACTIONS

USAID has developed a series of actions it will undertake to establish a process of adaptation planning, implementation, and evaluation in order to better understand and address climate change risks and opportunities for USAID's mission, programs, and operations. While this section presents these actions in an organization consistent with the *USAID Climate Change and Development Strategy*, it comprehensively includes the information outlined in the following CEQ suggested Adaptation Plan Elements: *3. Process of agency adaptation planning and evaluation; 4. Programmatic activities; 5. Actions to better understand climate change risks and opportunities;* and *6. Actions to address climate change risks and opportunities.*

As previously mentioned, the ability for USAID to achieve its mission (i.e., purpose, goals, and objectives) relies significantly on the success of its programs and projects, as well as the stability of its operations. Therefore, many of the actions identified in this section focus on understanding and addressing programmatic and operational climate change risks and opportunities to ensure successful achievement of USAID's mission. Finally, USAID expects that the actions described below will adjust and evolve over time in response to changes in need, context, interests, etc. and are therefore not static in nature.

This section is organized, like others in USAID's Adaptation Plan, by adaptation actions related to USAID's mission, programs, and operations. The actions that USAID will commence are further disaggregated by time periods: fiscal year 2012 (FY12), fiscal year 2013 (FY13), and fiscal years 2014 thru 2016 (FY14 – FY16) to ensure consistency with the *USAID Climate Change and Development Strategy* as well as CEQ Adaptation Plan requirements.

To complement the brief summary of each action provided in the text below, tables found in Appendix II. USAID Planned Adaptation Actions Summary Tables provide more detailed information about each action, such as the agency lead, scale, timeframe, coordination, and challenges, among other characteristics.

A. OVERARCHING ADAPTATION-RELATED ACTIONS SUPPORTING USAID'S MISSION

Most of the actions identified in this Plan are focused on programs and operations, which directly support the achievement of USAID's mission. This section presents some of the overarching actions needed to guide and enable Agency adaptation planning, implementation, and evaluation in FY13 and beyond.

The process of Agency adaptation planning, implementation, and evaluation will continue to be led by the Agency GCC Coordinator who will work closely with technical experts and Agency leadership across functional and regional bureaus and Missions to implement USAID's Adaptation Plan. In accordance with the *USAID Climate Change and Development Strategy* roadmap, the Coordinator will lead a process to more formally identify roles and responsibilities as well as a governance structure within the Agency for implementation of the Plan. The process will be flexible and adaptable to ensure that changes can be made to implementation as needed.

The actions listed in the following two sections, Adaptation-Related Actions Supporting USAID's Programs and Adaptation-Related Actions Supporting USAID's Operations, explain the processes that will be used to: explore and identify climate vulnerabilities; identify and prioritize actions to better understand or address risks and opportunities; and monitor or evaluate the implementation of successful climate change adaptation actions. Some of the actions describe implementation plans for processes that have already been established while other actions lay out a methodology for developing processes (e.g., monitoring and evaluation). Additional actions that are important at a strategic planning level are as follows.

FY12

- **Launch Agency Climate Change and Development Strategy**. This Strategy, released in January 2012, recognizes that consideration of climate change in strategic planning, program design, and project implementation across a range of development sectors is essential to the success of USAID's mission and purpose.

- **Complete Implementation Plan for Climate Change and Development Strategy**.

FY13

- **Distribute USAID's Adaptation Plan**. Make this Adaptation Plan available to Agency personnel as part of the Agency Sustainability Plan in headquarters and Missions upon CEQ approval, and disseminate the Plan to actors integral to implementation.

- **Review and Update USAID's Adaptation Plan.** During FY13, review the Adaptation Plan, evaluate the status of the FY12 and FY13 stated actions, and update the plan for FY14. Conduct on an annual basis.

B. ADAPTATION-RELATED ACTIONS SUPPORTING USAID'S PROGRAMS

USAID has developed a list of actions that will help the Agency both better understand and address climate change risks and opportunities of their programs and projects. These programmatic actions have been grouped into six overarching objectives that are consistent with the roadmap outlined in the *USAID Climate Change and Development Strategy* and include *Guidance and Training*, *Pilot Activities*, *Research and Information*, *Evaluation and Learning*, *Partnerships*, and *Inreach and Outreach*. These objectives are closely integrated; many actions support more than one objective. Together, they address each of the programmatic activities identified in CEQ guidance.

GUIDANCE & TRAINING

USAID understands that climate change must be taken into account throughout the programming cycle to ensure that programs and projects are resilient to the impacts of climate change. To facilitate successful integration of climate change considerations, USAID is developing guidance documents and trainings focused on areas where climate change should be integrated into program elements. These guidance documents and trainings are helping to educate and guide USAID staff in understanding climate change impacts, key vulnerabilities, and actions to address climate change risks and opportunities.

FY12

- **Publish Updated Adaptation Guidance Manual and Sectoral Briefs**. This action has been separated into three separate actions:
  - *Complete Development of USAID Climate Change Adaptation Programming Guidance*: Develop and disseminate a guide that helps USAID staff understand how climate change affects their development work, e.g., to avoid maladaptation, and how to design climate-resilient programs in line with the Climate Change and Development Strategy advantageously and appropriately. This guide explains the rules surrounding Adaptation Funding and provides guidance on how to fulfill strategic planning, project management, and reporting requirements for adaptation.
  - *Prepare Climate Guidance Briefs*: Collaborate within the Agency to prepare briefs that provide USAID Bureaus and Missions with knowledge and references on climate impacts in priority funding areas, such as infrastructure, water sanitation and hygiene (WASH), food security, and health, and describe methods for integrating climate considerations into programs.
  - *Update and Publish Programming Guidance for Climate-Resilient Development*. Publish an updated adaptation guidance manual for mainstreaming climate change into the program cycle, based on lessons learned and advances in the discipline since release of the 2007 Adaptation Guidance Manual. The objective of this guidance is to support climate resilient development in partner countries by enabling practitioners to integrate climate considerations into their programs and projects.
- **Develop Country Development Cooperation Strategy (CDCS) Supplemental Guidance**. Develop, disseminate, and advise countries on integrating climate considerations into their CDCS.

- **Conduct Targeted and Skills-Based Climate Change Adaptation Training**. Train 60 USAID staff on climate change adaptation.

FY13

- **Create Sectoral Project Design Guidance and Training**. Work within the Agency to develop guidance and training for resilient programming in climate-sensitive sectors (e.g., agriculture, health, water management, disaster risk reduction, natural resource management, and infrastructure). This may be in coordination with the more general mainstreaming guidance discussed above. Disseminate guidance broadly.

- **Conduct Climate Change Adaptation Training**. Train additional USAID staff on climate change adaptation and/or integrating climate change considerations into programming in climate-sensitive sectors.

FY14-FY16

- **Review Environmental Impact Assessment**. Following USAID policy development guidance, review core agency environmental procedures under 22 CFR 216 and other federal agency procedures under the National Environmental Policy Act (NEPA) to make recommendations as to whether and how required environmental impact assessment procedures should consider climate change in USAID-funded programs and activities. If appropriate, develop associated guidance and/or training.

- **Ensure Reporting Requirement Performance**. Work with Streamlining committee to ensure that all reporting requirements related to the *USAID Climate Change and Development Strategy* can be met through planning and reporting systems utilized by the Agency. If appropriate, develop associated guidance and/or training.

PILOT ACTIVITIES

Pilots allow for leadership to emerge, new approaches to be tested, and best practices, lessons, and tools to be generated. Therefore, USAID seeks to capitalize on pilot activities focused on climate change adaptation integration. The results of adaptation-focused pilot activities will help to inform the priorities of USAID's climate and development strategy beyond 2016.

FY12

- **Commence Integration Pilots**. Pilot activities on integrating climate change adaptation into USAID development programs in areas like food security, water, health, and democracy and governance have already been selected, and are proceeding to procurement, design and implementation.

FY13

- **Implement and Evaluate Integration Pilots**. Begin or continue to implement pilot activities. Develop and apply evaluation plans that comply with the Agency's new evaluation policy (discussed

below) and test the validity of the development hypothesis underpinning pilot design and ensure that lessons learned are shared for adaptive management.

- **Support Additional Integration Pilots**. Support additional integration pilots to begin in FY13.

FY14-FY16

- **Compile Lessons Learned and Best Practices from Pilots**. Use stakeholder input and the results of pilot monitoring and evaluation to identify key lessons learned. These lessons may include opportunities and obstacles that have influenced the effectiveness of the projects. As appropriate, translate the lessons learned into regional, country-specific, and sectoral best practices or case studies that will assist in the implementation of future climate change adaptation and integration efforts.

RESEARCH AND INFORMATION

While USAID understands it is imperative that Agency investments in climate change be evidence-based, there may be data gaps due to the infancy of climate change programming. Therefore, USAID will work within the Agency and among other USG partners and key external stakeholders (including other donors and civil society partners) to understand the needs for applied research on climate change and development and further the state of information.

FY12 - 13

- **Conduct Survey of Applied Climate Change and Development Research Needs.** Develop a rapid survey of perceived needs for applied research within the Agency and among USG partners and key external stakeholders.

- **Develop Climate Change and Development Research Strategy.** Use the results from the survey of applied research needs to develop a research strategy that will identify a set of core questions focused on understanding and addressing the risks and opportunities of climate change and identify financial resource, either centrally managed or country-based, to address these questions. The strategy will include a plan for leveraging the resources of the U.S. federal science community.

- **Conduct Climate Change and Development Research**. Begin to support prioritized research efforts identified in the climate change and research strategy. Research efforts may include innovative approaches to adaptation, such as a resiliency index, measuring the costs and benefits of adaptation, or tools for managing risk.

EVALUATION AND LEARNING

USAID has a responsibility to use its climate change funds to achieve the greatest impact per dollar spent; therefore, the Agency will emphasize effective monitoring and evaluation to ensure accountability for the results achieved with USAID's climate change investments. Furthermore, USAID will capitalize on stakeholder input and the results of program and project monitoring and evaluation to continue learning about effective ways to understand and address climate change risks and opportunities. The Agency will also invest in the exchange of learning both within and outside of the Agency as seen through actions under the *Guidance and Training* and *Partnerships* objectives.

FY12 - 13

- **Design Agency Monitoring and Evaluation Plan for Climate Change Programs.** USAID will design a monitoring and evaluation plan for climate change programs, one element of which will be focused on adaptation. USAID has already begun to design an evaluation plan that is consistent with its new evaluation policy to assess success, scalability, and replicability of direct climate change programming and integration activities. To the extent possible, the evaluation plan will incorporate impact evaluations of the largest investments and if necessary will identify design indicators to monitor program performance over time.

- **Host Climate Change Adaptation Learning Workshops**. Conduct a series of workshops around critical topics, such as best practices for vulnerability assessments, index measures for climate vulnerability, or tools for assessing the economic impacts of climate change and climate change programs.

- **Compile Climate Change Adaptation Lessons Learned**. Evaluate past climate change programs (including integration pilot activities as discussed above) and other relevant examples of integrated programming to glean lessons that will inform USAID's next generation of programming. Distribute to Agency staff, incorporate into revised guidance, and share with the broader development community.

- **Develop Climate Change Adaptation Help Desk**. Design, develop, and implement an internal climate change adaptation focused help desk that answers questions related to climate change vulnerability, impacts, and adaptation. The resource will allow staff with diverse needs to retrieve accurate and reliable information prepared by climate change adaptation experts in one location.

FY14-FY16

- **Exchange Climate Change Adaptation Lessons Learned**. Exchange lessons learned with other major actors in the climate change space. This exchange may occur through various mechanisms including sharing at smaller communities of practice or working groups; attending and presenting at domestic and international conferences or workshops, such as the Interagency Forum on Climate Change Impacts and Adaptations hosted by NASA and USACE; or supporting platforms for exchange of experiences.

PARTNERSHIPS

USAID recognizes that its resources for climate change are limited relative to the scope of the overall need, to those of other donors, and to potential investments by the private sector. Partnerships are therefore critical to successful and widespread adaptation. USAID encourages proactive development of diverse partnerships with other agencies within the USG, civil society, international institutions, and private sector organizations that can assist with information gathering and implementing climate change adaptation and development activities. USAID will take advantage of strong existing interagency partnerships that tap into the research and technical expertise of many agencies, such as NOAA, DoE, and EPA. These partnerships can provide

targeted technical assistance for actions under the *Guidance and Training* and *Pilot Activities* objectives and contribute in important ways to the Agency's actions that fall within the *Research and Information* objective.

FY13

- **Develop Climate Change Adaptation Coordination Plan**. Develop a coordination plan both within USAID and across USG agencies, other international donors, civil society groups, and the private sector. The coordination plan may identify the need to establish or participate in working groups, communities of practice, or partnerships that may be topic- or location- specific, or broad reaching; in-person or virtual; or technical or conceptual. When developing the strategy USAID will consider the Agency's research needs, programmatic investments, international commitments, and interests, among other elements.

- **Form Private Sector Alliance**. Actively pursue private sector alliances that offer opportunities to leverage public funds and to support innovation in areas such as insurance and information technologies toward adaptation investments.

FY14-FY16

- **Engage Youth Partnership**. Engage USAID's climate and youth experts and youth organizations to bring awareness to the impacts of climate change on youth and the opportunities it poses for young entrepreneurs, advocates, students, and others.

INREACH AND OUTREACH

USAID understands that effective inreach and outreach are critical to successfully implementing resilient programs and projects. USAID will expand communication on the importance of integrating climate change adaptation into development goals. USAID will also continue to make new information and resources, such as on-line resources, publications, methodologies, and tools available throughout the Agency.

Many of the actions described in the previous five objectives contain elements of inreach and outreach, and therefore this section does not list specific actions. For example, USAID plans to host summits, seminars, and other information exchanges to disseminate best practices to other organizations working in the field. Additionally, USAID will continue to lead efforts to incorporate climate change modules into trainings for new Foreign Service Officers and other employees.

C. ADAPTATION-RELATED ACTIONS SUPPORTING USAID'S OPERATIONS

As described in the section entitled USAID Operations Vulnerability Assessment, climate change could compromise numerous aspects of USAID operations, including assets, support systems, health and safety, and security. Impacts and/or disruptions to operations may ultimately affect the Agency's ability to implement programs effectively and, consequently, achieve its mission. This section summarizes a number of actions that USAID M Bureau will implement to both help the Agency better understand operational climate change risks and opportunities, as well as address them. Furthermore, the actions mentioned in this section

seek to build the capacity of USAID staff to identify and respond to climate risks and stress the need for integrated collaboration and coordination.

It is important to point out that collaboration with the Department of State (DoS) is critical for addressing operational vulnerability as a significant portion of USAID operations are co-located or co-implemented with DoS. As a result, a number of the actions identified below focus on building partnerships and enhancing communications with DoS. Without a coordinated effort it will be difficult for USAID to take action or respond to identified risks independently.

FY13

- **Explore Operational Climate Change Adaptation Partnership with Department of State.** Begin a dialogue with the DoS and explore establishing a productive partnership on operational climate change adaptation. A partnership with DoS may take various forms depending on the needs of both USAID and DoS; therefore, the Agency will consider their internal needs, effective methods for collaboration, and important topics of coordination as this working relationship is developed. For example, USAID may need to consider how to manage the decentralized nature of a partnership to support collaboration that fits the unique working relationships between DoS and USAID offices at the country level. Furthermore, since operational impacts may affect DoS and USAID differently, the Agency may need to consider how to best recognize and address distinct missions and purposes. Finally, the scale and type of collaboration may vary in different regions and operational concerns. In some locations the level of cooperation needed may be simply an exchange of information, resources, and/or tools; in other regions a comprehensive joint effort to reduce operational climate vulnerability may be warranted.

- **Support Climate Smart Missions.** Solicit interest from operating units in becoming climate smart missions and provide selected Missions with funding and technical support to integrate climate change adaptation into their operations. Actions for climate smart missions may include: screening operations for climate change vulnerability, identifying potential adaptation actions, and prioritizing actions for enhancing resilience. Furthermore, lessons gleaned from climate smart missions (e.g., ways to motivate staff to achieve goals) will be collected and used to inform efforts to bring the model to scale at the Agency level.

FY14 – FY16

- **Adaptively Manage Operational Climate Change Adaptation Partnership with Department of State.** Building off the DoS partnership dialogue in FY13, assess the Agency's partnership with DoS and determine the most effective path toward reducing operational vulnerability. Potential actions that could be undertaken in collaboration with DoS include the following steps. These actions are iterative and ongoing activities that may be initiated and updated concurrently.

    - *Develop Inventory of USAID/DoS Operations*. Inventory all operations, including buildings, facilities, equipment, vehicles, processes, and systems, that are jointly occupied by USAID and DoS. If appropriate, disaggregate operations by type, location, ownership (e.g., owned,

leased, rented, co-located), design standards, or other important vulnerability-related characteristics (e.g., coastally located).

- *Conduct Vulnerability Screen*. Screen operations (including assets, systems, and processes) for exposure, sensitivity, and/or adaptive capacity to better understand vulnerability. The screen will also help to identify which operations are most vulnerable to certain climate impacts.

- *Identify Critical Operations and Associated Backup Systems*. For operations recognized as vulnerable to climate change, identify those that are critical (e.g., operations that required to (1) keep USAID programs and projects moving forward or (2) ensure staff welfare). Examples may include approval processes, funding mechanisms, and emergency procedures. For operations that are both vulnerable and critical, determine if a backup system exists. If not, consider developing a redundant process to reduce vulnerability of those operations.

- *Implement Actions to Reduce Operational Vulnerability*. Consider methods or actions for building more resilient operations. Adaptation examples include: incorporating climate change considerations into design standards, building codes, and/or environmental protocols when building new infrastructure; developing backup systems for critical operations; or considering resilience of buildings/other infrastructure during rental agreements. Other measures may comprise retreating /relocating or protecting/hardening of infrastructure (e.g. upgrading systems, structural improvements, or environmental buffers) or managing of impacts (e.g., increase maintenance budget, update emergency management plans). In reviewing and selecting potential adaptation actions, managers will consider cost effectiveness, and seek actions that will support and optimize other development objectives (e.g. enhanced food security; reduced disease incidence) which increasing climate resilience.

- **Seek Opportunities for Operational Climate Change Adaptation Training & Resources**. Explore opportunities for operational climate change adaptation training. This may involve capitalizing on existing training, collaborating with other agencies to develop training, or creating internal training for USAID mission and headquarters staff working on operational-related activities. For example, the Agency may adopt or modify trainings already developed by other agencies (e.g., GSA or CEQ) that could be delivered to USAID. Alternatively, USAID may work with other agencies (e.g., DoS or DoD) to develop or alter trainings that are applicable to diverse stakeholders in a global setting. In addition to trainings, USAID will also consider the use of guidance, frameworks, or checklists that will help the Agency to understand and respond to operational climate change risks and opportunities.

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APPENDIX I. USAID CLIMATE CHANGE ADAPTATION POLICY STATEMENT

Reducing the risks of climate change impacts on people, places, and livelihoods–and anticipating and building resilience to manage these potential impacts—depends on the deliberate and strategic integration of adaptation considerations into development plans and actions. For this reason, USAID will consider the role of climate variability and change in constraining development across its portfolio, and will work with partners to build climate resiliency into national, sub-national, and local plans and actions in climate-sensitive sectors. This integrated approach will allow USAID to advance its core mission and development objectives while ensuring the long-term sustainability of USAID programs and operations.

USAID will ensure its development portfolio and operations are sustainable in the face of an uncertain and changing climate by:

- Working with experts throughout the Agency in key climate-sensitive sectors such as agriculture, health, disaster preparedness, and water management to integrate climate change considerations into strategic planning, program design, and implementation.
- Evaluating past climate change programs and other relevant examples of integrated programming to glean lessons that will inform USAID's next generation of programming, and by developing an evaluation plan for climate change mitigation and adaptation programming in accordance with USAID's new evaluation policy.
- Designing and implementing a research agenda and a learning plan to ensure that the Agency answers the most critical questions about climate change and development, and learns from its programs to inform future programming and to share these lessons with the broader development community.
- Developing new curricula and training development professionals from a variety of disciplines to understand climate change, its potential impacts on development gains, and opportunities to spur low emissions, climate resilient development.
- Reviewing current environmental policies and guidelines and making recommendations as to whether required environmental assessments should be altered to explicitly address climate change.

USAID will invest its current appropriated resources for adaptation programming in three intermediate results:

- Improved access to science and analysis for decision-making;
- Effective governance systems; and
- Identification and dissemination of programs and actions that reduce the long term vulnerability to climate change of people, places and livelihoods.

APPENDIX II. USAID PLANNED ADAPTATION ACTIONS SUMMARY TABLES

Table A.1. USAID Mission Actions

Action	Agency Lead	Scale	Expected Start	Expected Completion	Type of Action	Coordination / Collaboration	Considerations / Linkages	Status / Accomplishments
2012								
Launch Agency Climate Change and Development Strategy	GCC Coordinator	International	January 2012	2012	Understand & Address	Agency-wide	Linkage with almost all programmatic actions	Completed
Complete Implementation Plan for Climate Change and Development Strategy	GCC Coordinator	International	January 2012	January 2016	Understand & Address	Agency-wide	Linkage with almost all programmatic actions	In progress
2013								
Distribute USAID's Adaptation Plan	GCC Coordinator	International	2013	Ongoing on annual basis	Understand & Address	Agency-wide	Make available to the Agency & distribute to identified Agency leads	
Review, Evaluate, and Update USAID's Adaptation Plan	GCC Coordinator	International	2013	Ongoing on annual basis	Understand & Address	Agency-wide & potential collaboration with other USG agencies	Linkage with almost all programmatic actions	

Table A.2. USAID Guidance and Training Programmatic Actions

Action	Agency Lead	Scale	Expected Start	Expected Completion	Type of Action	Coordination / Collaboration	Considerations / Linkages	Status / Accomplishments
2012								
Publish Updated Adaptation Guidance Manual and Sectoral Briefs	GCC Office	International	February 2012	2012	Understand & Address	Share within agency and with country stakeholders & other development professionals	Linkage with trainings & Mission programs	In draft form
Develop Country Development Cooperation Strategy Supplemental Guidance	PPL?	International	2012	2012	Understand	Agency-wide	Linkage with Mission programs	Completed
Conduct Climate Change Adaptation Training	GCC Office	International	April 2012	Ongoing	Understand & Address	Agency-wide		Ongoing
2013								
Create Sectoral Project Design Guidance and	GCC Office	International	2013	Ongoing	Understand & Address	Agency-wide	Linkage with research and learning	

Training								
Conduct Climate Change Adaptation Training	GCC Office	International	2013	Ongoing	Understand & Address	Agency-wide	Links direct to Sectoral Training	
2014-2016								
Review Environmental Impact Assessment	TBD	U.S.	TBD	TBD	Understand & Address	Agency-wide		
Ensure Reporting Requirement Performance	TBD	International	TBD	TBD	Address	Agency-wide		

Table A.3. USAID Pilot Activities Programmatic Actions

Action	Agency Lead	Scale	Expected Start	Expected Completion	Type of Action	Coordination / Collaboration	Considerations / Linkages	Status / Accomplishments
2012								
Commence Integration Pilots	GCC Coordinator and Missions	International	March 2012	2014	Understand & Address	Agency-wide		Pilots have been awarded
2013								
Implement and Evaluate Integration Pilots	Missions	International	March 2012	2014	Understand & Address	Agency-wide	Links directly to integration pilots & M&E strategy	Some pilots have begun implementation
Support Additional Integration Pilots	GCC Coordinator	International	2013	Ongoing	Understand & Address	Agency-wide	Links directly to integration pilots	
2014-2016								
Compile Lessons Learned & Best Practices from Pilots	TBD	International	TBD	TBD	Understand & Address	Agency-wide with potential external collaboration	Links directly to integration pilots	

Table A.4. USAID Research and Information Programmatic Actions

Action	Agency Lead	Scale	Expected Start	Expected Completion	Type of Action	Coordination / Collaboration	Considerations / Linkages	Status / Accomplishments
2012								
Conduct Survey of Applied Climate Change and Development Research Needs	GCC Office	International	January 2012	August 2012	Understand & Address	Agency-wide	Linkage to learning & pilots	In progress
Develop Climate Change and Development Research Strategy	GCC Office	International	March 2012	Ongoing	Understand & Address	Agency-wide	Links directly to survey and other linkages to partnerships, mission programs, & pilots	In progress (Elements of research are beginning to

								emerge)
2013								
Conduct Climate Change and Development Research	TBD	International	2013	Ongoing	Understand & Address	Agency-wide with potential USG collaboration	Links directly to the research strategy	

Table A.5. USAID Evaluation and Learning Programmatic Actions

Action	Agency Lead	Scale	Expected Start	Expected Completion	Type of Action	Coordination / Collaboration	Considerations / Linkages	Status / Accomplishments
2012								
Design Agency Monitoring and Evaluation Plan for Climate Change Programs	GCC Coordinator	International	March 2012	2012	Understand	Agency-wide	Linkage to pilot activities	In progress
Host Climate Change Adaptation Learning Workshops	GCC Coordinator	International	2013	Ongoing	Understand & Address	Agency-wide with potential external collaboration	Linkage to training and research	In progress (workshop on vulnerability assessment)
2013								
Compile Climate Change Adaptation Lessons Learned	GCC Coordinator	International	2013	Ongoing	Understand & Address	Agency-wide	Linkage to mission programs, training, pilots, & partnership	
Develop Climate Change Adaptation Help Desk	GCC Office	International	2013	Ongoing	Understand & Address	Agency-wide	Linkage to guidance, training, pilots, lessons learned, & research	
2014-2016								
Exchange Climate Change Adaptation Lessons Learned	TBD	International	TBD	TBD	Understand & Address	Agency-wide & external (e.g., Interagency Forum on Climate Change Impacts and Adaptations hosted by NASA & USACE)	Linkage to partnerships	

Table A.6. USAID Partnership Programmatic Actions

Action	Agency Lead	Scale	Expected Start	Expected Completion	Type of Action	Coordination / Collaboration	Considerations / Linkages	Status / Accomplishments
2013								
Develop Climate Change Adaptation Coordination Plan	GCC Coordinator	International	2013	Ongoing	Understand & Address	Other USG agencies, international donors, civil society groups, and the	Linkage to research, learning, inreach and outreach	

						private sector		
Form Private Sector Alliances	GCC Office and other Operating Units	International	2013	Ongoing	Address	Private sector	Direct linkage to coordination plan & other partnership activities	
2014-2016								
Engage Youth Partnership	TBD	International	TBD	TBD	Address	Youth organizations	Direct linkage to coordination plan	

Table A.7. USAID Operational Actions

Action	Agency Lead	Scale	Expected Start	Expected Completion	Type of Action	Coordination / Collaboration	Considerations / Linkages	Status / Accomplishments
2013								
Explore Operational Climate Change Adaptation Partnership with DoS	TBD	International	2013	Ongoing	Understand & Address	Agency-wide, potential coordination with DoS and/or GSA	Dependent on partnership with DoS	
Support Climate Smart Missions	GCC Coordinator	International	2013	Ongoing	Address	Agency-wide, potential coordination with DoS	Potential linkage to integration pilots	
2014-2016								
Adaptively Manage Operational Climate Change Adaptation Partnership with DoS	TBD	International	Annually	Ongoing on annual basis	Understand & Address	Agency-wide, potential coordination with DoS and/or GSA	Direct linkage with adaptation partnership with DoS	
Seek Opportunities for Operational Climate Change Adaptation Training & Resources	TBD	International	TBD	TBD	Address	Potential coordination within USAID and externally with GSA, CEQ, DoS, DoD	Potential linkage to adaptation training	

APPENDIX III. COUNTRY AND REGIONAL VULNERABILITY PROFILES

CLIMATE VULNERABILITY PROFILE

Bangladesh

US Foreign Assistance:[16] (thousands USD)	Requested FY 2012	Requested FY 2013
Estimated total:	**200,076**	**199,489**
Adaptation:	5,000	4,000
Feed the Future:	70,000	50,000
Water:	2,000	4,500
Priority Adaptation Country in 2011:	**Yes**	
Key Climate Stressors:	**Heat, Flooding, Sea level rise, Extreme events**	

Introduction

Bangladesh, located in South Asia, has a population of approximately 150 million people. It contains the second largest river basin in the world, including the confluence of 3 major rivers (the Ganges, Brahmaputra, and Meghna) and their associated tributaries. The country consists mostly of low and flat land; only about 10 percent of the country lies over 1 meter above mean sea level (MSL), and one-third of the land is under tidal excursions. The northeast and southeast portions of the country are hilly. The Bangladesh economy is predominantly based on agriculture, forestry, and fishing. In recent years, the economy has diversified to include manufacturing, which currently generates nearly 75 percent of the country's export earnings. However, agricultural and fisheries activities still support a large proportion of the population and make up approximately 20 percent of the country's Gross Domestic Product (GDP). The country's child and infant mortality rates and gender parity in schooling have improved in recent years. However, the country still experiences persistent poverty, with higher rates in the western and more rural and inland areas. Some challenges include the lack of reliable infrastructure, access to capital, and governance structures (e.g., land tenure systems).

Projected weather and climate changes

Bangladesh has a humid, warm, and tropical climate, primarily influenced by its monsoon season. The monsoon season is marked with heavy torrential rain that contributes most of the year's rainfall. Due to the country's low-lying land, nearly 70 percent of the country is flooded during heavy monsoons.

[16] US foreign assistance includes both USAID and Department of State program funding, but in most cases the bulk of this funding is implemented through USAID. In order to have comparable figures in these categories, all country profiles use figures from the Congressional Budget Justification (CBJ) (see http://transition.usaid.gov/performance/cbj/185016.pdf and http://transition.usaid.gov/performance/cbj/158269.pdf). Between the time of the budget request and the 653(a) report to Congress, these figures can change significantly.

Temperature: Bangladesh's mean temperatures are projected to increase about 1.4°C by 2050 and 2.4°C by 2100 from the 1960 baseline. This warming is expected to be more pronounced in the winter months (December-February).

Precipitation: Climate models are inconclusive for changes in precipitation in Bangladesh. Some models project wetter conditions in Bangladesh, while others project drier conditions in the future. The critical factor will be to understand what happens during Bangladesh's monsoon seasons, as the majority of the country's rainfall is experienced during that time.

Sea level rise: Sea level rise projections for Bangladesh's coast range between 9 and 100 cm by 2100. Due to the relatively low elevation of the country's land, this projected sea level rise and storm surge will pose significant challenges for Bangladesh.

Extreme events: Bangladesh is extremely vulnerable to wind- and water-related disasters such as cyclones. By 2100, the power of tropical storms is projected to significantly increase in the North Indian Ocean, affecting Bangladesh.

Key climate impacts and vulnerabilities

Bangladesh, due to its unique geographic, socio-economic, and physical characteristics, is extremely vulnerable to the impacts of climate change. Bangladesh's water and agricultural resources (and thus economic activities) and coastal infrastructure are particularly vulnerable. Saltwater intrusion threatens Bangladeshi freshwater resources; changing temperatures, precipitation, and sea level rise could reduce agricultural productivity; and sea level rise, storm surge, and extreme events could damage or destroy coastal infrastructure.

Key USAID program vulnerabilities

Bangladesh receives support from USAID for programs related to food security, economic development, peace and security, water, and malaria.

Food security: Bangladesh is a priority country under the Feed the Future Initiative (FTF). As such, USAID aims to increase the production of more affordable and nutritious staple foods through increased on-farm productivity, increased investment in market systems, enhanced food security policy and planning capacity, and enhanced agricultural innovation. Agriculture (e.g., production of wheat and rice) in Bangladesh will be vulnerable to increasing water-related extreme events such as floods and drought, as well as heat stress, sea level rise, and extreme events.

A priority of USAID's response is to diversify the diet available to Bangladeshis. Some of the programs focus on technology transfer and research trials for enhancing production of cereals, fish, legumes, and vegetables, or the use of transgenic crops (e.g., potatoes and eggplant). The success of these new crops could be influenced by changes in climate. Research and trial efforts should take into consideration how future climate could change the results and communicate those findings. Further, climate changes could impact which locations are best suited for producing these alternative sources of food and nutrition.

USAID is also building the capacity of the Government of Bangladesh (GoB) in relation to developing policy, research agendas, coordination between different agencies, and encouraging civil society participation in developing food security and agricultural policies. While the GoB has been proactive in planning for climate change and adaptation, FTF will need to ensure that its policy and research agenda and stakeholder engagement efforts reinforce the GoB's efforts to proactively adapt.

Economic growth: While agriculture employs about 60 percent of the population, it only contributes about 27 percent to the country's GDP. USAID is supporting the expansion of job opportunities and facilitating business expansion. For example, USAID is encouraging entry into shrimp farming and processing for export, increasing access to credit, and identifying opportunities for new labor-intensive products and services. Climate changes could impact such programming. For example, climate changes could impact the

sustainability of shrimp farming in the future or impact the longevity and resilience of new infrastructure construction. All programs should be designed to be resilient in the face of projected climate changes.

Democracy and governance: USAID is also working to help Bangladesh improve its governance structure. However, mounting pressures from environmental challenges, including climate change and a rapidly growing population, may create a need for greater resources, capacity, and efforts related to democracy and governance.

Health: Approximately 40 percent of children and 30 percent of mothers in Bangladesh suffer from moderate to severe malnutrition. Improving maternal and child health and reducing malnutrition rates are some of USAID's priorities in its health programming. To improve nutrition, the Global Health Initiative (GHI) will work collaboratively with FTF to catalyze nutrition activities within new and existing programs. Climate change could pose risks to these efforts. For example, agricultural production in a given year may decline due to flooding or drought, with resulting impacts on the GHI and nutrition status of mothers and children. An integrated and holistic approach to addressing climate risks will ultimately increase the resilience of the population and program.

Biodiversity and natural resource management: About 77 percent of Bangladeshis depend on natural resources for their livelihoods. Degradation of natural capital and biodiversity has a serious and direct impact on food security, nutrition, and income for the poor. Climate change-caused degradation could further stress these important resources. Further, natural coastal forests have been a key source of protection during extreme events. Climate change impacts will make these forests even more critical, as sea levels rise and extreme weather events become more frequent. USAID has played a critical role in protecting and restoring Bangladesh's natural resources in a participatory "co-management" manner. However, climate change-caused shifts in habitats due to changing temperature and precipitation patterns, saltwater intrusion, and inundation may impact these protection and restoration efforts. Programs will need to consider future climate conditions.

Disaster management: USAID supports disaster management in Bangladesh. Bangladesh is frequently affected by natural disasters, particularly cyclones, tornadoes, and floods. Increasingly, the country is also affected by river erosion, mud slides, and drought. Due to the relatively high population density throughout the country, much of the population of Bangladesh is vulnerable to these extreme events. Bangladeshis living close to or below the poverty line are often the most vulnerable. USAID has worked with the GoB, local governments, and communities to establish an effective emergency warning and response system. Climate change is likely to worsen natural disasters, making them more frequent and intense and potentially necessitating additional support from USAID and other donors.

Actions underway

USAID adaptation activities underway in Bangladesh have focused on natural resource and disaster risk management, as well as building capacity and raising awareness within communities, local governments, and the national government. Several efforts have acknowledged the interconnectedness of implemented programs and have started to integrate climate vulnerabilities, risk assessments, and adaptation actions into their programming. For example, the Integrated Protected Area Co-management (IPAC) program directly addresses the need for climate considerations in natural resource management and protection, and will address a series of short-, medium-, and long-term adaptation issues. Bangladesh is an adaptation priority country for USAID, which has provided bilateral government funding for adaptation initiatives related to disaster risk management and ecosystem conservation, and is beginning to address food security and climate linkages through FTF. The USAID disaster management response has taken into account the impacts of climate change and has started to adapt accordingly. For example, in reducing the vulnerability of the poor, USAID has worked with the GoB and local governments and communities to establish an effective emergency warning and response system, which will help Bangladeshis respond more effectively to climate-related extreme events.

Resources

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CLIMATE VULNERABILITY PROFILE

Colombia

US Foreign Assistance:[17] (thousands USD)	Requested FY 2012	Requested FY 2013
Estimated total:	**383,015**	**331,825**
Adaptation:	0	3,000
Priority Adaptation Country in 2011:	**Yes**	
Key Climate Stressors:	**Heat, Drought, Flooding, Sea level rise**	

Introduction

Colombia, located in northwestern South America, has a population of nearly 46 million people. Approximately 68 percent of the labor force works in the service sector, contributing to about 53 percent of the country's Gross Domestic Product (GDP). Industry, including oil exports, accounts for approximately 38 percent of the GDP. Approximately half of Colombia's citizens live below the poverty line and numerous rural municipalities are isolated by poor infrastructure and fragile institutions. Inequality, underemployment, drug trafficking, and inadequate infrastructure are the most significant challenges to sustained economic expansion in Colombia.

Projected weather and climate changes

Colombia has 3,208 km of coastline along the North Pacific Ocean and the Caribbean Sea. The geography ranges from coastal lowlands to central highlands, the Andes Mountains, and lowland eastern plains. The climate is tropical along the coast and the eastern lowlands, and cooler in the highlands and Andes. El Niño is associated with droughts and La Niña is associated with flooding in Colombia.

Temperature: Based on the average of several climate model scenarios, most of Colombia is projected to experience a temperature increase of 2.4°C by 2070 compared to the 1971-2000 base period. The largest temperature increases are expected in the highlands, with a 1-2°C increase by 2050.

[17] US foreign assistance includes both USAID and Department of State program funding, but in most cases the bulk of this funding is implemented through USAID. In order to have comparable figures in these categories, all country profiles use figures from the Congressional Budget Justification (CBJ) (see http://transition.usaid.gov/performance/cbj/185016.pdf and http://transition.usaid.gov/performance/cbj/158269.pdf). Between the time of the budget request and the 653(a) report to Congress, these figures can change significantly.

Precipitation: Changes in precipitation patterns are projected to vary by region in Colombia. Climate models project rainfall will increase in the coastal areas and the Amazon. In the highland areas, rainfall is projected to decrease.

Extreme events: Changes in precipitation patterns may lead to an increase in flooding events. The duration of the rainy season in the San Andrés islands could increase by 15 percent by 2050 and 20 percent by 2080, leading to increased risk of flooding. Simultaneously, dry season water shortages may become more severe.

Sea level rise: By 2050-2060, sea level rise along the Caribbean and Pacific Coast is projected to increase by 40-60 cm, compared to the baseline 1961-1990 levels.

Key climate impacts and vulnerabilities

Temperature increases and changes in precipitation patterns are likely to be the most significant climate changes in Colombia. Water shortages are likely to become more significant. This could impact irrigated agriculture, human health, and other sectors that rely on a consistent water supply, such as hydropower. The increased temperature and decreases in precipitation are expected to contribute to a disappearance of snow-covered areas by as early as 2030. Additionally, a 56 percent decrease in moorland will further contribute to water shortages. Currently, Colombia experiences about 1.7 disasters per year including droughts and floods, often related to El Niño and La Niña, respectively. Between 2002 and 2007 Colombia experienced eight significant flood events, which affected 2.9 million people. Heavy rains in 2010 and 2011 resulted in floods that caused more than $6 billion dollars in damage to crops and infrastructure, resulted in hundreds of deaths, and displaced millions of Colombians. Sea level rise is likely to have localized impacts that may have significant effects in cities, like Cartagena, that rely on tourism. However, the most heavily populated urban centers are not located on the coast.

Key USAID program vulnerabilities

Alternative development: A significant amount of USAID work in Colombia is based around minimizing the drug trade and providing economic options for people within the country. These programs seek to provide alternative, sustainable, and legal economic opportunities and reintegrate conflict-affected populations. The alternatives promoted by USAID should be designed to be resilient to anticipated climate change impacts if they are going to be successful at transitioning people into viable long-term livelihoods.

Environment: USAID's environment program seeks to improve the livelihoods of people depend on local ecosystems and environmental services. Natural resource-based livelihoods are common around the ethnic territories, national parks, protected areas, and other biologically or climate-sensitive ecosystems in Colombia. Deforestation, habitat conversion, invasive species, illicit crops, armed conflict, and a weak state presence threaten these resources. Climate changes will likely pose an additional threat, exacerbating these existing stressors. At the same time, effective conservation of resources like mangrove forests can help vulnerable communities address growing climate threats.

Actions underway

Adaptation is incorporated into USAID's BIO-REDD+ program. The Government of Colombia (GOC) is creating 7 regional climate change and disaster risk management nodes (centers), which will work on adaptation planning, implementation, and dissemination of climate information. USAID is building the capacity of the Pacific Regional Climate Change Node. GOC also works with local communities to implement adaptation measures, particularly ecosystem-based adaptation measures, since this has greatest synergies with biodiversity and REDD+ work being done through this mechanism. Colombia has also included adaptation as a cross-cutting issue in its National Development Plan (2010-2014). Adaptation is dealt with both in a separate sub-chapter on climate change and as a cross-cutting stressor related to biodiversity

and urban development. Additionally, Colombia established a national Adaptation Fund in 2010. As of February 2011, Colombia was also working on a National Adaptation Plan.

Challenges to adaptation

Current adaptation programming in Colombia does not address human settlements, energy, gender, and ecosystem conservation. Since the geography of Colombia creates three distinct climates—coastal, mountainous, and rainforest—climate change impacts must be considered on a local and seasonal scale. This makes adaptation more challenging. Yet while the climate varies considerably within the country, several neighboring countries have similar climatic splits. Collaboration across borders could provide improved information as well as potential opportunities for program coordination.

Resources

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CLIMATE VULNERABILITY PROFILE

Democratic Republic of the Congo

U.S. Foreign Assistance:[18] (thousands USD)	Requested FY 2012	Requested FY 2013
Estimated total:	**226,850**	**228,388**
Agriculture:	8,208	8,208
Malaria:	23,500	35,000
Water:	16,000	4,671
Priority Adaptation Country in 2011:	**No**	
Key Climate Stressors:	**Heat**	

Introduction

The Democratic Republic of the Congo (DRC) is a large, nearly landlocked country with a population of over 67 million people. The country is relatively rural, with only about 30 percent of its inhabitants located in urban areas and eight percent with access to grid-based electrical supplies. The country experiences profound development challenges, including hunger, malnutrition, and a lack of access to basic services.

The DRC holds some of the world's largest deposits of mineral resources (e.g., cobalt, copper, zinc) and harbors diverse and rich ecosystems and biodiversity, including the second largest tropical moist forest in the world. Forests and agricultural land cover about 60 percent and 10 percent of the country, respectively. The country has low lying plains in its center, surrounded by mountain terraces and dense grasslands, and its small coastline drains into the Atlantic Ocean. Climate changes are expected to augment existing vulnerabilities. In addition, future population growth, which may be rapid, could also put greater demand on water and other natural resources.

Projected weather and climate changes

The DRC's climate varies from hot and humid in the equatorial river basin region, to cooler and drier in the southern highlands, and cooler and wetter in the eastern highlands. The country has two short wet and dry seasons.

Temperature: Average annual temperatures range between 18°C to 32°C. Temperatures are projected to increase by about 2.7-3.2°C by the 2100s, as compared to the 1990 baseline.

Precipitation: Since the DRC straddles the Equator, its northern and southern regions experience wet and dry seasons at different times of the year. The southern wet season occurs between October and April, whereas the northern wet season occurs between April and September. Average rainfall currently ranges from 1,000 mm to 1,700 mm. Climate models project that most regions within the country will experience a

[18] US foreign assistance includes both USAID and Department of State program funding, but in most cases the bulk of this funding is implemented through USAID. In order to have comparable figures in these categories, all country profiles use figures from the Congressional Budget Justification (CBJ) (see http://transition.usaid.gov/performance/cbj/185016.pdf and http://transition.usaid.gov/performance/cbj/158269.pdf). Between the time of the budget request and the 653(a) report to Congress, these figures can change significantly.

decrease in rainfall of 0.8-11.4 percent by the 2100s. The projections also indicate a shortening of the rainfall season in the southern region.

Extreme events: The DRC experiences periodic droughts in the south and seasonal flooding in the east. These events are directly related to the abundance (or lack) of precipitation. Climate models do not project whether these events will change in the future.

Key climate impacts and vulnerabilities

The DRC is vulnerable in several ways to projected changes in climate. First, a vast majority of Congolese livelihoods are dependent on sectors which are highly interlinked with climate processes, such as small scale agriculture, forestry, fisheries, and mining. If the climate changes, these livelihoods may be threatened. For example, changes in temperatures and rainfall may affect crop production and alter biodiversity and ecosystem resources. Furthermore, and depending on how interactions between rainfall, temperature, and disease pathways develop, more regions of the country may become susceptible to vector- and water-borne diseases. Finally, the low-lying, coastal areas of the DRC, which are often inundated by high tides, are already susceptible to erosion. Sea level rise may cause more frequent erosion, saltwater intrusion, mangrove ecosystem damage and destruction, and infrastructure and land losses.

Key USAID program vulnerabilities

Health: USAID/DRC's current health program is focused on improving basic health conditions for the Congolese people by reducing infectious disease threats; reducing maternal, infant, and child diseases and deaths; rehabilitating essential health infrastructure; and increasing access to potable water. These efforts are vulnerable to current environmental stressors and will likely become more vulnerable under future climate scenarios. For example, climate changes are projected to expand the area and population susceptible to some vector- and water-borne diseases. Furthermore, certain infectious diseases may be reintroduced to the area. Malnutrition, which is already a major concern in the country, may intensify if climate changes affect agricultural production and incomes. These impacts will also have implications for the type and quality of care that USAID can provide, as the health system will likely be overstressed and unprepared to cope with changes in the distribution and extent of health concerns.

Economic growth: USAID/DRC's economic growth program seeks to increase agricultural productivity through distribution of peanut, maize, bean, and cassava seeds; strengthen microenterprises and linkages to markets; and provide natural resource management training and biodiversity protection. These projects may be vulnerable under future climate scenarios. For example, as climatic conditions change, today's agricultural practices could become less effective, potentially resulting in reduced agricultural productivity. Environmental degradation due to climate change, including impacts on forests, biodiversity, and water, could also affect productivity. Declines in agricultural productivity will likely affect farmer's incomes and impact local, regional, and national economic growth.

Humanitarian assistance: USAID currently supports a number of humanitarian assistance efforts in the DRC. As climate changes, natural disasters are projected to become more damaging. Climate change may also exacerbate refugee flows from neighboring countries due to increases in conflict over natural resources, food, water, and shelter. These impacts are likely to increase the need for more frequent and sizeable investments in humanitarian assistance efforts.

Democracy and governance: USAID is supporting democracy and governance programs within the DRC that are promoting the rule of law, good governance policies, and participatory decision making. Climate changes may have negative implications for progress on good governance if the government is not able to support the country during periods of disaster or hardship exacerbated by climate change, such as a regional food or water shortage. At the same time, advances in good governance, especially at the local level, could significantly improve the effectiveness of adaptation planning and action.

Actions underway[19]

USAID is supporting a variety of biodiversity and natural resource management actions within the DRC that indirectly support adaptation efforts through better monitoring, data collection, and information dissemination activities. With funding from the Presidential Initiative on Global Climate Change through the Central Africa Regional Program for the Environment (CARPE), USAID is supporting national climate change mitigation efforts by reducing emissions from deforestation and forest degradation (REDD), including improved forest management and conservation and enhancement of forest carbon stocks (known as REDD+). Although to-date USAID has not focused significant adaptation resources on the DRC, the country has a high number of adaptation projects relative to other countries in the region. While most of these projects have a regional or global focus, a small number are focused on the DRC alone. The primary focus of these projects is agriculture, forestry, and energy, and they typically relate to research and capacity building. The most notable DRC-focused adaptation project is funded by the multilateral Least Developed Countries Fund and is focused on agriculture and food security.

Challenges to adaptation

The DRC may face challenges in adapting to climate changes, especially in the Albertine Rift and the southeastern area of the country. The first challenge is that the country lacks the stronger legal, institutional, and regulatory framework necessary to encourage and support the adaptation process in specific regions and sectors that are likely to be impacted by climate changes. Second, while some data and information monitoring has already begun, the country needs a more systematic data collection effort that can inform regular vulnerability and risk assessments. This will be important to further research relationships between basic climate stressors (e.g., increased temperature, rainfall) and important sectors. Finally, the country requires access to more sustainable and consistent sources of financing to identify and implement required adaptation options.

Resources

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[19] Actions underway include those from direct adaptation funds and indirectly attributed funds. More information on U.S. climate finance can be found at http://www.state.gov/e/oes/climate/faststart/index.htm.

CLIMATE VULNERABILITY PROFILE

Ethiopia

U.S. Foreign Assistance:[20] (thousands USD)	Requested FY 2012	Requested FY 2013
Estimated total:	**580,405**	**351,271**
Adaptation:	5,000	4,000
Feed the Future:	29,000	50,000
Malaria:	26,350	39,000
Water:	7,892	26,046
Priority Adaptation Country in 2011:	**Yes**	
Key Climate Stressors:	**Heat, Extreme events**	

Introduction

Ethiopia, located in eastern Africa, has a population of approximately 80 million people. Agriculture is an important sector of the economy; almost half of the country's Gross Domestic Product (GDP) comes from this sector and 85 percent of the population depends on agriculture for their livelihoods. Ethiopia is one of the poorest countries in the world and has encountered problems with inflation and regional security in the volatile Horn of Africa. The country faces numerous challenges to development, including high death and disease rates, limited access to education, and lack of food security. Growth in the agricultural sector is constrained by factors including increasing land degradation; conflicts over scarce resources; limited access to information, education, skills, and financial services; inadequate government policies, capacities, and coordination; and social and gender inequalities. Climate changes will exacerbate these development stressors.

Projected weather and climate changes

The geography of Ethiopia varies by region and influences the local climate. The topography of the landlocked country includes high plateaus, mountains, and lowland plains. The climate is tropical in the southeast and northeast lowland areas and cooler in the central highland region.

Temperature: Global climate models project the temperature will rise between 1.5°C and 5.1°C from the base period 1970-1999 by the 2090s.

Precipitation: Ethiopia's precipitation trends have strong inter-annual and inter-decadal variability, but it is overall an arid country. Rainfall projections are uncertain given the historical variability, but suggest a larger percentage of precipitation falling during heavy events.

[20] US foreign assistance includes both USAID and Department of State program funding, but in most cases the bulk of this funding is implemented through USAID. In order to have comparable figures in these categories, all country profiles use figures from the Congressional Budget Justification (CBJ) (see http://transition.usaid.gov/performance/cbj/185016.pdf and http://transition.usaid.gov/performance/cbj/158269.pdf). Between the time of the budget request and the 653(a) report to Congress, these figures can change significantly.

Extreme events: Historically, Ethiopia has been prone to extreme weather variability, particularly erratic rainfall resulting in droughts and floods. A rising frequency of severe flooding, droughts, and extreme heat days is projected to occur under climate change.

For more information on observed climate trends to date in Ethiopia, please see the Climate Trend Analysis prepared by the Famine Early Warning Systems Network (FEWS NET) at http://pubs.usgs.gov/fs/2012/3053/.

Key climate impacts and vulnerabilities

The population as a whole is vulnerable to climate impacts, particularly the large portion that depends on rain-fed agricultural and pastoral activities. The country is also vulnerable to desertification, drought, and flooding, which are each expected to have a negative impact on livestock, farmland, and overall nutrition. Furthermore, changes to water resources will affect agriculture, human health, and hydropower electricity production. Other sectors of concern include changes to forest and biodiversity resources and public health, as climate changes may cause a greater prevalence of diarrhea and vector-borne diseases such as malaria. The regions of Afar, Somali, Oromia, and Tigray, which have relatively high poverty levels, are comparatively more vulnerable to climate changes than other regions in the country.

Key USAID program vulnerabilities

USAID invests significantly in Ethiopia's social and economic development. Several of the USAID/Ethiopia Mission's programs will be vulnerable to climate changes, including food security, economic development, water, and malaria.

Food security: Food security programming supports the country's agricultural growth and is one of USAID's key programs in Ethiopia. The Feed the Future Initiative employs a "push-pull" strategy to improve food security throughout the three distinct agro-ecological regions of Ethiopia.

Investment in agricultural production, labor, and services in the fertile and high potential areas of western Ethiopia is designed to "pull" the country towards rural economic growth. Key Ethiopian crops such as maize, wheat, and coffee may be increasingly vulnerable to rising temperatures and variable precipitation.

The strategy will also link the chronically food insecure households and pastoralist communities in central and eastern Ethiopia to food and economic markets in order to create greater demand and "push" for food security. This component, designed to prepare vulnerable populations for engagement in the improved agricultural markets and related livelihood opportunities, recognizes the need to facilitate the development of community adaptation responses to climate change.

The Feed the Future strategy in Ethiopia will face rising need to respond to climate impacts. The more heavily invested agricultural components will need to adapt to heat and extreme precipitation events, especially because they are critical to pulling the country towards food security. Additionally, the changing climate will directly increase the importance of the disaster management and biodiversity projects under the Climate Change and Natural Resource Management program of the Feed the Future Initiative.

Economic growth: Given that agriculture is a key sector of the economy and a focus for USAID in fostering economic growth, climate change impacts on livestock and rain-fed crops can hinder the goals of the economic development programs focused on strengthening market resilience and growth.

Health: Approximately 68 percent of Ethiopia's total population lives in malaria-endemic areas; historically, Ethiopia has experienced cycles of malaria epidemics every five to eight years. The malaria initiative, a core component of the Global Health Initiative (GHI), may need to be scaled up as vector-borne diseases become

more prevalent, especially in higher altitudes, with rises in temperature potentially increasing the percentage of vulnerable population and frequency of malaria.

Water: Current water supply and sanitation projects aim to provide clean and sustainable water supplies by creating wells, increasing awareness of sanitation practices, and improving local capacity to sustainably manage water facilities. Water availability in Ethiopia will be stressed under increasingly uncertain precipitation patterns and more intense extremes, which will ultimately increase the need for water initiatives. USAID includes conflict mitigation and "do no harm" approaches in all its pastoralist area work, and this strategy will be increasingly important in projects related to this vulnerable natural resource.

Actions underway[21]

Ethiopia is an adaptation priority country for USAID, which has provided bilateral government funding for adaptation initiatives related to disaster risk management, agriculture, and ecosystem conservation. The USAID adaptation actions aim to develop early-warning systems related to drought, prevent over-exploitation of water resources, reduce the vulnerability of pastoralists, and build capacity to adapt food production systems to changing climate conditions. Other adaptation activities underway that are funded by multiple agencies focus on agriculture, but also address freshwater resources, disaster risk management, and capacity building for adaptation. The projects include assessment of climate risks and vulnerabilities, development of planning and management guidance for water storage, mainstreaming climate change considerations into poverty reduction development strategies, and development of a drought/crop insurance program.

Challenges to adaptation

Ethiopia is vulnerable to climate change due to high poverty rates, under-development of water resources, low health service coverage, inadequate road infrastructure, weak institutions, and lack of awareness. The need for USAID assistance with these key non-climate challenges will need to be balanced with efforts to adapt to the impacts of a changing climate. Particular adaptation challenges include the need for more technical expertise in vulnerability and adaptation assessment and implementation; capacity to develop accurate weather and climate forecasts; a strengthened institutional framework for dealing with climate change; and enhanced coordination.

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CLIMATE VULNERABILITY PROFILE

Ghana

U.S. Foreign Assistance:[22] (thousands USD)	Requested FY 2012	Requested FY 2013
Estimated total:	**172,183**	**179,304**
Feed the Future:	60,000	60,000
Malaria:	28,900	28,000
Water:	4,070	5,570
Priority Adaptation Country in 2011:	**No**	
Key Climate Stressors:	**Heat, Drought, Flooding, Sea level rise**	

Introduction

Ghana is located in West Africa with a population of over 24 million people. The country extends from a low-lying coastal zone, where about one-quarter of the population lives, to the sparsely inhabited northern regions in the savannah zone. Agriculture is the mainstay of Ghana's economy, accounting for 33 percent of the country's Gross Domestic Product (GDP) and employing more than half of the economically active population. Cocoa production is the main source of foreign exchange. Other key exports include gold, timber, oil, diamonds, bauxite, manganese, and hydropower. Ghana's sectors are already burdened with non-climate stressors such as desertification, land degradation, and erosion in the agricultural sector; pollution, inadequate infrastructure, increasing impervious surfaces, and poor management in the water resources sector; and inadequate service quality and accessibility in the health sector. Climate change is projected to exacerbate these existing developmental challenges in Ghana.

Projected weather and climate changes

Ghana's climate is tropical with two main rainfall regimes: the north experiences a single wet season from May to November, while the south experiences two wet seasons, a longer rainy season from March to July and a shorter one from September to November. The observed and projected climate changes in Ghana are as follows:

Temperature: Observations indicate that average annual temperatures have risen 1.0°C since 1960, and are projected to increase by 1.0-3.0°C by the 2060s from the 1970-1999 average.

Precipitation: Overall precipitation in Ghana decreased by 2.4 percent per decade between 1960 and 2006. Rainfall is expected to exhibit greater variability, and projected changes in annual rainfall for the 2030s range from a decrease of 9 percent to an increase of 8 percent from the 1970-1999 average.

[22] US foreign assistance includes both USAID and Department of State program funding, but in most cases the bulk of this funding is implemented through USAID. In order to have comparable figures in these categories, all country profiles use figures from the Congressional Budget Justification (CBJ) (see http://transition.usaid.gov/performance/cbj/185016.pdf and http://transition.usaid.gov/performance/cbj/158269.pdf). Between the time of the budget request and the 653(a) report to Congress, these figures can change significantly.

Extreme events: Ghana has experienced periodic extreme events such as rainstorms, floods, and droughts. With a changing climate, a larger percentage of precipitation is projected to fall during heavy rainfall events, and droughts are also anticipated to become more frequent and intense.

Sea level rise: Sea level has risen 2.1 mm per year at the Port of Takoradi over the last 30 years. It is projected to rise by 75-190 cm by 2100.

Key climate impacts and vulnerabilities

Climate changes will likely affect a number of Ghana's key sectors, including agriculture, water resources, health, forests, coastal zones, and marine ecosystems. Warmer temperatures and an increase in the frequency and severity of drought may decrease the length of the growing season in parts of West Africa by 5 percent or more by 2050. This will likely affect the production and yield of crops such as maize, millet, sorghum, and rice. Water resources in Ghana are highly vulnerable to climate change as the quantity and quality of water available for human consumption, agriculture, industry, and hydropower will likely be affected by changes in temperature and precipitation.

Climate changes are also projected to have negative public health consequences, such as increased rates of extreme event related deaths and injuries and increased rates of malaria and meningitis due to expanded range and activity of mosquitos and parasites. In addition, higher temperatures and increases in the incidence of severe droughts may increase the vulnerability of Ghana's forests to fires. Climatic shifts may also change the age and class distribution of trees and alter landscape patterns, which will have implications for biodiversity. Ghana is also highly vulnerable to sea level rise, as the coastal zones are home to five major cities and a quarter of the population. Impacts may include increased shoreline erosion, inundation of low-lying coastal areas, and salinization of estuaries and aquifers. These impacts would have negative implications for coastal biodiversity, agriculture, fisheries, freshwater resources, and infrastructure.

Key USAID program vulnerabilities

Food security: USAID supports food security and economic growth in Ghana through the Feed the Future (FTF) Initiative. FTF in Ghana focuses on the three northern regions, which have a poverty rate nearly twice that of the south. The program consists of four core investment areas, including (1) increasing the competitiveness of staple value chains, including rice, maize, soya, and marine fisheries; (2) supporting government capacity to improve policies and attract private investment; (3) reducing malnutrition and improving resilience of vulnerable populations; and (4) improving nutritional status of pregnant women and children. Ghana's FTF Strategy acknowledges that climate changes can have adverse effects on agricultural production in Ghana, and consequently on the economy and food security. As a result, the Strategy aims to embed climate change adaptation as a cross-cutting issue in all FTF programs and activities. The Strategy also calls for use of climate information in developing scenarios to plan for food security investments. Additionally, the Strategy recognizes that environmental sustainability and climate changes are of special concern for Ghana's fisheries and coastal resources.

Health: USAID's Health program in Ghana aims at decreasing mortality among women and children under five by expanding access to quality health services and reducing the impact and spread of malaria, HIV/AIDS, and other infectious diseases. Climate change is likely to increase the rates of meningitis, diarrhea, malaria, and other infectious diseases as well as affect food productivity that will consequently impair child growth and development. Extreme events such as floods and storms can also damage public health infrastructure. USAID may therefore need to scale up its health program in order to respond to these changes and potentially allocate more resources to program components that are more vulnerable to climate changes.

Water: USAID is funding a Water Supply, Sanitation, and Hygiene Infrastructure Program in Ghana. This program integrates climate changes by supporting infrastructure projects that take into account (1) expected

variability in water availability or quality from climatic changes and (2) the increased potential for extreme weather events that could damage water systems. It also addresses specific climate change scenarios and plans for adaptation in peri-urban and rural areas.

Democracy and governance: This program supports strengthening civic participation in democratic processes and ensuring that the national and local governments are responsive to the interests of its citizens. Due to the fact that climate change is expected to affect sectors in Ghana that much of its population relies on—agriculture, health care, and economic growth initiatives—it is likely that these impacts will ripple throughout Ghanaian society. USAID's existing work on strengthening civil participation may help build increased capacity for citizens to participate in planning for adaptation to climate change.

Actions underway[23]

Ghana is one of the countries in West Africa with highest numbers of adaptation projects underway. The projects are focused on human health, freshwater resources, agriculture, urban sustainability, ecosystem conservation, and enhancing government capacity to facilitate adaptive action. USAID is supporting Ghana on adaptation via its Feed the Future (FTF) Initiative and Water, Sanitation, and Hygiene (WASH) Program mentioned above. Ghana is also part of the Integrating Climate Change Mitigation and Adaptation into Development Planning project funded by USAID, UNEP, and the European Commission.

Challenges to adaptation

The adaptation needs in Ghana include further refining and launching of the National Climate Change Adaptation Strategy, further enhancing the capacity of the National Climate Change Information Center and increasing public awareness of the risks of climate change more broadly, and moving more quickly to mainstream adaptation into sectoral and local planning efforts. Ghana would benefit from an increased number of adaptation projects with field implementation or community-based adaptation components. In addition, Ghana needs increased efforts to address climate impacts on coastal zones. There are currently few projects underway that specifically focus on this sector, even though it has been identified as one of the key sectors in vulnerability assessments.

Resources

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[23] Actions underway include those from direct adaptation funds and indirectly attributed funds. More information on U.S. climate finance can be found at http://www.state.gov/e/oes/climate/faststart/index.htm.

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CLIMATE VULNERABILITY PROFILE

Guatemala

US Foreign Assistance:[24] (thousands USD)	Requested FY 2012	Requested FY 2013
Estimated total:	**95,185**	**93,570**
Adaptation:	0	2,000
Feed the Future:	13,000	13,000
Priority Adaptation Country in 2011:	**Yes**	
Key Climate Stressors:	**Heat, Drought, Flooding, Sea level rise, Extreme events**	

Introduction

Guatemala, located in Central America, borders the North Pacific Ocean and the Gulf of Honduras in the Caribbean Sea. With a population of approximately 14 million people, Guatemala is the most populous country in Central America. Guatemala's agricultural sector contributes over 13 percent of its Gross Domestic Product (GDP) and employs nearly 40 percent of the labor force. The Caribbean coast is extremely susceptible to hurricanes and other tropical storms. The main development stressors in Guatemala are malnutrition and poverty as well as violence and impunity.

Projected weather and climate changes

Guatemala is a mostly mountainous country. The climate varies with the topography, ranging from hot and dry to cool and humid. Currently, tropical storms, droughts, and extreme rainfall are the most significant climate hazards.

Temperature: According to the Climate Change Knowledge Portal (CCKP), climate models project increases in average monthly temperature between 1.5°C and 4.5°C above current levels by 2050. May is projected to be the hottest month by 2050, with temperatures exceeding 28°C.

Precipitation: Model projections for changes in precipitation are less conclusive than those for temperature. The Adaptation Partnership's data suggest that under different emissions scenarios, precipitation could either increase or decrease. The CCKP points to results that project an average reduction in precipitation by 2050 for July-September, with August showing the biggest decrease.

Extreme events: Droughts, tropical storms, hurricanes, and cyclones present a current threat to Guatemala. Projections lack clarity about whether these extreme events will increase or decrease in frequency and severity. Heat waves, however, are projected to intensify, due to the combined increase in temperature and decrease in summer precipitation.

[24] US foreign assistance includes both USAID and Department of State program funding, but in most cases the bulk of this funding is implemented through USAID. In order to have comparable figures in these categories, all country profiles use figures from the Congressional Budget Justification (CBJ) (see http://transition.usaid.gov/performance/cbj/185016.pdf and http://transition.usaid.gov/performance/cbj/158269.pdf). Between the time of the budget request and the 653(a) report to Congress, these figures can change significantly.

Sea level rise: Global sea levels are projected to rise; however, local projections for the Guatemalan coast are inconclusive.

Key climate impacts and vulnerabilities

The main climate concerns in Guatemala revolve around agriculture and threats to natural resources. Chronic malnutrition is a major concern and climate changes could place additional strain on agricultural production. Drought and flooding could threaten the viability of critical crops. Additionally, Guatemala's key agricultural exports—including coffee, sugar, bananas, and vegetables—are climate-sensitive and production could be altered by changes in precipitation, temperature, and extreme events.

Key USAID program vulnerabilities

The USAID Guatemala Country Development Cooperation Strategy for 2012-2016 is based on three development objectives: (1) Greater Security and Justice for Citizens, (2) Improved Levels of Economic Growth and Social Development in the Western Highlands, and (3) Improved Management of Natural Resources to Mitigate Impacts of Global Climate Change. Their key program vulnerabilities relate to citizen security, food security, and health.

Citizen security: USAID implements activities to counter security threats from drug trafficking and organized crime. Climate stresses on the already limited food supply may contribute to conflict and disrupt the peace and security of the country. The Central America Regional Security Initiative (CARSI) Economic Support Fund provides at-risk youth with educational and alternative opportunities to avert future crime and violence. As climate stressors and changes in extreme events undermine agricultural production, the need may increase for programs to provide economic alternatives for displaced workers and youth.

Food security and agriculture: Guatemala is a priority country under the Feed the Future Initiative (FTF). Approximately 50 percent of Guatemalan children under the age of five suffer from chronic malnutrition. The majority of people suffering from chronic malnutrition live in the rural areas of the Western Highlands, which is the focus area for FTF investments. FY 2012 programs targeted agriculture and food supplies and FY 2013 programs are designed to improve coffee and horticulture value chains in order to increase incomes. Coffee production, especially Arabica beans that are produced in Guatemala, requires a specific climate for optimal quantity and quality. Changes in climate may increase the productivity of land at higher elevations, but that increase is unlikely to offset the changes in the areas where coffee growing is currently optimal.

Health: Guatemala is one of the few countries designated as a "GHI Plus" country under the Global Health Initiative (GHI). USAID identified Guatemala as one of the countries in need of an intensified effort to improve public health. The dollars spent through the GHI in Guatemala are used for family planning and reproductive health, maternal and child health, and nutrition. Nutrition may be increasingly stressed if agricultural production is affected by changes in water availability and increased temperatures. This would have an impact on chronic malnutrition, while extreme events would impact acute malnutrition.

Actions underway[25]

Guatemala is an adaptation priority country for USAID. Through collaboration with the Government of Guatemala, USAID is working on an adaptation and sustainable land use program to build resilience to climate change impacts. Proposed USAID adaptation actions include a $1 million food security support program (using indirect adaptation funding) that would assist small-scale producers in adjusting to changes in soil moisture and runoff that may result from changing precipitation regimes. Additional USAID food

[25] Actions underway include those from direct adaptation funds and indirectly attributed funds. More information on U.S. climate finance can be found at http://www.state.gov/e/oes/climate/faststart/index.htm.

security programs will focus on ways to protect the area from climate shocks through improved cultivation and irrigation practices, early warning systems, and disaster preparation. USAID is providing scholarships for students to study climate change and apply their knowledge to help vulnerable communities adapt. USAID will also invest $1 million in adaptation projects in the coastal zones of Central America.

There are several other adaptation efforts underway in Guatemala that are supported by other donors and actors. These range from sustainable forest management to coffee production analysis, integrated water resource management, disaster risk capacity strengthening, and community based adaptation programs.

Challenges to adaptation

Several data and information gaps exist that may be challenges to adaptation in Guatemala. The country's First National Communication to the United Nations Framework Convention on Climate Change noted that some of the climate data were incomplete or inaccurate from the five climate stations used. Guatemala will need to improve the number of weather stations to accurately monitor the changing climate, as well as improve dissemination of weather information to communities. There is also a lack of vulnerability and impact assessments, particularly on the climate thresholds for staple crops.

Resources

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CLIMATE VULNERABILITY PROFILE

Haiti

US Foreign Assistance:[26] (thousands USD)	Requested FY 2012	Requested FY 2013
Estimated total:	**357,161**	**339,963**
Adaptation:	3,000	0
Feed the Future:	35,700	30,000
Water:	1,100	1,166
Priority Adaptation Country in 2011:	**No**	
Key Climate Stressors:	**Heat, Drought, Flooding, Sea level rise**	

Introduction

Haiti is a small impoverished Caribbean country occupying the western half of the Island of Hispaniola. Haiti has a population of over 8 million people and is statistically the poorest country in the Western Hemisphere, ranking 158 out of 187 on the UN Human Development Index. Haiti's topography consists of rugged mountains mixed with river valleys and coastal flat lands. Most Haitians reside on the coastline, which spans 1,771 km. Haiti faces significant development challenges, including food and economic security, health and education, political violence, and environmental degradation. It is estimated that population stress has caused 98 percent of Haiti's forest to be cleared for fuel. These challenges are compounded by frequent and devastating natural disasters, including hurricanes, flooding, drought, and earthquakes. The 7.0 magnitude earthquake on January 12, 2010 is considered one of the largest economic and humanitarian disasters to occur in the Western Hemisphere. The earthquake killed hundreds of thousands of people, caused significant damage to infrastructure, and left over 1.6 million people without access to shelter or basic services.

Projected weather and climate changes

Haiti experiences tropical humid conditions year-round with a long wet season, predominantly in the northern and southern regions of the island. Between March and November, Haiti experiences two periods of peak rainfall. Haiti is also located in the middle of a hurricane belt, with the most severe storms routinely occurring from June to October. These storms typically cause widespread flooding and deadly landslides.

Temperature: Temperature observations show that the frequency of cold days and cold nights has decreased steadily since 1960, while the frequency of hot days and hot nights per year has increased by 63 and 48 days, respectively, between 1960 and 2003. This trend it expected to continue and temperature is projected to increase by 0.5-2.3°C by 2060.

[26] US foreign assistance includes both USAID and Department of State program funding, but in most cases the bulk of this funding is implemented through USAID. In order to have comparable figures in these categories, all country profiles use figures from the Congressional Budget Justification (CBJ) (see http://transition.usaid.gov/performance/cbj/185016.pdf and http://transition.usaid.gov/performance/cbj/158269.pdf). Between the time of the budget request and the 653(a) report to Congress, these figures can change significantly.

Precipitation: Average annual rainfall in Haiti has decreased by 5 mm per month per decade since 1960. Climate models project that rainfall will continue to decrease during June-August, while projections for the remainder of the year are less definitive.

Extreme events: Observations show that the intensity of hurricanes has increased considerably since 1980, but future projections of hurricane frequency and intensity in the Atlantic are still debated. The U.S. Climate Change Science Program states that increases in hurricane rainfall, wind speeds, and storm surge are likely to occur in conjunction with a rise in sea temperature.

Sea level rise: Sea level rise projections for Haiti's coast are also uncertain. According to the Intergovernmental Panel on Climate Change's Fourth Assessment Report, the Caribbean is projected to experience a rise in sea level between 0.13 and 0.56 m by 2090 relative to the 1980-1999 baseline.

Key climate impacts and vulnerabilities

The most significant climate-related hazards in Haiti include flooding, drought, intense rainfall, landslides, severe soil erosion, salt water intrusion, and hurricanes. These hazards will likely impact various facets of Haiti's economy and society. The most significant impacts are likely to be experienced in agriculture and food security, coastal communities, and water resources. For example, a reduction in annual rainfall coupled with more intense storm events will likely decrease agricultural productivity in Haiti for corn, rice, and potatoes and exacerbate food security issues. Furthermore, the supply and quality of water resources will be threatened by reductions in precipitation, inadequate water–related infrastructure, and saltwater intrusion. Coastal communities will become more vulnerable as more intense and frequent storms are experienced, natural resources are further degraded, and landslides and floods become more severe. In sum, climate changes are very likely to exacerbate Haiti's existing vulnerabilities because the country has little economic and institutional capacity to respond.

Key USAID program vulnerabilities

Infrastructure and energy: USAID is building basic services for Haiti's citizens in response to the destruction of public infrastructure from the 2010 earthquake. USAID's projects focus on providing economic support and increasing employment through investments in housing, ports, and energy. Infrastructure in Haiti is already vulnerable to natural disasters and will become increasingly more vulnerable as climate change impacts worsen. In particular, urban areas are threatened by intensified hurricanes, landslides, and flooding caused by increased precipitation, widespread deforestation, and inadequate drainage infrastructure. USAID infrastructure investments and programs in Haiti are therefore threatened by climate change impacts.

Food security: Agriculture generates more than 25 percent of Haiti's Gross Domestic Product (GDP) and employs more than 60 percent of the country's population. USAID's food security project activities include efforts to improve the storage of harvested crops and the roads needed for transport. In the past, droughts and floods in Haiti have devastated crops, reduced agricultural yields, and weakened food security. As climate change causes more unpredictable and irregular rainfall and more frequent and intense storms, current agricultural practices will be challenged. These practices include the type of crops chosen and the timing of planting. Furthermore, the infrastructure used throughout the agricultural supply chain, including water storage, transport, and industrial machinery, may be damaged or destroyed by extreme events such as floods, hurricanes, and landslides. Impacts in Haiti's agriculture sector may cause food security conflicts, negatively affecting USAID/Haiti's governance program.

Economic security: USAID is investing in economic security in Haiti by strengthening lending to small and medium enterprises (SMEs), with a focus on those involved in the U.S. government's target sectors of construction, garments and apparel, and agriculture. Any number of these SMEs could be vulnerable to climate change as aspects of the supply chain are destabilized by climate-related hazards. For example, the

underlying infrastructure and systems developed to support services could be damaged or disrupted by high speed winds, flooding, or landslides.

Health and other basic services: USAID supports a number of health programs in Haiti, one of which is focused on Water, Sanitation, and Hygiene (WASH). Inadequate waste management systems are a critical challenge to public health. Climate impacts, such as hurricanes, flooding, or sea level rise, will exacerbate this challenge and may affect the success of USAID's WASH program in Haiti through increased risk of water-borne diseases or saltwater intrusion.

Actions underway[27]

USAID adaptation actions in Haiti focus on building resilience in the agriculture sector. USAID is working on sustainable agricultural development in the Port-au-Prince and St. Marc development corridors to increase resilience to extreme weather events. Furthermore, USAID is supporting the integration of climate change considerations into infrastructure, natural resource management, and governance related to agricultural activities. Local researchers, planners, and decision makers in Haiti will also receive adaptation assistance from the Energy and Climate Partnership of the Americas, which receives funding from the State Department.

Haiti has a number of adaptation projects currently underway that are sponsored by other donors. These include a United Nations Development Programme project on coastal zone management funded by the Least Developed Countries Fund and a Food and Agriculture Organization project on agriculture and disaster risk reduction funded by the Global Environment Fund. Haiti is also a part of several regional adaptation projects.

Challenges to adaptation

Haiti's National Adaptation Programme of Action identified a number of challenges that need to be overcome to effectively implement adaptation actions in Haiti. These include: the possibility of a return of political turbulence and instability, resulting in lack of trust in government programs by Haitians and donors; potential conflicts between partner organizations and local authorities; lack of coordination between various environmental projects; difficulty accessing priority areas; and the potential occurrence of new disasters during implementation of adaptation projects.

Resources

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[27] Actions underway include those from direct adaptation funds and indirectly attributed funds. More information on U.S. climate finance can be found at http://www.state.gov/e/oes/climate/faststart/index.htm.

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CLIMATE VULNERABILITY PROFILE

Indonesia

US Foreign Assistance:[28] (thousands USD)	Requested FY 2012	Requested FY 2013
Estimated total:	**180,000**	**180,276**
Adaptation:	3,000	3,000
Agriculture:	7,395	3,000
Water:	6,333	6,333
Priority Adaptation Country in 2011:	**Yes**	
Key Climate Stressors:	**Flooding, Sea level rise**	

Introduction

Indonesia is the world's largest archipelago, with more than 17,500 islands and 230 million people, and is located in the Indian and Pacific Oceans. The manufacturing industry supports about a quarter of Indonesia's economy. Agricultural production and natural resource mining together contribute another quarter of the country's Gross Domestic Product (GDP). Forests, as well as marine and coastal ecosystems, provide vital services that sustain millions of livelihoods. While the country has experienced sustained development over the last decade, it faces several challenges, including a lack of reliable infrastructure (e.g., energy production) for leveraging by the private sector and weak governance systems (e.g., land use, environmental protection, human rights). These challenges, coupled with environmental and natural resource stressors, could hinder further sustained growth.

Projected weather and climate changes

Indonesia experiences two main seasons: a dry season from June to September and a wet season from December to March. Tropical areas of the country tend to experience rain throughout almost the entire year. Average temperatures range from 23°C in mountainous, high altitude areas to 30°C in inland areas. Average relative humidity varies between 70 and 90 percent.

Temperature: Average annual temperature has increased by 0.3°C since 1990. Temperature is expected to continue to increase at a rate of 0.2-0.3°C per decade through 2100.

Precipitation: Overall, annual rainfall has decreased 2-3 percent since 1990. Seasonal precipitation patterns have also changed. In southern regions, there has been a decline in average annual rainfall, but an increase in wet season rainfall. Meanwhile, in northern regions, there has been an increase in average rainfall, but a decrease in dry season rainfall.

Indonesia is projected to experience increasing annual precipitation, except in the southern regions, where precipitation is projected to decline by up to 15 percent by 2100 from the 1980-1999 period. In addition,

[28] US foreign assistance includes both USAID and Department of State program funding, but in most cases the bulk of this funding is implemented through USAID. In order to have comparable figures in these categories, all country profiles use figures from the Congressional Budget Justification (CBJ) (see http://transition.usaid.gov/performance/cbj/185016.pdf and http://transition.usaid.gov/performance/cbj/158269.pdf). Between the time of the budget request and the 653(a) report to Congress, these figures can change significantly.

models project a 30-day delay in the annual monsoon season. This delay would result in a 10 percent increase in rainfall later in the crop year (April-June) and up to a 75 percent decrease in rainfall later in the dry season (July- September).

Extreme events: Indonesia is vulnerable to extreme hydro-meteorological events such as floods and droughts. Urban centers such as Jakarta, Medan, and Bandung frequently experience floods and flood-induced landslides and mudslides. Projections are inconclusive as to how the intensity and frequency of these events may change. Prolonged droughts have and will continue to exacerbate the risk of forest fires.

Sea level rise: Indonesia has 42 million citizens who live on low-lying land less than 10 meters above sea level. A one-meter rise in sea level could inundate about 405,000 hectares of land and low-lying islands. A recent study by the Government of Indonesia projects that sea levels will rise 27.5-40 cm by 2050 and 60-80 cm by 2100 from the 2000 baseline.

Key climate impacts and vulnerabilities

Agriculture, freshwater resources, and coastal and forest ecosystems are expected to be particularly vulnerable to climate impacts.

Climate change will affect both subsistence and cash crops, with food security and economic growth implications. Changing precipitation patterns, evaporation, run-off, and soil moisture could all impact agricultural production levels. As sea levels rise, districts located in rural coastal areas may face reductions in local rice and maize production. Aquaculture production may also be affected. Since Indonesians rely heavily on seafood for their protein intake, reductions in aquaculture production will threaten food security.

Saltwater intrusion may alter the availability and quality of freshwater supplies during the dry season. Freshwater in Indonesia is required for irrigation, drinking water, and industrial uses. Compromised (i.e. contaminated by saltwater) and reduced availability of freshwater will thus have implications for health, agriculture, and economic production processes.

Finally, changes in land-use, temperature, and precipitation have caused widespread wildfires in Indonesia that have altered forest composition and structure. Climate changes could exacerbate this problem. Further, mangrove systems have and will continue to feel the effects of climate variability and change. Reduced freshwater flows and sea level rise will increase pressure on these ecosystems.

Key USAID program vulnerabilities

Education: USAID supports several education programs that are developing opportunities for children with visual and hearing impairments and physical and mental disabilities, promoting university partnerships, and building capacity for higher education. Climate changes such as sea level rise and storm surge could affect USAID-built structures for schools and related facilities. The program will need to ensure that facilities are properly sited to minimize impacts and constructed with materials that increase climate resilience.

Democratic governance: By working with local communities, governments, and civil-society organizations, USAID is supporting the further development of democratic governance structures. Climate stressors may affect the ability of government agencies and local institutions to deliver services.

Economic growth: USAID supports programs that promote the production and marketing of high-value crops such as coffee, cocoa, and horticultural products. These crops are likely to be vulnerable to climate impacts in the future, including temperature and precipitation change and saltwater intrusion. USAID's programs can help promote agricultural practices that increase resilience to climate change impacts.

Environment: USAID supports several environment-related programs, including ones that are improving the management of forest, marine, and mangrove ecosystems; increasing access to clean energy systems; and reducing disaster risk. Climate changes could stress managed ecosystems. Over time, areas may become uninhabitable for certain species. For example, sea level rise could affect and displace mangrove forests. USAID programs can protect their gains by adjusting ecosystem management practices in ways that consider future climate conditions. Climate changes may also exacerbate extreme weather events, resulting in an increased need for disaster risk reduction programs.

Health: USAID programs in Indonesia are focused on improving child and maternal health and stemming infectious diseases. Climate change could have significant impacts on agriculture production, which will affect nutrition programs aimed at improving child and maternal health. In addition, increasing temperature and variable precipitation could affect the future distribution and abundance of disease vectors.

Actions underway

Indonesia is an adaptation priority country for USAID, and USAID has several ongoing climate change-related efforts in the country. These include the Coral Triangle Support Partnership, a National Oceanic and Atmospheric Administration (NOAA) Training program, the Indonesia Marine and Climate Support Project, Adapting to Climate Change in Eastern Indonesia, and the Indonesian Forest and Climate Support Project. These programs address the integral role that forest and marine ecosystems play in ensuring climate resilience. Further, the NOAA program provides capacity building in fisheries and marine protected areas management. Additionally, all of USAID's environment-related programs listed in the Environment section above take into account climate risks.

Challenges to adaptation

Significant challenges to adaptation remain, including data, information, and research gaps. Needs include: additional climate information in forms that can be easily integrated and used in decision-making; detailed vulnerability assessments in more regions of the country to help clarify the nuances of future impacts; training on how to integrate climate information into programming; and early warning systems for disaster risk reduction efforts.

Resources

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CLIMATE VULNERABILITY PROFILE

Kenya

U.S. Foreign Assistance:[29] (thousands USD)	Requested FY 2012	Requested FY 2013
Estimated total:	**652,200**	**459,538**
Adaptation:	3,000	3,000
Feed the Future:	29,000	50,000
Malaria:	37,000	35,000
Water:	1,332	9,394
Priority Adaptation Country in 2011:	**Yes**	
Key Climate Stressors:	**Heat, Drought, Flooding, Sea level rise**	

Introduction

Kenya straddles the equator in East Africa and has a population of over 43 million people. It has a diverse terrain that ranges from coastal plains to mountain ridges and plateaus in the central and western regions, and arid and semi-arid plains in the northern and eastern interior. Kenya is the largest economy in East Africa, and serves as the finance and transport hub for the region. The country's economy is highly dependent on rain-fed agriculture, tourism, and the service industry. Agriculture represents 51 percent of the country's Gross Domestic Product (GDP) and employs about 75 percent of the population. Other key sectors include livestock/pastoralism, horticulture, fisheries, and forest products. Climate changes are expected to exacerbate existing stressors such as high population growth and natural resource degradation, thus posing additional challenges to economic development and poverty reduction in Kenya.

Projected weather and climate changes

Temperature: Average annual temperatures have risen by about 1.0°C since 1960 and are projected to increase by 1.0-2.8°C and 1.3-4.6°C by the 2060s and 2090s, respectively.

Precipitation: Precipitation in Kenya has generally remained the same in recent decades, with only a slight decrease experienced, likely due to a reduction in precipitation during extended rain periods. Future projections of annual rainfall are uncertain and range from a 6 percent decrease to a 26 percent increase from the 1970-1999 average by 2060. The amount and timing of rainfall throughout the year is also projected to change, with increased inter-annual variability.

Extreme events: Kenya has experienced extreme events of droughts, floods, and storms. Droughts have increased in frequency and extent in recent decades and now impact areas that were unaffected historically. Since 1993, Kenya has declared six national disasters due to droughts. Projections indicate an increase in the

[29] US foreign assistance includes both USAID and Department of State program funding, but in most cases the bulk of this funding is implemented through USAID. In order to have comparable figures in these categories, all country profiles use figures from the Congressional Budget Justification (CBJ) (see http://transition.usaid.gov/performance/cbj/185016.pdf and http://transition.usaid.gov/performance/cbj/158269.pdf). Between the time of the budget request and the 653(a) report to Congress, these figures can change significantly.

frequency and duration of droughts and a greater amount of annual precipitation falling during heavy rainfall events.

Sea level rise: Sea level rose by 2.1 mm per year between 1986 and 2008 near Mombasa, and a rise in sea level of 0.75-1.90 m is projected by 2100.

For more information on observed climate trends to date in Kenya, please see the Climate Trend Analysis prepared by the Famine Early Warning Systems Network (FEWS NET) at http://pubs.usgs.gov/fs/2010/3074/.

Key climate impacts and vulnerabilities

The key sectors in Kenya that are vulnerable to climate changes include agriculture, water resources, health, and ecosystems. For example, increased rainfall variability and shifts in the frequency, intensity, and duration of droughts can reduce agricultural and horticultural crop production or affect grazing potential through expansion of arid and semi-arid lands. As a result, food security will be affected through direct impacts on food availability and indirect impacts on food accessibility, livelihoods, and income. Increases in the frequency and severity of extreme events may reduce productivity of rangelands, which support millions of pastoralists and agro-pastoralists in Kenya.

The availability and accessibility of water resources varies throughout the country. Water resources are concentrated in five drainage basins in areas subject to frequent droughts and floods and therefore vulnerable to further changes in climate variability. Additionally, changes in temperature and precipitation will likely affect vectors for diseases such as malaria, especially in high altitude areas. Furthermore, impacts to water supply, quality, and sanitation will further compound other health impacts. Potential environmental impacts include reduced biodiversity; increased risk of forest fires; changes in distribution of pests, pathogens, and invasive species; a shift in vegetation to higher elevations; and substantial loss of tourism income. Coastal and marine ecosystems, including mangroves, coral reefs, and fisheries, will also be affected by climate change.

Key USAID program vulnerabilities

Food security: USAID's Feed the Future (FTF) Initiative in Kenya focuses on improving several key agricultural value chains in two regions: (1) horticulture, dairy, and maize in the rural arable poor areas and (2) drought-tolerant crops (sorghum/millet and root crop systems), drought-tolerant maize, horticulture, and pulses in the semi-arid areas. Livestock production, as well as agricultural and horticultural crop production, is vulnerable to higher temperatures, increased rainfall variability, and more frequent and severe extreme events. Climate change has been identified as a cross-cutting theme in the Kenya FTF Strategy.

Health: USAID's Health program in Kenya consists of four key areas: (1) HIV/AIDS, (2) family health, (3) malaria, and (4) strengthening of health sector systems. Kenya is one of fifteen countries in the President's Malaria Initiative. As climate changes are expected to increase the geographic ranges and incidence of vector-borne diseases, USAID's malaria program in Kenya may need to be scaled up in order to respond to these changes. The family health program may also be affected by climate change, as impacts on agriculture and food security will have implications for nutrition.

Peace and security: USAID supports reconciliation and conflict resolution in areas that suffered severe post-election violence and areas with chronic conflicts over land resources. Climate changes coupled with population growth and land degradation are likely to result in increased conflict over scarce resources. As a result, USAID may consider integrating climate change adaptation measures such as early warning systems for droughts, floods, and disease outbreaks into its peace and security program in Kenya.

Economic growth: The Kenya USAID Mission's Economic Growth program focuses on agricultural development and providing access to finance for small businesses and microenterprises. Small businesses and

microenterprises are vulnerable to economic shocks resulting from extreme events such as droughts, floods, and storms. USAID could therefore consider integrating elements of disaster risk management into its economic growth program, such as helping small businesses access insurance products.

Actions underway[30]

Kenya currently has the highest number of adaptation projects in East Africa and the government of Kenya has initiated activities to determine vulnerability and adaptation priorities. Kenya is a USAID climate change adaptation priority country and USAID is funding adaptation efforts focused on addressing vulnerabilities in key river catchment areas and other natural resources management issues.

Challenges to adaptation

Challenges to adaptation in Kenya include lack of quantitative and sector-specific data, lack of downscaled regional and local results of global circulation models, low capacity to conduct adaptation analyses, and difficulty coordinating between actors pertinent to adaptation and disaster risk reduction. These challenges need to be overcome to provide better collection and systematization of data relevant for vulnerability mapping and assessments and, ultimately, implementation of adaptation strategies.

Resources

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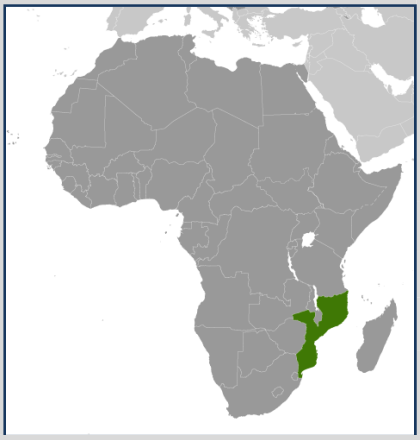
[30] Actions underway include those from direct adaptation funds and indirectly attributed funds. More information on U.S. climate finance can be found at http://www.state.gov/e/oes/climate/faststart/index.htm.

CLIMATE VULNERABILITY PROFILE

Mozambique



U.S. Foreign Assistance:[31] (thousands USD)	Requested FY 2012	Requested FY 2013
Estimated total:	**380,489**	**316,211**
Adaptation:	4,000	3,000
Feed the Future:	10,000	18,000
Malaria:	32,300	29,000
Water:	3,380	4,243
Priority Adaptation Country in 2011:	**Yes**	
Key Climate Stressors:	**Heat, Drought, Flooding, Sea level rise**	

Introduction

Mozambique is located on the eastern coast of southern Africa and has a population of approximately 23.4 million people. Mozambique's coastline is the third longest in Africa and is home to approximately 60 percent of the country's population as well as critical ecosystems such as dunes, reefs, bays, and mangroves. The rest of Mozambique is covered by savannah and secondary forest. Topographically, Mozambique is mountainous in the northwest and lies at the end of several river basins. The country faces multiple development challenges, including widespread poverty, low life expectancy, and gaps in its education system. Much of the country depends on rain-fed agriculture for both subsistence and export needs. Twenty-five percent of the country's Gross Domestic Product (GDP) comes from agriculture and 80 percent of its population relies on agriculture for their livelihoods. Similarly, fisheries and aquaculture also represent critical livelihoods, representing about 40 percent of total export earnings. Mozambique also has rich biodiversity and ecosystems that support a growing tourism industry.

Projected weather and climate changes

Mozambique has a tropical to sub-tropical climate and experiences two seasons: a cool and dry season from April to September and a hot and humid season between October and March. Temperatures are warmer near the coast and southern lowland regions compared to the higher, inland regions. Mozambique is often affected by natural disasters, including droughts and floods associated with the El Niño Southern Oscillation.

Temperature: Average annual temperatures in warmer regions of Mozambique range from 20 to 27°C, and in cooler regions average annual temperatures range from 15 to 25°C. Average annual temperature has increased by 0.6°C between 1960 and 2006. Mean annual temperatures are projected to increase by 1.0-2.8°C by the 2060s and by 1.4-4.6°C by the 2090s compared to 1970-1999 average observed temperatures. These increases are projected to be more rapid in the inland regions than on the coast. The frequency of hot days and nights are projected to increase while the frequency of cold days and nights will decrease.

[31] US foreign assistance includes both USAID and Department of State program funding, but in most cases the bulk of this funding is implemented through USAID. In order to have comparable figures in these categories, all country profiles use figures from the Congressional Budget Justification (CBJ) (see http://transition.usaid.gov/performance/cbj/185016.pdf and http://transition.usaid.gov/performance/cbj/158269.pdf). Between the time of the budget request and the 653(a) report to Congress, these figures can change significantly.

Precipitation: The wet season in Mozambique lasts from November to April, bringing around 150 to 300 mm of rainfall per month in the north and 50 to 150 mm per month in the south. Average annual rainfall has decreased by 2.5 mm per month per decade between 1960 and 2006. However, the intensity of heavy rainfall events has increased over the same period, with the largest increases during the wet season. Rainfall projections are varied and divergent across models, particularly depending on season and region. The models indicate an overall increase in precipitation, especially during the wet season and in coastal regions.

Extreme events: The coastal areas of Mozambique experience cyclones and associated storm surge. Since the 1950s, the occurrence of extreme weather events, including drought, heavy rainfall events, hurricanes, and cyclones, has increased. While cyclones are projected to become less frequent, their intensity and associated levels of precipitation are likely to increase.

Sea level rise: Mozambique's coasts are susceptible to future sea level rise as the majority of the country's coastal zone is located below sea level. Sea levels are projected to rise between 0.18 m and 0.59 m by the 2090s compared to 1980-1999 sea levels.

For more information on observed climate trends to date in Mozambique, please see the Climate Trend Analysis prepared by the Famine Early Warning Systems Network (FEWS NET) at http://pubs.usgs.gov/fs/2011/3110/.

Key climate impacts and vulnerabilities

Mozambique is extremely vulnerable to the impacts of climate change. Much of the population lives in low-lying coastal areas with weak, non-resilient infrastructure and relies on local natural resources (e.g., agriculture and fisheries) for their livelihoods. Alternating flood and drought events will affect the ability of farmers and fishermen to consistently grow crops and fish, which will likely impact food security, malnutrition, and sustainable incomes. Furthermore, sea level rise and associated saltwater intrusion could affect the availability of aquaculture, the viability of the coastal mangrove systems, and contaminate already stressed water supplies. Droughts, flooding, and greater temperatures will negatively impact human health and forest ecosystems. Finally, extreme events—namely tropical cyclones—will affect already weak infrastructure and damage or destroy coastal ecosystems and livelihoods.

Key USAID program vulnerabilities

Agriculture: USAID/Mozambique is implementing projects that focus on identifying higher yield or disease-resistant crop varieties, providing education on modern cultivation techniques, and helping farmers move from subsistence farming to agricultural business markets. Current agriculture practices being promoted under these projects are likely to be vulnerable to changes in climate as they were designed to be effective under current climate conditions but not under future climate scenarios where higher temperatures, changes in precipitation, and more severe droughts and floods, are expected.

Economic growth and trade: USAID/Mozambique is supporting the Government of Mozambique in diversification of its economic base through projects that help attract private investment, improve economic governance and business climate, and invest in green growth. While much of the economy still relies on agriculture, the country is also moving towards investing in its tourism sector and renewable energy efforts. These sectors are also vulnerable to projected future climate change. Changes in temperature, rainfall, sea level, and extreme events could affect the length of tourism seasons and impact coastal and land resources that attract tourists and enable renewable energy production. Furthermore, the infrastructure investments needed to support these sectors may be threatened by a number of climate variables. For example, an increase in the severity of cyclone winds and precipitation may cause damage or destruction to energy, transport, and/or tourism infrastructure.

Health: USAID/Mozambique's health program has three focus areas. Two of these focus areas, the Malaria Initiative and improving child and maternal health, are likely to be vulnerable to future climate impacts. For example, changes in temperature and rainfall patterns could cause alterations in current malaria disease vectors. This may ultimately change the areas and populations within Mozambique that are exposed and susceptible to malaria. Furthermore, future impacts on agricultural and aquaculture production could have secondary impacts on the availability of nutritious food for mothers and their children. Additionally, Mozambique is vulnerable to cholera outbreaks, which are closely linked with flooding. Intense precipitation events can overrun poorly placed latrines, increasing prevalence of cholera and other enteric diseases. USAID/Mozambique's health program may need to address these additional areas.

Coastal and marine areas: Coastal zones in Mozambique have already begun to, and are anticipated to continue to, experience rises in sea level. The country's 2,700 km of coastline are made up of many low-lying areas characterized by a variety of ecosystems such as estuaries, mangroves, dunes, inland lagoons, coastal lakes, coral reefs, and marine swamps. The ecosystems provide habitats for a wide range of ecologically important and economically valuable species. Projected sea level rise is anticipated to increase the vulnerability of ecosystems and land to erosion and flooding. An estimated 90 percent of coastal erosion is caused by climate impacts, with average erosion rates of 0.11-1.10 m per year from 1999 to 2004. Provinces most vulnerable to rising sea levels are Zambezia, Nampula, Sofala, Beira, and Maputo, due to their low-lying topography and large populations. Beria and Maputo are particularly vulnerable because they are below sea level. Over 13 million people (60 percent of Mozambique's population) live within 50 km of the coastal zone. By the 2040s, coastal related damages in Mozambique could rise to $103 million per year, with transportation and coastal infrastructure at risk.

Actions underway[32]

Mozambique has a many of discrete adaptation-related efforts currently underway. Some of these efforts are focused solely on Mozambique while others include participation from other developing countries. The projects mostly center on building the capacity of Mozambique to respond to climate impacts and formulate adaptation policies, but focus on a range of sectors including disaster risk management, coastal zone management, forestry, freshwater, and rural development. One of the most important adaptation programs in Mozambique is the Pilot Program on Climate Resilience, a multilateral climate investment fund that focuses on roads, water, agriculture, coastal cities, and private sector investment. USAID/Mozambique has been allocated adaptation funding and recently supported a risk assessment study for the National Institute of Disaster Management (INGC), which looked at climate vulnerabilities in three major cities (Maputo, Beira and Quelimane) and considered costs, benefits, and averted losses for possible adaptation measures. The Mission recently released a draft statement of work for a coastal urban adaptation program. The program will focus on several coastal cities and will seek to improve the provision of climate-resilient urban services by municipalities, increase adoption of climate resilient measures by communities, and increase access to risk-sharing tools for at-risk infrastructure and livelihoods.

Challenges to adaptation

Significant challenges to adaptation exist in Mozambique. Further research is required on the changes in extreme events and the subsequent need for disaster management and response. Coastal vulnerability and risk assessments need to be conducted. Additionally, a network of observing and data management stations and systems needs to be established in order to support decision making in disaster situations, particularly for rivers in the central region and major cities at risk from cyclones and storms surges. Institutionally, the Mozambican government would benefit from strengthening of its relevant Ministries (e.g., Environment, Agriculture) and local institutions and improved coordination between these agencies to develop and implement adaptation strategies.

[32] Actions underway include those from direct adaptation funds and indirectly attributed funds. More information on U.S. climate finance can be found at http://www.state.gov/e/oes/climate/faststart/index.htm.

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CLIMATE VULNERABILITY PROFILE

Nigeria

U.S. Foreign Assistance:[33] (thousands USD)	Requested FY 2012	Requested FY 2013
Estimated total:	**625,388**	**599,450**
Agriculture:	15,000	12,000
Malaria:	23,500	44,000
Water:	2,473	2,886
Priority Adaptation Country in 2011:	**No**	
Key Climate Stressors:	**Heat, Extreme events, Sea level rise**	

Introduction

Nigeria is home to more than 150 million people, making it the most populous country in Africa. Petroleum, natural gas, coal, oil sands, and telecommunications industries play important roles in the country's economy, and a significant portion of the country's labor force is employed in the agricultural sector. While Nigeria benefits economically from being the biggest oil exporter in Africa, poverty remains an issue. One of the main challenges to national development is the considerable policy autonomy and weak capacity among Nigeria's 36 states and 774 local governments. Inadequate access to energy is also a large obstacle to economic growth.

Projected weather and climate changes

Nigeria lies in West Africa and experiences a diverse climate that ranges from arid in the north to tropical in the majority of the rest of the country.

Temperature: Temperatures average about 27°C throughout Nigeria and climate change scenarios suggest a warmer climate in the future. Regionally, the northeast is projected to experience the largest projected increase, 4.5°C from present day climate by 2081-2100. The coastal regions in the southwest are projected to warm less than the interior regions.

Precipitation: Annual rainfall has declined across the country over the past half century. Future precipitation projections vary across the country. The south may experience a wetter climate with an additional 15 cm of rainfall annually and the northeast may have a drier climate with 7.5 cm less rainfall annually by 2046-2065 compared to present day climate.

Extreme events: Nigeria is prone to a variety of climate-induced hazards, including floods, storms, ocean surges, droughts, and wildfires. Changes in climate may increase the frequency and intensity of extreme

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events in Nigeria. Climate projections suggest a small increase in the number of extreme rainfall days and a considerable increase in the number of extreme heat days.

Sea level rise: Sea levels in Nigeria are projected to rise between 0.5 m and 1.0 m by the end of the century.

Key climate impacts and vulnerabilities

Changes in climate may alter Nigeria's major ecological zones. Agricultural ecosystems, freshwater and coastal resources, forests, and biodiversity are all susceptible to impacts from climate changes. Such impacts include increases in soil erosion, flooding, desertification, and salt-water intrusion. Additionally, the country's coastal zone and low-lying islands in the Gulf of Guinea are vulnerable to sea level rise. An estimated 27 to 53 million people in the country may need to be relocated with a 0.5 meter increase in sea level. Nigeria's coastal and marine areas are also home to the country's economically important petroleum and fisheries industries. Furthermore, Nigeria's transportation infrastructure, which is inadequate for current needs, will be further degraded by extreme weather, negatively impacting industry and commerce and placing greater stress on the economy.

Key USAID program vulnerabilities

Agriculture: Agriculture employs 70 percent of the country's population. USAID's agricultural program focuses on strengthening private sector demand-driven value chains for products that can increase rural incomes and jobs by developing partnerships with private sector firms involved in processing, agricultural input supply, and exports. Changes in temperature and precipitation patterns are likely to affect the productivity and yield of Nigeria's agricultural sector. These impacts may ultimately reduce the stability of agricultural supply, threaten the livelihoods of rural farmers, and cause disruptions throughout the supply chain.

Economic growth: Oil accounts for 95 percent of export earnings in Nigeria and is an important source of revenue. USAID works closely with the Government of Nigeria on activities designed to promote increased trade, including reducing Lagos seaport congestion, increasing transport flows along the LKAJA (Lagos, Kano, Jibiya) Transport Corridor, and building trade capacity at the Ministry of Commerce and Industry. More frequent and severe extreme events such as flooding and storm surge may hinder effective trade and transport systems through impacts on transportation and energy infrastructure and their associated services.

Health: The USAID Health, Population, and Nutrition strategy works on maternal and child health, reproductive health, HIV, and malaria. Climate changes may alter the distribution and prevalence of vector-borne diseases in Nigeria. Furthermore, food shortages caused by disruptions in current agricultural production may affect the health of women and children, among other vulnerable populations. These potential impacts to the health of Nigerians may threaten the success of the outcomes stated in USAID/Nigeria's current Health, Population, and Nutrition strategy.

Water: Many Nigerians lack adequate access to safe drinking water, particularly in the rural north. One of USAID's goals under the Access to Water Sanitation and Hygiene (WASH) program is to increase access to safe water by helping community groups build, operate, and maintain borehole hand pumps and rain water catchment systems. While water is projected to become scarcer in the north as overall precipitation decreases, the demand for safe drinking water may simultaneously increase as temperatures rise. Considering future climate scenarios in the design of USAID/Nigeria's WASH program will ensure increased resilience to a range of possible future conditions.

Overarching: The northern part of Nigeria has experienced underinvestment in agriculture and infrastructure, high rates of mortality, poor governance, and conflict. USAID has adopted a Focus States Strategy for Nigeria, focusing the bulk of its resources on two northern states, Bauchi and Sokoto, to achieve maximum impact. These two states are projected to experience more drastic temperature increases than the

rest of the country and a reduction in rainfall. Changes in climate may threaten the long-term success of the Focus States Strategy if interventions continue to be designed and implemented based on current climate conditions.

Actions underway[34]

USAID is supporting a project to strengthen the seed value chain and expand the genetic seed base in order to help farmers in northern Nigeria adapt to climate change. The few existing adaptation projects in Nigeria, funded through various agencies, work toward understanding the potential impacts of climate change, increasing awareness of these risks, and supporting the government in building its capacity to address climate change impacts. The projects focus on the sectors of agriculture, ecosystem conservation, and governance and currently do not address climate impacts on human health, freshwater resources, coastal zone management, and gender issues.

Challenges to adaptation

USAID may encounter gaps and lack of capacity while developing adaptation activities in Nigeria. USAID will need to work with the Government of Nigeria to gain a more detailed understanding of actions they have undertaken since the release of the National Communication in 2003. Additionally, large-scale adaptation activities will require coordination among the country's numerous disjointed state governments.

Resources

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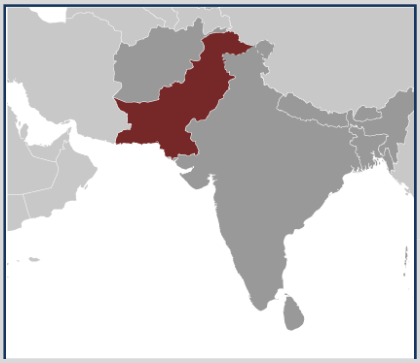
[34] Actions underway include those from direct adaptation funds and indirectly attributed funds. More information on U.S. climate finance can be found at http://www.state.gov/e/oes/climate/faststart/index.htm.

CLIMATE VULNERABILITY PROFILE

Pakistan



US Foreign Assistance:[35] (thousands USD)	Requested FY 2012	Requested FY 2013
Estimated total:	**2,101,908**	**2,227,596**
Water:	0	12,000
Priority Adaptation Country in 2011:	**No**	
Key Climate Stressors:	**Heat, Drought, Flooding**	

Introduction

Pakistan is located in South Asia and is bordered by India, Afghanistan, Iran, and China. It borders the Arabian Sea to the south, and stretches north to the Hindukush and Karakoram mountain ranges. Pakistan's 170 million people are economically and culturally diverse, and live in very different climate zones, topographies, and ecosystems. Most live along the banks of the Indus River, which is prone to severe flooding in July and August. Approximately 33 percent of the population lives below the poverty line. Pakistan has rich natural resources, including productive land, water, and mineral deposits, but still grapples with the challenge of balancing economic development with environmental protection. Pakistan is considered a semi-industrialized country and has generally shown slow growth. Its economy increasingly revolves around services, although a large part of the population still lives in rural areas and works in the agricultural sector. Agriculture contributes 22 percent of the national Gross Domestic Product (GDP) and employs 43 percent of the labor force.

Projected weather and climate changes

Pakistan has 11 climate zones due to its range of topographies and ecosystems, and each of these climate zones experiences different weather and climate patterns. Generally, the coastal areas of the country are dry and hot and the northern uplands get progressively cooler. The winter months (December-February) are cool and dry. The country experiences monsoons from June through September, with a lesser degree of monsoon activity in October and November as well.

Temperature: Widespread changes in extreme temperatures have been observed in Pakistan over the last 50 years. Cold days, nights, and frost have become less frequent whereas hot days, nights, and heat waves have become more frequent. According to Pakistan's Task Force on Climate Change, temperature is projected to increase from the 1960-1999 baseline by 1.3°C by 2020, 2.5°C by 2050, and 4.4°C by 2080 under the A2 scenario. Under the A1B scenario, temperatures in Pakistan are projected to rise by 1.45°C, 2.75°C and 3.87°C in 2020, 2050, and 2080, respectively.

[35] US foreign assistance includes both USAID and Department of State program funding, but in most cases the bulk of this funding is implemented through USAID. In order to have comparable figures in these categories, all country profiles use figures from the Congressional Budget Justification (CBJ) (see http://transition.usaid.gov/performance/cbj/185016.pdf and http://transition.usaid.gov/performance/cbj/158269.pdf). Between the time of the budget request and the 653(a) report to Congress, these figures can change significantly.

Precipitation: Average rainfall in the arid and coastal plains of Pakistan has decreased by between 10 and 15 percent since 1960, while increasing during the same time period over northern Pakistan. Heavy rainfall events have increased, with the nine heaviest rains recorded in 24 hours all being registered in 2010.

Extreme events: Pakistan has experienced about 18 extreme weather events since 1990, including the historic 2010 floods, as well as droughts, cyclones, and landslides. Due to the heavy monsoon rains during the summer months, Pakistan often experiences severe flooding in the Indus River basin, where much of the population lives on low-lying lands. Rain- or otherwise- triggered landslides are common in the northern regions of Pakistan, particularly those connected to Azad Jammu Kashmir province. Lowland plains, especially those surrounding the urban areas of Karachi and Hyderabad, are vulnerable to the impacts of cyclones and storm surge. Finally, sparse and erratic rainfall patterns can alter water tables, leading to drought conditions in the southern and central regions of Pakistan.

Sea level rise: The low-lying plains along the coast of Pakistan are exposed to the impacts of sea level rise, with conservative scenarios projecting an increase of 40 cm by 2100.

Key climate impacts and vulnerabilities

Much of the Pakistani population depends on agricultural activities for food and income. Under future climate scenarios, rising temperatures and erratic rainfall could limit the country's ability to sustain its current levels of agricultural and livestock production. Agriculture uses 92 percent of the country's extracted water, which makes it highly vulnerable to changes in hydrologic balance. Pakistan is ranked fourth in the world in terms of the extent of irrigated farmland; about 90 percent of agricultural output comes from irrigated land. The irrigation network receives 50 to 80 percent of its water directly from glaciers and snow melt in the Karakuram Hindu Kush series. Any change in the glacier mass balance will thus directly affect irrigated agriculture. Increasing temperatures could also increase demand for irrigation by triggering evapotranspiration. Further, erratic rainfall could increase the vulnerability of energy production, as 33 percent of Pakistan's energy supply is hydropower-driven. Availability of freshwater for key requirements such as drinking water and industrial uses will be diminished since most of this water comes from groundwater aquifers. Coastal communities and infrastructure are likely to be impacted by severe cyclones, storm surge, saltwater intrusion, and flooding during wet years.

Key USAID program vulnerabilities

Energy: USAID/Pakistan is partnering with the Government of Pakistan, the private sector, and other donors to strengthen the country's energy sector. The program focuses on increasing Pakistan's energy supplies, improving energy efficiency, and improving governance in the energy sector. USAID/Pakistan's energy program may be vulnerable to climate changes in a number of ways. First, hydropower, on which the country is heavily dependent, is highly vulnerable to projected climate changes as Pakistan may experience increased drought in the long-term when glacial melt is no longer consistent. Furthermore, the effectiveness of different types of renewable energy projects such as solar or wind may be diminished (or conversely expanded) by changing temperatures, winds, and/or storm patterns. Finally, investments in energy infrastructure may be in jeopardy as flooding, high winds, and rising temperatures may cause physical damage to energy production facilities and transport and distribution systems (e.g., power lines).

Economic growth: USAID supports a variety of economic growth projects in Pakistan, including promoting competitiveness of agricultural value chains, increasing technological innovation, and increasing irrigated acreage as well as water use efficiency. Agriculture in Pakistan, predominantly an arid to semi-arid country, almost entirely depends upon irrigation water to support agricultural production. USAID interventions like the Gomal Zam Irrigation Project and the Satpara Development Project expanded the irrigated area by 180,000 acres. These projects are vulnerable to climate change impacts in two ways: 1) floods could seriously damage the newly built irrigation canal infrastructure; and 2) droughts could diminish river inflows, which would reduce water available for irrigation. Thus, both agriculture and water are key areas of vulnerability in

Pakistan. Water availability and use are expected to change over time and across locations in Pakistan due to receding glaciers, decreased water reservoir capacity, and severe floods and droughts. With projected changes in climate, Pakistan's agricultural system is also expected to experience changes in crop and livestock productivity, pests, and water availability and use, as well as impacts from heat stress and shifts in spatial patterns of crops.

Health: Objectives of USAID/Pakistan's health program include increasing access to family planning services, improving maternal and child health care, behavior change communication, health systems strengthening, and improving access to water. Child and maternal health projects may be threatened by changes in nutrient availability as climate changes impact agricultural production. Additionally, climate changes are expected to stress water resources, making it difficult to consistently supply potable water. Flooding caused by excessive rainfall led to a range of health issues during the summer of 2010 and is an ongoing potential threat.

Peace and security: Much of USAID/Pakistan's portfolio is focused on promoting stabilization within the country. To this end, USAID is supporting infrastructure development, service provision (energy, water, health, etc.), and livelihood development. Many of these projects could be vulnerable to the impacts of extreme events such as floods, droughts, and cyclones that may become more frequent or more severe under climate change. For example, USAID rebuilt infrastructure such as the head-works on the Swat River, as well as bridges, roads, schools and hotels which were badly damaged by the 2010 floods and by conflicts, is highly vulnerable to climate changes, including increased frequency and severity of flooding.

Humanitarian assistance: USAID supports a variety of emergency response and cash compensation programs in Pakistan that support vulnerable families in affected areas. As extreme events may become more frequent, USAID's assistance, through the Office of U.S. Foreign Disaster Assistance (ODFA) and Food for Peace (FFP), may be in higher demand.

Actions underway[36]

To date, Pakistan has received modest attention on adaptation compared to other South Asian countries. Most of these programs do not target Pakistan alone, but rather include a number of other countries in the region and across the world. In Pakistan, adaptation projects have mainly focused on water but also address disaster risk reduction, policy formulation, agriculture, and energy. In its disaster response program, USAID/Pakistan is already supporting the National Disaster Management Agency in coordinating information sharing and dissemination; however, the program does not specifically consider climate change.

Challenges to adaptation

Pakistan faces several challenges in adapting to the impacts of climate change. Some of these are related to data and information gaps, including inadequate coverage of weather stations in some areas of the country (including on the Hunza river basin), lack of monitoring of the Karakoram glaciers, and poor demarcation of flood-prone zones. Institutionally, the country needs expanded capacity to respond in disaster situations, better capacity and training in managing flood waters, and institutions that can help mainstream climate considerations into all aspects of development, while also learning how best to engage people in affected communities. Further, there is a need to investigate changing rainfall patterns, especially the monsoon pattern, and their associated impacts, and develop sea level rise and storm surge models to evaluate impacts on low-lying areas around Karachi. The biggest of all these challenges will be developing an integrated political, social, and technical approach to transform climate change vulnerabilities into opportunities by developing appropriate strategies in all sectors. In the agricultural sector, for example, this could involve

[36] Actions underway include those from direct adaptation funds and indirectly attributed funds. More information on U.S. climate finance can be found at http://www.state.gov/e/oes/climate/faststart/index.htm.

actions such as building more water reservoirs, increasing the efficiency of irrigation practices, increasing access to crop insurance, and promoting high value agriculture to increase economic growth.

Resources

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CLIMATE VULNERABILITY PROFILE

Philippines

US Foreign Assistance:[37] (thousands USD)	Requested FY 2012	Requested FY 2013
Estimated total:	**142,435**	**144,432**
Adaptation:	12,500	10,500
Water:	2,047	1,500
Priority Adaptation Country in 2011:	**Yes**	
Key Climate Stressors:	**Heat, Flooding, Sea level rise**	

Introduction

The Philippines is an archipelago of 7,107 islands with a total population of about 91 million people. The country's territory includes both mountainous terrain and narrow coastal plains. The Philippines is one of the world's most biologically rich and diverse countries and has one of the world's longest coastlines. Over half of the Philippines population lives in urban areas. The services sector contributes more than half of overall Philippine economic output, followed by industry and agriculture. Many communities also depend on coastal ecosystems (fisheries, aquaculture, and related tourism) for their livelihoods.

Projected weather and climate changes

The Philippine climate is characterized by relatively high temperatures, humidity, and abundant rainfall. Temperatures average around 25.5°C in the winter and around 28.3°C in the summer. During the summer months, rainfall is typically concentrated in the southwest portion of the country. During the winter months, the northeast portion of the country experiences an average of twenty monsoons and tropical cyclones per year.

Temperature: Average annual temperatures have increased by approximately 1°C since 1970 at an average rate of 0.3°C per decade. Sea surface temperatures in the surrounding waters have increased between 0.6°C and 1°C since 1910, with the most significant warming occurring after the 1970s. Temperatures are projected to increase by about 1.4°C by 2050 and 3.1°C by 2100 compared to the 1980-1999 base period.

Precipitation: Rainfall projections are inconsistent across climate models. In addition to the uncertainty in projections, there are also significant regional variations. For example, increases in rainfall are projected for the Central Visayas and Southern Tagalog provinces, while decreases are projected for the Mindanao province. Furthermore, La Niña years bring wet periods and more storms, while El Niño causes prolonged dry periods. Recent evidence and model simulations suggest there may be more frequent drought conditions in the region.

[37] US foreign assistance includes both USAID and Department of State program funding, but in most cases the bulk of this funding is implemented through USAID. In order to have comparable figures in these categories, all country profiles use figures from the Congressional Budget Justification (CBJ) (see http://transition.usaid.gov/performance/cbj/185016.pdf and http://transition.usaid.gov/performance/cbj/158269.pdf). Between the time of the budget request and the 653(a) report to Congress, these figures can change significantly.

Extreme events: Typhoons are common in the Philippines, with most occurring between June and December. These events are projected to intensify with rising sea surface temperatures. The heavy rainfall associated with these typhoons is projected to lead to more frequent and more intense floods and landslides. Climate change projections also suggest that severe droughts associated with weather patterns (e.g., El Niño) may increase, which have implications for agricultural production such as reduction in crop yield and greater incidence of pests.

Sea level rise: Sea levels in the Philippines are projected to rise 23-47 cm by the end of the century (2090-2099). Actual sea level changes are projected to vary around the country due to differences in ocean circulation and density.

Key climate impacts and vulnerabilities

The Philippines' agricultural production and coastal infrastructure and ecosystems are particularly vulnerable to projected climate change impacts. Increasing temperatures combined with periods of heavy rainfall and drought will stress crop and fisheries production. Increased typhoons will inflict further damage on crop stocks. In addition, rising sea levels could contaminate freshwater ponds, lead to saltwater intrusion, inundate infrastructure, and affect aquaculture. Storms, sea level rise, and associated storm surge will affect a majority of the country's population, as 60 percent of municipalities and 10 of the country's largest cities are located on the coast. Due to this coastal concentration, significant amounts of infrastructure, livelihoods, and other assets are vulnerable to climate changes.

Key USAID program vulnerabilities

Energy and environment: USAID's efforts in the Philippines in the energy and environment sector focus on four areas: forests, marine conservation, water, and renewable energy. All of these efforts integrate climate change to some degree. USAID works in target geographies for each of the program areas to maximize impacts and results. The program also focuses on advancing low emissions development strategies and improving climate resilience through adaptation activities.

To improve natural resources and environmental services, USAID addresses the continuing degradation of biodiversity and natural resources while also more deeply integrating climate change considerations into long-term planning. USAID also expands related key infrastructure and makes it more affordable, which increases access to fundamental services while proofing them against anticipated climate change impacts. Additionally, programs strengthen weak governance of natural resources, energy and water and expand the benefits of sustainable natural resources management while confronting issues of overexploitation and undervaluation that reduce benefits in the long term. Furthermore, the programs increase the resilience of key energy and water infrastructure, environmental services, and already fragile ecosystems to natural disasters and climate change impacts. Finally, USAID is also working with the Philippines to develop a long-term plan to reduce its greenhouse gas emissions while considering population and economic growth.

Projects under these areas will be vulnerable to the impacts of climate change. For example, USAID is promoting the adoption of clean energy sources, including small scale solar and hydropower. Future climate patterns should be taken into account to ensure that these sources of energy are sustainable (e.g., water availability and/or variability could impact small-scale hydropower production). Further, the interaction between biofuels use and food security should be taken into account, given that future agricultural production may be reduced due to climate changes.

Climate changes will have a direct impact on environmental governance, which aims to improve governance of natural resources and conserve biodiversity. Climate changes threaten ecosystem health by changing conditions on which species depend. Changing temperature and precipitation patterns, as well as inundation from sea level rise and storm surge, could impact the distribution and abundance of species, change species' phenology, or make certain areas uninhabitable.

Finally, climate change could affect USAID's support of sanitation and water supply. For example, erratic rainfall patterns could stress water supply in many ways. Droughts could reduce water availability, while heavy rainfall events could increase contaminant loading in the water supply.

Economic growth: In the Philippines, USAID supports economic reforms that sustain good fiscal performance and remove barriers to investment and competition. In addition, USAID supports the economic development of Mindanao through infrastructure projects and improved agribusiness competitiveness. USAID efforts in Mindanao are vulnerable to the impacts of climate change, since both agribusiness and infrastructure construction are vulnerable to climate patterns. For example, roads and ports can be affected by rising sea levels and storm surges, coastal erosion patterns, and heat stress. Likewise, agriculture can be affected by changing temperature and precipitation patterns.

Democracy and governance: The USAID mission to the Philippines supports several efforts that are aimed at improving democracy and governance institutions and mitigating conflict situations. These programs focus on capacity building and technology adoption within institutions and local governments and by other stakeholders and communities. These programs do not currently appear to be directly vulnerable to the impacts of climate change. However, future climate stressors could exacerbate current governance and socio-economic issues and lead to conflict. For example, increased water stress due to droughts, forced relocation due to sea level rise, or increased poverty from reduced agriculture productivity could all contribute to conflict.

Health: Currently, USAID programs in the Philippines focus on improving child and maternal health, family planning, tuberculosis and HIV outcomes, expanding the role of private health service providers, promoting healthy behaviors and practices, and improving the policy environment for provision of health services. Climate changes could affect the distribution and abundance of food-, water- and vector-borne diseases with resulting infectious and diarrheal disease impacts. For example, a combination of higher temperatures and more rainfall in some areas may increase the incidence of dengue, encephalitis, or malaria cases. Climate changes could also affect agricultural production, which would increase the risk of malnutrition and affect maternal and child health.

Education: Much of USAID's education work in the Philippines is concentrated in the Mindanao region. Currently, USAID education programs support improvements in quality education for primary, post-secondary, and adult learners. Activities include teacher trainings, parent and community involvement in education, the return of out-of-school children and youth to school, provision of learning materials, teaching English proficiency for selected college and university students, and promoting adult literacy. Climate changes will impact education in terms of infrastructure, classroom and school furniture, and materials, including computers and other information technology equipment. For example, after recent disasters like tropical storm Ketsana/Ondoy and tropical storm Washi/Sendong, schools lost furniture and other school supplies.

Humanitarian assistance: The Philippines is vulnerable to both man-made and natural disasters. USAID's humanitarian assistance programs are tailored to assist the country in times of need. USAID efforts have included early recovery of internally displaced persons, help with reconstruction, and disaster risk reduction. Climate changes could increase the frequency of typhoons and other extreme weather events, which could increase the need for humanitarian assistance and stress USAID efforts. In responding to disasters and providing reconstruction assistance, USAID provides seeds for grains and other crops, infrastructure construction support (of housing, schools, roads, etc.), and capacity building for disaster response officials. Climate changes could affect all of these activities. For example, USAID may need to shift the types of seeds provided to ensure the crops are viable given climate changes, ensure that construction efforts are located in less exposed zones, and that disaster response officials are equipped with better early warning systems.

Actions underway[38]

Some of USAID's current programs already focus on adaptive responses to the impacts of climate changes. Specifically, USAID is taking into account the impacts of climate changes in the Environmental Governance focus area of their Energy and Environment programs. USAID supports the Coral Triangle Support Partnership and the Biodiversity Conservation Partnership, which are actively adapting to projected climate change impacts by designing strategies and conserving critical ecosystems through better governance. In addition to USAID and the Philippine Government, other organizations such as the World Bank, GIZ, and UN-Habitat are actively involved in adaptation efforts.

Challenges to adaptation

Challenges to adaptation in the Philippines can be divided into three main areas: research, institutional coordination, and data and information. Research gaps include the need for improved sub-national information about the impacts of climate changes on agricultural production, as well as detailed climate change risk assessments for water and coastal resources. Institutionally, coordination among donors, agencies, and other relevant institutions is difficult but crucial for synergistic action on disaster response and disaster risk reduction more generally. Lastly, improving the country's meteorological services, mapping hazards and vulnerabilities, and downscaling climate information to individual islands have all been cited as necessary to building climate resiliency.

Resources

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[38] Actions underway include those from direct adaptation funds and indirectly attributed funds. More information on U.S. climate finance can be found at http://www.state.gov/e/oes/climate/faststart/index.htm.

CLIMATE VULNERABILITY PROFILE

Regional Development Mission for Asia (RDMA)

US Foreign Assistance:[39] (thousands USD)	Requested FY 2012	Requested FY 2013
Estimated total:	**65,440**	**45,283**
Adaptation:	6,000	6,000
Agriculture:	3,000	2,700
Malaria:	7,000	7,200
Water:	2,500	1,000
Priority Adaptation Country in 2011:	**Yes**	
Key Climate Stressors:	**Extreme events, Flooding, Sea level rise, Heat**	

Introduction

USAID's Regional Development Mission for Asia (RDMA) supports bilateral programs in Burma, China, Laos, Thailand, and Papua New Guinea. The mission also manages regional programs in East, Southeast, and South Asia and the Pacific. Countries in the region are politically, socially, and economically diverse; however, they face similar development and environmental challenges. Priority economic sectors in the region include agriculture, food security, human settlements, infrastructure, forests, ecosystem biodiversity, disaster management, health and sanitation, and resource-based livelihoods including tourism and fisheries. RDMA addresses challenges brought about by non-climate stressors such as poverty, increased urbanization, rural-urban migration, environmental degradation, and civil unrest. Climate change impacts exacerbate these challenges and place additional stress on livelihoods, infrastructure, and ecosystems.

Projected weather and climate changes

Temperature: Overall, a warming trend has been observed in the region. Minimum and maximum temperatures have been increasing and are projected to continue on a similar trajectory. Projections for South Asia suggest the region may experience stronger warming than other regions in Asia, with a 2.4-4.5°C increase in average annual temperature by the end of the century. In the Pacific region, temperatures may rise by up to 2-3°C by the end of the century.

Precipitation: Historically, precipitation trends in the region have been highly variable, and climate model projections show a range of potential precipitation patterns in the future. Depending on the season and region, rainfall intensity and frequency could either increase or decrease. North and Southeast Asia are expected to experience more intense rainfall events in warmer years than in colder years. Overall, annual rainfall may decline in Southeast Asia and increase in North Asia over the rest of the century.

[39] US foreign assistance includes both USAID and Department of State program funding, but in most cases the bulk of this funding is implemented through USAID. In order to have comparable figures in these categories, all country profiles use figures from the Congressional Budget Justification (CBJ) (see http://transition.usaid.gov/performance/cbj/185016.pdf and http://transition.usaid.gov/performance/cbj/158269.pdf). Between the time of the budget request and the 653(a) report to Congress, these figures can change significantly.

Extreme events: Models project that South Asia will experience more severe heat extremes and an increase in the intensity and frequency of tropical storms and other extreme weather events throughout the century. In the Pacific region, more tropical cyclones, floods, and storm surges are projected.

Sea level rise: The region is vulnerable to sea level rise, which causes erosion and salt water intrusion in coastal areas. In Southeast Asia, sea level is anticipated to rise at a rate of 1-3 mm per year. Projected sea level rise in the Pacific by the end of the century ranges from 0.19-0.58 m.

Key climate impacts and vulnerabilities

Higher air and water temperatures and changes in precipitation patterns, floods, droughts, and sea level rise will impact human settlements and infrastructure, agricultural production, food security, the spread of pests and diseases, water quality and supply, energy, and transport and communication systems. Glacial melting, a result of warmer temperatures, can cause runoff, variation in river flows, and may increase glacial lake outburst floods. Climate changes can also damage or destroy forests, grasslands, mangroves, and coral reefs, which are rich in biodiversity. Climate change impacts can also impact human health directly or indirectly. Direct health impacts include heat stroke and morbidity or mortality due to extreme events. Indirect health impacts include impacts on agriculture, water, and infrastructure, which may affect disease prevalence. Populations dependent on natural resources for their livelihoods and living in low-lying, coastal, and densely populated areas are highly vulnerable to climate change. The Pacific Island countries, Asian coastal cities, the Mekong River Basin, the Coral Triangle, and the Greater Himalayan region and Tibetan Plateau are highly at risk to climate changes, as they may have significant economic, social, and environmental costs in these regions.

Key USAID program vulnerabilities

RDMA has a range of programs that are likely to be affected by climate change.

Health: The Asian countries that RDMA supports continue to suffer from HIV/AIDS, avian influenza (AI), malaria, and tuberculosis (TB). RMDA supports a number of programs across Asia that manage HIV/AIDS and battle AI, TB, and malaria. As part of these efforts, USAID builds capacity for infectious disease research and surveillance, helps countries communicate and understand behavioral changes, and delivers a suite of health services. Public health programs, particularly those helping to address the spread of malaria and other diseases, are vulnerable to climate changes. Rising temperatures, heavy rainfall events, and increased flooding can contribute to the spread and prevalence of malaria and other diseases while a decrease in water quality and availability can lead to an increase in cases of cholera and diarrhea.

Economic growth: RDMA projects in this area focus on economic integration, enhancing trade and growth, and improving management of coastal and marine resources. These projects are vulnerable to extreme weather events and other types of climatic changes. Floods and storms can impact infrastructure such as roads, ports, communication systems, and facilities that are vital to economic growth. In addition, projects supporting key economic sectors such as agriculture, industry, tourism, and energy are vulnerable to climate impacts through disruptions or damage to various elements throughout the supply chain.

Environment: Asia contains some of the world's fastest growing economies and highest rates of population growth. This brings about many transnational environmental challenges, such as supplying clean water and sanitation services, providing clean energy and energy security, sustainably managing natural resources, and conserving biodiversity. USAID/RDMA addresses these challenges through a number of programs that promote regional cooperation, but these programs themselves are also vulnerable to climate change impacts. For example, both flooding and drought will make it difficult to store and supply clean water and provide effective sanitation services. Furthermore, as climate shifts occur, the type and distribution of natural resources such as fisheries and certain plant and animal species will likely change. These impacts will exacerbate the existing vulnerabilities of natural-resource dependent populations.

Actions underway

RDMA already has projects that address climate vulnerability and risk in various sectors and communities. The highest priority for regional programming is to ensure that government, communities, practitioners, the private sector, and civil society have access to appropriate information, tools, and methods needed to carry out assessments and make informed decisions on how to address challenges posed by climate changes. Several RDMA-funded assessments have been carried out on climate change and adaptation in the Asia-Pacific region. In the Mekong River Basin, RDMA is funding a study on climate change impacts on agriculture and ecosystems. The program also includes the implementation of integrated ecosystem and community based adaption pilot projects in the Basin. To address adaptation capacity, information, and financing needs in the Asia region, RDMA launched the Asia Climate Change Adaptation Project Preparation Facility program. Other donors and multilateral development banks have also provided funding and support for a range of adaptation activities; most of these however, have been early stage efforts—including assessments, studies, strategy development, and pilots—rather than adaptation implementation.

Challenges to adaptation

Overall progress on adaptation throughout the region has been limited, particularly in relation to the implementation of adaptation strategies. Challenges to adaptation include inadequate data on local climate change impacts and vulnerabilities, limited understanding of adaptation concepts by policy makers, limited capacity to develop and implement adaptation plans, weaknesses in and limited capacity of governance structures at national and subnational levels, lack of financial resources to implement adaptation projects, and limited knowledge on accessing donor funding. There is also a need for improved civil society engagement; greater cooperation and coordination at the regional, national, and local levels; and the implementation of relevant and effective climate change related laws, policies, and regulations. In addition, addressing pressing sustainable development issues related to poverty, access to resources, economic growth, and urbanization may be considered higher priority for countries in the region than climate change adaptation if they do not see clear linkages between the two.

Resources

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CLIMATE VULNERABILITY PROFILE

South Sudan

U.S. Foreign Assistance:[40] (thousands USD)	Requested FY 2012	Requested FY 2013
Estimated total:	**470,206**	**426,598**
Agriculture:	19,855	26,000
Malaria:	4,500	4,500
Water:	11,000	11,850
Priority Adaptation Country in 2011:	**No**	
Key Climate Stressors:	**Heat**	

Introduction

South Sudan is a landlocked country located in the east-central region of Africa. South Sudan gained independence in July 2011. The country has about 8.26 million people, most of whom live in rural areas. South Sudan is heavily dependent on agricultural activities and exports timber. It is also rich in other natural and mineral resources including oil, iron ore, gold, silver, and copper. South Sudan is home to the world's largest swamp, the Sudd, and the Nile River flows across the country. As a newly independent country, South Sudan faces several serious development challenges, including the absence of reliable infrastructure (e.g., lack of roads and airport) and skilled labor, heavy dependency on oil revenues, corruption, and limited governing capabilities.

Projected weather and climate changes

The South Sudanese terrain is covered with thick equatorial vegetation and savannah grasslands. The country has mountainous ranges along the border it shares with Uganda. It experiences an equatorial climate with high humidity and precipitation. The wet season generally spans between April and November. Because South Sudan is a relatively new country, many of the projections provided here are for Sudan as a whole.

Temperature: Average temperatures range between 18°C and 30°C, with the coldest temperatures experienced in elevated areas. The hottest month is generally March, whereas the coldest is August. Available climate projections indicate that temperatures could increase by 0.6 -1.7°C by the 2030s and by 1.1 -3.1°C by the 2060s compared to the 1961-1990 baseline.

Precipitation: Most of South Sudan experiences monsoons between April and November, while the extreme southern section of the country generally experiences two peaks in the rainy season. Annual rainfall ranges from 500 mm to 2,000 mm. Available climate projections do not indicate a clear change in precipitation, and models show both increases and decreases across the country and seasons.

[40] US foreign assistance includes both USAID and Department of State program funding, but in most cases the bulk of this funding is implemented through USAID. In order to have comparable figures in these categories, all country profiles use figures from the Congressional Budget Justification (CBJ) (see http://transition.usaid.gov/performance/cbj/185016.pdf and http://transition.usaid.gov/performance/cbj/158269.pdf). Between the time of the budget request and the 653(a) report to Congress, these figures can change significantly.

Extreme events: South Sudan experiences both widespread and localized droughts and floods. Widespread events are a result of either above- or below-normal rainfall across the country, while localized events are caused by concentrated above- or below-normal rainfall in a certain region. Flash floods often occur when the Nile River and its tributaries overflow during the months of August and September.

Key climate impacts and vulnerabilities

Much of the country's agricultural and forestry production comes from small farms and is rain-fed. Because rainfall projections are not conclusive, precise vulnerabilities and impacts on agriculture and forestry are unknown. However, temperature indicators show that the country will experience higher heat stress in the future, which would impact the viability of crops and forestry production. Furthermore, as home to the world's largest swamp, increasing temperatures and uncertain rainfall in South Sudan could harm the viability of a biodiversity treasure.

Key USAID program vulnerabilities

Economic growth: Nearly 87 percent of the South Sudanese population depends on agriculture, livestock, and forestry, yet the sector contributes very little to the economy and food imports support most of the urban population. USAID/South Sudan is investing in agricultural development projects to diversify the economy, alleviate poverty, and reduce food insecurity through promotion of inclusive agriculture-led growth, linkage of communities to markets, construction of critical infrastructure, and provision of policy and governance training. Agricultural production, livestock, and forest resources are expected to be impacted by higher temperatures, while both drought and flooding will also result in negative implications for these activities. Furthermore, it is likely that climate change impacts will also affect investments in transport infrastructure that facilitate trade, potentially disrupting the supply chain.

Democracy and governance: USAID/South Sudan is currently building governance capacity within the country through supporting key institutions, processes, and stakeholders. The stability of the country is dependent on the ability of the government to meet public demands and communicate effectively to its citizens. Therefore, USAID/South Sudan's projects focused on strengthening core governance institutions are some of the most important to achieving development objectives. Climate hazards are projected to impact key sectors that the South Sudanese rely on, such as agriculture and forestry. If the government cannot effectively address food security emergencies or other situations exacerbated by climate changes, increased distrust in government may drive civilian unrest and impede progress in strengthening governing institutions.

Health: The Government of the Republic of South Sudan, its Ministry of Health, and USAID are currently working together to enact a "Basic Package of Health and Nutrition Services" that comprises interventions for disease prevention, health promotion, and maternal and child health. Some aspects of these programs will be vulnerable to changes in climate, specifically USAID activities that address nutrition, malaria, and clean water and sanitation. For example, future interactions between rising temperatures and rainfall may result in more areas of the country being suitable for malaria transmission. Furthermore, nutrition, clean water, and sanitation projects may experience more frequent and larger setbacks as agricultural production is threatened, water availability is reduced, and water quality is diminished due to changes in climate.

Actions underway[41]

Some aspects of USAID's programs are focused on environmental protection and biodiversity conservation; however, no projects in USAID/South Sudan's portfolio directly address the impacts of climate change. Little information available on current adaptation actions underway in South Sudan by other donors (this is likely due to the recent independence of the country), although South Sudan is involved in a handful of regional projects. For example, South Sudan is part of the Global Environment Facility-funded Great Green

[41] Actions underway include those from direct adaptation funds and indirectly attributed funds. More information on U.S. climate finance can be found at http://www.state.gov/e/oes/climate/faststart/index.htm.

Wall Initiative to improve the climate resiliency of resource-based livelihoods and ecosystem functions in West African and Sahelian countries.

Challenges to adaptation

South Sudan is challenged by its relative newness as an independent country. As such, the country is still establishing its governance institutions and building its economy. Further, the country's land area is still in flux. These institutional and governance challenges hinder concrete adaptation action. Moreover, it is important to note that South Sudan lacks basic infrastructure needed to monitor weather and climate patterns. There is a significant lack of climate data and understanding of climate projections and sensitivity of the relationship between impacts on key sectors and socio-economic conditions. The impacts of climate change may exacerbate South Sudan's existing instability, making effective responses more difficult to achieve and ultimately leaving the country more vulnerable to shocks of all types.

Resources

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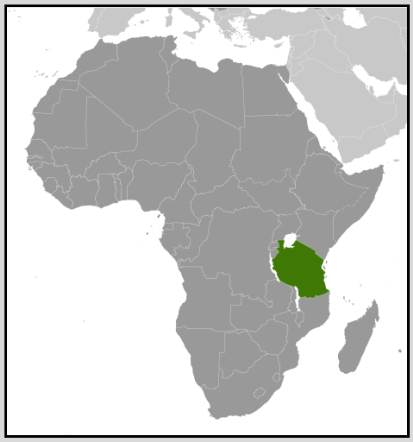
CLIMATE VULNERABILITY PROFILE

Tanzania



U.S. Foreign Assistance:[42] (thousands USD)	Requested FY 2012	Requested FY 2013
Estimated total:	**531,179**	**571,365**
Adaptation:	3,000	5,000
Feed the Future:	60,000	75,000
Malaria:	48,000	45,000
Water:	5,087	5,550
Priority Adaptation Country in 2011:	**Yes**	
Key Climate Stressors:	**Heat, Drought, Flooding, Sea level rise**	

Introduction

Tanzania is located on the coast of East Africa and has a population of nearly 47 million people. Agriculture is the major sector of the economy, accounting for 28 percent of the country's Gross Domestic Product (GDP) and employing 80 percent of the labor force. Tanzania's economic growth has averaged 7 percent over the last decade, but the percentage of people living in poverty has decreased only slightly. Tanzania faces several development challenges, including rapid population growth, heavy reliance on foreign aid, corruption, lack of basic healthcare, the impact of HIV/AIDS and malaria, and low levels of education and agricultural productivity. Climate changes represent an additional stress on development in the country.

Projected weather and climate changes

Tanzania has a tropical climate with regional variation due to its varied topography. The north and east regions experience a bimodal rainfall pattern, with short rains from October to December and long rains from March to May. The south, west, and central regions experience a unimodal rainfall pattern, with a wet season from October until April or May.

Temperature: Average annual temperatures have increased by 1°C since the 1960s and are projected to rise by 1-2.7°C by the 2060s and 1.5-4.5°C by the 2090s compared to the 1970-1999 baseline.

Precipitation: From 1960-2006, annual rainfall in Tanzania has decreased at an average rate of 3.3 percent per decade. Rainfall patterns have become more variable, with an increase in the amount of precipitation falling in isolated events. Projected changes in annual precipitation range from a decrease of 1 percent to an increase of 18 percent by the 2060s from the 1970-1999 average.

[42] US foreign assistance includes both USAID and Department of State program funding, but in most cases the bulk of this funding is implemented through USAID. In order to have comparable figures in these categories, all country profiles use figures from the Congressional Budget Justification (CBJ) (see http://transition.usaid.gov/performance/cbj/185016.pdf and http://transition.usaid.gov/performance/cbj/158269.pdf). Between the time of the budget request and the 653(a) report to Congress, these figures can change significantly.

Extreme events: Tanzania already experienced frequent and severe droughts. The country has had six major droughts over the past 30 years. With projected changes in climate, a larger proportion of the country's annual precipitation is anticipated to fall in heavy rainfall events.

Sea level rise: Global sea level is projected to rise by 0.75-1.90 m by 2100.

Key climate impacts and vulnerabilities

Tanzania's agriculture, livestock, human health, water, and ecosystems are vulnerable to climate changes. Increasingly unpredictable rainfall, shifting agro-ecological zones, and increased dry periods could reduce production of certain crops while boosting production of other crops. Overall, a 5°C increase in temperature in Eastern Africa may lead to a production decline of nearly 20 percent. Climate changes are expected to shrink rangelands, change plant species distribution, and cause livestock deaths during heat waves. Climate changes may also increase the prevalence of malaria, the leading cause of death in Tanzania. Water is another key sector that would be significantly affected by climate changes. Impacts are expected to include changes in runoff in river basins, leading to changes in downstream water availability and timing, amounts of water pollution, and disturbances of stream ecosystems. Hydropower production is projected to decrease, mainly due to increased evaporation, with negative impacts on industry. As a coastal country, Tanzania is also vulnerable to sea level rise, which can cause land losses, coastal erosion, damage to coastal infrastructure, and loss of coastal and marine habitats. The forestry sector could be impacted by desertification, more frequent forest fires, and the disappearance of species and other forest products that generate income, such as medicinal plants.

Key USAID program vulnerabilities

Food security: The Feed the Future Initiative in Tanzania targets the value chains of rice, maize, and horticulture. One of these key crops, maize, has been identified as being vulnerable to climate changes. According to Tanzania's National Adaptation Programme of Action (NAPA), maize yield is projected to decrease by 33 percent countrywide from the 1950-1980 baseline under a doubling of CO_2 scenario. The Tanzania Feed the Future program has four core investment areas: (1) addressing high-impact bottlenecks, such as agricultural production and processing systems, irrigation, and rural roads infrastructure, to transform selected value chains; (2) improving nutrition; (3) capacity building; and (4) policy engagement. Climate change adaptation has been included as a component of the first area. USAID will support applied research and capacity building for the water management and agriculture sectors in order to increase resiliency to climate changes.

Health: Malaria is one of the largest causes of illness and loss of life in Tanzania, responsible for 80 percent of deaths in children under five years of age. Malaria accounts for more than 40 percent of all outpatient visits. USAID/Tanzania supports efforts to address malaria in Tanzania through the President's Malaria Initiative. Recent surveys show that malaria incidence is occurring in areas where it was not commonly found in previous decades, such as some parts of Tanga, Kilimanjaro, and Arusha highlands. Malaria prevalence is projected to further expand in range due to changes in temperature and rainfall patterns. As a result, USAID's Malaria program may need to be extended to more areas in Tanzania.

Economic growth: In addition to agriculture, USAID's support for economic growth in Tanzania focuses on natural resource conservation to improve the livelihoods of the rural poor. Over 6.8 million hectares of land and marine areas have been brought under improved conservation management through this program, and USAID also supports the establishment of wildlife management areas. This program and its accomplishments may be vulnerable to a number of climate change impacts, including shrinking wildlife habitat, disappearance of wildlife corridors, and loss of coastal and marine habitats due to sea level rise.

Actions underway[43]

USAID is involved in multiple adaptation projects in Tanzania intended to increase capacity and resilience to climate changes. The agency is working to build adaptive capacity and incorporate climate change adaptation measures into the Southern Agricultural Growth Corridor of Tanzania by supporting vulnerability and impact assessments, working with key institutions to enhance climate change resilience, developing educational materials for rural communities, and contributing to a multi-donor climate change fund that supports strengthening Tanzanian institutions. Other initiatives within the country include enhancing climate change awareness in national institutions and preparing local vulnerability assessments and adaptation plans. USAID, together with the European Commission and UNEP, is also funding the Integrating Climate Change Mitigation and Adaptation into Development Planning (CCMAP) project, which engages scientists and policy makers in nine countries, including Tanzania, in a range of activities that aim to raise awareness and improve access to scientific information so that decision-makers can better integrate climate changes into development planning and poverty reduction measures. In addition, Tanzania is included under the USAID East Africa Regional Climate Change Program, which is investing in building the capacity of regional organizations to respond to climate changes.

Challenges to adaptation

The challenges to adaptation in Tanzania include limited data availability, data accessibility, and capacity to predict future climate changes and assess sector impacts. Tanzania also has a need to increase capacity to develop, design, and implement financing proposals and projects on adaptation that meet donor requirements.

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[43] Actions underway include those from direct adaptation funds and indirectly attributed funds. More information on U.S. climate finance can be found at http://www.state.gov/e/oes/climate/faststart/index.htm.

CLIMATE VULNERABILITY PROFILE

Uganda

U.S. Foreign Assistance:[44] (thousands USD)	Requested FY 2012	Requested FY 2013
Estimated total:	**460,958**	**438,314**
Adaptation:	3,000	2,000
Feed the Future:	47,000	34,000
Malaria:	32,500	33,000
Water:	3,315	5,290
Priority Adaptation Country in 2011:	**Yes**	
Key Climate Stressors:	**Heat, Drought, Flooding**	

Introduction

Uganda is a landlocked country in East Africa with a population of about 33.6 million people. Uganda has substantial natural resources, including relatively fertile soils; biodiversity; rich vegetation; abundant water resources; small deposits of copper, gold, other minerals; and oil. Agriculture is the main economic sector, accounting for 20 percent of Uganda's Gross Domestic Product (GDP) and employing 70 percent of the labor force. Uganda faces several developmental constraints such as high population growth (currently at a rate of 3.2 percent, the second highest in the world), post-conflict conditions in the North, soil erosion and degradation, and impacts of malaria and HIV/AIDS. Climate changes in Uganda will likely present an additional stress on development in the country. Since climate changes will have complex impacts across many development sectors in Uganda, establishing a cross-cutting integrated strategy could improve the effectiveness and resilience of climate-sensitive USAID investments.

Projected weather and climate changes

Uganda has a tropical climate with two wet seasons: a short one from October to December and a longer one from March to May.

Temperature: Average temperatures in Uganda have risen by about 1.3°C since 1960 and are projected to increase by 1°C by the 2030s compared to the 1970-1999 average.

Precipitation: Annual rainfall has decreased at a rate of about 3.5 percent per decade since 1960, with the greatest reductions during the long wet season between March and May. Projections of rainfall in Uganda are uncertain, ranging from a decrease of 7 percent to an increase of up to 14 percent by the 2030s compared to the 1970-1999 observed average.

[44] US foreign assistance includes both USAID and Department of State program funding, but in most cases the bulk of this funding is implemented through USAID. In order to have comparable figures in these categories, all country profiles use figures from the Congressional Budget Justification (CBJ) (see http://transition.usaid.gov/performance/cbj/185016.pdf and http://transition.usaid.gov/performance/cbj/158269.pdf). Between the time of the budget request and the 653(a) report to Congress, these figures can change significantly.

Extreme events: Uganda has experienced an increase in the frequency and intensity of droughts and floods in recent decades. The percentage of rainfall coming in the form of heavy precipitation events is anticipated to increase, which would escalate the risk of disasters such as floods and landslides.

For more information on observed climate trends to date in Uganda, please see the Climate Trend Analysis prepared by the Famine Early Warning Systems Network (FEWS NET) at http://pubs.usgs.gov/fs/2012/3062/.

Key climate impacts and vulnerabilities

Agriculture, health, water resources, wetlands, and forests are the key sectors that are vulnerable to climate change in Uganda. Temperature rise and an increase in the frequency and intensity of extreme droughts and floods can reduce crop yields and cause a loss in livestock, which will have important implications for food security.

Climate changes can also cause both direct and indirect health impacts. Direct impacts can result from exposure to extreme events such as droughts, floods, and heat waves. Indirect impacts may result from expanded ranges of vector-borne diseases and parasites.

Water resources are also likely to be increasingly strained in Uganda's future climate. While it is projected that precipitation will increase in some parts of East Africa, warmer temperatures will accelerate the rate of evapotranspiration, thus reducing the benefits of increased rainfall. With more frequent and severe droughts, the region will likely experience negative impacts on water supply, biodiversity, and hydropower generation. A potential simultaneous increase in floods poses a serious water pollution threat. Climate changes may also affect the health of wetland and forest ecosystems, which provide critical ecosystem services for communities in Uganda.

Key USAID program vulnerabilities

Agriculture and food security: USAID's Feed the Future (FTF) Initiative in Uganda, housed under its economic growth portfolio, focuses on three strategic value chains, including maize for regional food security, beans for nutrition, and coffee for economic growth. Rising temperatures and shifting rainfall patterns can reduce the extent of agricultural land, shorten growing seasons, and alter the occurrence and distribution of pests. The Uganda FTF program identifies the need to integrate climate changes throughout its strategy, from research into disease and drought resistant crops to working with farmers and communities at all levels to understand and mitigate the impact of soil degradation and erosion.

Peace and security: USAID supports peace and security in Uganda through building the capacity of government institutions and civil society organizations, furthering truth and reconciliation, providing training on human rights, and supporting victims of human trafficking. Conflicts in Uganda may be exacerbated as a result of more frequent and severe droughts due to climate changes. The scarcity of pasture and water resulting from droughts is already a major cause of intra- and inter-district, as well as inter-regional, conflicts in the country.

Health: Malaria is the leading cause of morbidity and mortality in Uganda, and Uganda is thus one of the Presidential Malaria Initiative countries. Temperature increases have enabled malaria to spread into the previously malaria-free highlands. Continued warming is expected to further expand the geographic range of malaria to even higher elevations. The Presidential Malaria Initiative has a goal of ending global deaths from malaria by 2015. In order to achieve this goal and maintain the achievements to-date under the program, USAID and the U.S. Centers for Disease Control may need to enhance disease surveillance and be prepared to provide services in regions that have previously been malaria-free.

Economic growth: Besides improving agricultural productivity and enhancing food security, USAID/Uganda's economic growth program also focuses on developing the rural financial sector, improving the dairy market chain, strengthening rural infrastructure, and supporting biodiversity conservation and the sustainable use of resources. Droughts and flooding could have major negative impacts that could delay or interrupt the success of these programs. Specifically, droughts can decrease the quantity and quality of grazing areas and water resources. Such disruptions could interfere with improvements in the dairy market, agriculture, and the availability of sustainable use resources. Similarly, rural infrastructure is vulnerable to extreme events such as flooding. As the regional climate shifts, biodiversity conservation efforts may suffer. The geographic location of suitable habitats may change and sensitive species may be forced to compete for more limited resources.

Actions underway[45]

Uganda is a priority country in the USAID Global Climate Change Initiative. USAID/Uganda is conducting a climate change vulnerability assessment of the agriculture and food security sector, which is a priority for the Government of Uganda. USAID is also working on a project to disseminate improved and drought-resistant seed varieties to small farmers and supporting the use of alternative methods of predicting planting and harvesting seasons. In coordination with other donors, USAID is increasing awareness of climate changes in Uganda, improving local capacity to deal with climate impacts, and rehabilitating weather stations to track and record weather data. In addition to mission-funded programs, USAID also contributes funding to the multilateral Integrating Climate Change Mitigation and Adaptation into Development Planning project, which is implemented in nine countries including Uganda.

Many other organizations are also implementing climate change adaptation programs in Uganda. These projects address concerns in several sectors, including, but not limited to, agriculture, water, disaster risk management, and public health. These projects span a wide range of audiences and adaptation needs, from integrating climate changes into urban development to collecting and distributing climate information.

Challenges to adaptation

The major challenges to climate change adaptation in Uganda are primarily related to data and capacity. Gaps exist in both climate and sector-specific data, and generating downscaled climate data requires both resources and advanced scientific and technical capacity. The second level of the data challenge is accessibility. The format and location of climate and sector data need to be accessible to in-country decision-makers, who also need to have the capacity to effectively apply the information to planning and decision-making. Vulnerability assessments and projections need to be readily available and translated into terms that resonate with policymakers and community leaders.

Resources

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[45] Actions underway include those from direct adaptation funds and indirectly attributed funds. More information on U.S. climate finance can be found at http://www.state.gov/e/oes/climate/faststart/index.htm.

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CLIMATE VULNERABILITY PROFILE

Zambia

U.S. Foreign Assistance:[46] (thousands USD)	Requested FY 2012	Requested FY 2013
Estimated total:	**368,097**	**380,030**
Feed the Future:	15,000	8,000
Malaria:	24,000	24,000
Water:	7,378	5,475
Priority Adaptation Country in 2011:	**No**	
Key Climate Stressors:	**Heat, Drought, Flooding**	

Introduction

Zambia is a landlocked country in Southern Africa with a population of nearly 14 million people, about 40 percent of whom live in urban areas. Political stability and strong growth in mining, construction, telecommunications, and tourism have enabled Zambia to achieve economic growth rates of more than 5 percent per year during the last decade. However, this growth has mostly benefited the urban dwellers, as poverty rates in rural areas have remained at 80 percent over the past two decades. About two-thirds of Zambia's population depends on rain-fed agriculture for their livelihoods. Climate changes will add additional stress on development in Zambia, which is already constrained by high population growth; the impacts of HIV/AIDS; and environmental issues such as air pollution in mining towns, water pollution, substandard sanitation, wildlife depletion, land degradation, and biodiversity loss.

Projected weather and climate changes

Zambia has a sub-tropical climate with three distinct seasons: a hot and dry season between mid-August and November, a cool dry season from May to mid-August, and a rainy season from November to April.

Temperature: Annual temperatures in Zambia have warmed by 1.3°C since 1960 and are projected to increase above the 1970-1999 average by 1.2-3.4°C and 1.6-5.5°C by the 2060s and 2090s respectively.

Precipitation: Annual rainfall has decreased by an average of 1.9 mm per decade since 1960, and projections show an overall downward trend in precipitation.

Extreme events: Zambia has experienced an increase in the frequency and intensity of drought and flood events in recent decades. Climate models project an increase in the frequency and intensity of heavy rainfall events during the rainy season.

Key climate impacts and vulnerabilities

[46] US foreign assistance includes both USAID and Department of State program funding, but in most cases the bulk of this funding is implemented through USAID. In order to have comparable figures in these categories, all country profiles use figures from the Congressional Budget Justification (CBJ) (see http://transition.usaid.gov/performance/cbj/185016.pdf and http://transition.usaid.gov/performance/cbj/158269.pdf). Between the time of the budget request and the 653(a) report to Congress, these figures can change significantly.

Climate changes are expected to impact a number of Zambia's key sectors, such as agriculture and food security, water resources, health, forests, grasslands, and wildlife. The impacts of climate changes on agriculture include excessive precipitation, erosion, increased frequency of droughts, shortening of growing seasons, and flash floods. The groups that depend on rain-fed agriculture are particularly vulnerable to these climate changes.

Zambia has relatively abundant surface water and groundwater resources, but the distribution of surface water is uneven and the southern region of the country often experiences water shortages. Surface and groundwater resources would be negatively affected by drought. Reduced water availability and increased evapotranspiration rates may also impact hydropower generation. The health of Zambia's population is also vulnerable to changes in climate. Malaria may become more prevalent in Zambia as areas habitable by mosquitoes and other disease vectors expand. Furthermore, an increased occurrence of droughts and crop failures may cause malnutrition, while increased flooding may cause water pollution and consequently exacerbate health and sanitation problems.

Forests, grasslands, and wildlife have significant ecological, economic, and social value for Zambia, but they are vulnerable to climate changes. Warmer temperatures, drought, and declines in precipitation may cause vegetation loss and soil degradation. Meanwhile, a higher incidence of forest fires and changes in the range of pests and pathogens will impact tree growth and survival. More intense rainfall and flooding can also result in land and soil erosion. Wildlife health can therefore be undermined as a result of habitat degradation due to climate changes and other non-climate stresses such as agricultural expansion, greater demand for timber, and unsustainable land use practices.

Key USAID program vulnerabilities

Food security: USAID's Feed the Future (FTF) Initiative in Zambia focuses on developing the value chains of oilseeds and legumes, maize, and horticulture through investments in a number of key areas, including policy, science and technology, innovation, capacity building, finance, and knowledge management. As mentioned above, climate changes will have significant impacts on agricultural production in Zambia. Zambia's FTF strategy recognizes the potential impacts of climate changes on agriculture and indicates that FTF investments in the country will build resilience in farming systems through conservation agriculture and drought-resistant crop varieties, as well as promoting sustainable use of natural resources.

Health: The USAID/Zambia Mission's health program focuses on malaria and tuberculosis, maternal and child health, family planning and reproductive health, and HIV/AIDS. The impacts of climate changes on agriculture and food security will likely have negative effects on the nutrition of Zambia's mothers and children, which may cause potential setbacks to current nutrition programs. Furthermore, climate changes may expand the geographic range of malaria. This may have implications for the mission's current malaria program such as requiring the program to be scaled-up to reach a larger population.

Water: In coordination with the USAID/Zambia's education program, the mission's water and sanitation program supports the provision of clean water and sanitation facilities in schools. Climate changes are expected to increase the occurrence and intensity of droughts and floods. These impacts will likely have implications for the availability and quality of water, and could lead to the damage or destruction of water infrastructure.

Forests: USAID will be involved in piloting small-scale forest management programs and measuring, reporting, and verifying sites. As climate changes reduce agricultural production and increase the prevalence of crop diseases, more farmers may leave agriculture and turn to charcoal production or timber production, thereby intensifying the economic drivers of deforestation. With increases in floods and droughts, some tree species will likely fare worse than others, diminishing biodiversity.

Actions underway[47]

The Government of Zambia has taken a number of steps to determine priority climate impacts and vulnerabilities in the country, as well as identify adaptation strategies. The most recent effort is the development of the National Climate Change Response Strategy in 2010. The donor community is supporting a number of adaptation projects in Zambia, which focus on developing strategies and plans, carrying out assessments, integrating adaptation into general development and sector initiatives, and raising awareness on climate change issues. One of the most important programs on adaptation is the Pilot Program on Climate Resilience, a multilateral climate investment fund, focusing on water, community-based adaptation on agriculture, and private sector support. In line with the goal of integrating climate change concerns into its FTF program, USAID is supporting several initiatives to improve the resilience of the agricultural sector. These include improving the food security of very poor agricultural households, enhancing small-scale farmers' resilience, and investing in a research and development program to develop drought-tolerant and disease-resistant crop varieties.

Challenges to adaptation

The adaptation needs in Zambia include collecting additional climate-related data, monitoring climate change impacts, improving training for policymakers and other relevant stakeholders, moving from the development of adaptation plans to implementation, increasing public awareness on climate change issues, developing a legal and policy framework to help direct adaptation planning, and addressing the financial constraints to adaptation.

Resources

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[47] Actions underway include those from direct adaptation funds and indirectly attributed funds. More information on U.S. climate finance can be found at http://www.state.gov/e/oes/climate/faststart/index.htm.

CLIMATE VULNERABILITY PROFILE

Nepal

US Foreign Assistance:[48] (thousands USD)	Requested FY 2012	Requested FY 2013
Estimated total:	**84,833**	**75,100**
Adaptation:	3,000	2,000
Feed the Future/Agriculture:	10,000	10,000
Water:	2,100	2,526
Priority Adaptation Country in 2011:	**Yes**	
Key Climate Stressors:	**Heat, Drought, Flooding**	

Introduction

Nepal is located in the Himalayan mountain range between India and China. It is a landlocked nation with generally mountainous terrain. Much of the country's 28 million inhabitants live in rural areas, with only about 12-15 percent of the population concentrated in urban areas. Small-scale subsistence agriculture and other natural resource use employ about 78 percent of the country's work force and provide 36 percent of Nepal's Gross Domestic Product (GDP). Resource-dependent livelihoods are common in Nepal and the country has low literacy rates, high hunger rates, and widespread poverty. Nepal contains a significant amount of freshwater, derived from glaciers, snowmelt, and rainfall. This water and the associated river systems supply water for a large portion of the 178 million people who live in the Ganges River basin.

Projected weather and climate changes

Nepal currently experiences a warm spring between March and May, monsoons that last from June to September, and largely dry winters. Average annual temperature is about 27°C, varying by region and altitude. Rainfall is driven by the monsoons, which bring about 250-450 mm of rainfall each month to the majority of the country.

Temperature: Projections of future temperature in Nepal suggest increases of 1.3-3.8°C by 2060 and 1.8-5.8°C by 2090 from the 1980-1999 base period. Warming is expected to occur more rapidly during the winter months.

Precipitation: Average annual rainfall has decreased since 1960, by an average of 3.7 mm per month per decade. This decrease is particularly significant during the monsoon period (June-September). Climate models currently cannot clearly characterize future rainfall. However, estimates consistently suggest that southeastern Nepal will experience increases in rainfall.

Extreme events: Floods and landslides are common occurrences in Nepal. These events are often triggered by heavy rains, while rapid snow and ice melt in the mountains also contribute to them. Glacial melt resulting

[48] US foreign assistance includes both USAID and Department of State program funding, but in most cases the bulk of this funding is implemented through USAID. In order to have comparable figures in these categories, all country profiles use figures from the Congressional Budget Justification (CBJ) (see http://transition.usaid.gov/performance/cbj/185016.pdf and http://transition.usaid.gov/performance/cbj/158269.pdf). Between the time of the budget request and the 653(a) report to Congress, these figures can change significantly.

from increased temperatures can also increase risk of Glacial Lake Outburst Floods. Droughts are also becoming more frequent, particularly during the winter months and in historically dry areas.

Key climate impacts and vulnerabilities

Changes in precipitation will be the primary source of Nepal's vulnerability to climate changes. Changes in precipitation, combined with changes in the rates and timing of glacial melt, could change the variability and availability of Nepal's water resources. Too much or too little water will have serious implications for Nepal's biodiversity and forestry, agriculture, and hydropower energy production. Too little rainfall will reduce rice and maize cultivation, which is the main source of food for much of the country's population. Inadequate rainfall would disproportionally affect already vulnerable populations including women, the poor, and other disadvantaged groups. Too much rainfall can also destroy crops and increase topsoil erosion. Floods have already devastated populations living in lowland areas, particularly along river banks, and future floods are expected in new areas unaccustomed to flooding. Furthermore, much of the country's electricity system relies on hydropower production, which is vulnerable to both increases and decreases in rainfall. Reduced water flow would reduce hydropower production, while high water flows will increase erosion and result in siltation of the dams. In addition to precipitation impacts, increasing temperatures in the northern part of the country could increase the rate of glacial melt from the Himalayan glaciers, affecting water supply. Changes in glacial melt patterns can also impact downstream villages and areas by breaching river banks and other structures. This will also have implications on the timing of water available for residents of the Ganges River basin.

Key USAID program vulnerabilities

Food security: Nepal is a focus country for the Feed the Future (FTF) Initiative. Climate changes could have negative impacts on agriculture, threatening food security. This would particularly impact the large proportion of the population that depends on small-scale subsistence agriculture. Rising temperatures and changes in total precipitation could reduce agricultural yields and affect the ability of families to raise livestock and produce livestock fodder. Flooding and landslides could completely wipe out crops. These impacts would add pressure to FTF efforts.

Under FTF, USAID/Nepal is promoting agricultural production of high-value vegetables, lentils, livestock, and drought/flood resistant varieties of staple grains. FTF also promotes nutrition, hygiene, and increasing resiliency of vulnerable groups. USAID will need to ensure that newer agricultural production initiatives take into account projected climate changes. For example, small scale irrigation could be impacted by erratic or changing rainfall patterns and certain crops may be less productive under future climate conditions.

Biodiversity: The forests, biodiversity, and resource-dependent communities of Nepal are at risk from destructive heat, drought, forest fires, invasive plant and animal species, landslides, and floods projected from climate changes. Such risks are particularly high in areas with low connectivity between natural areas. The lack of connectivity disrupts ecological processes, preventing species migration and reducing genetic variability. Increased heat may bring an increase in invasive pests as well as new plant diseases, and rare mountain plant species will experience devastating habitat loss. USAID/Nepal receives Sustainable Landscape and Adaptation funding from the Global Climate Change Initiative, as well as earmarked biodiversity resources. Under the flagship Hariyo Ban program, USAID is investing in protecting the biodiversity of the country, promoting sustainable landscapes to help mitigate climate change, and preparing the Nepali people to adapt to the negative effects of climate change.

Economic growth and education: The USAID/Nepal Economic Growth and Education portfolio includes programs that foster food security, flood recovery, early childhood education development, income generation, and trade. These programs are vulnerable to climate change impacts. For example, infrastructure rehabilitated or built by the Nepal Flood Recovery Program may be vulnerable to increased extreme events such as waterlogging or floods, forest fires, or landslides. Increased extreme events also put additional stresses on local people and available resources. Any degree of change in the availability of water, the availability of

firewood, and agricultural production directly affects the quality of life of women and disadvantaged communities in rural areas. Climate changes may require increased work in agriculture or other industries, which may lower school attendance and education attainment, particularly for women and children. Finally, new agriculture pests and invasive species from climate changes may impact Nepal's international trade.

Health and family planning: Nepal is a focus country for the Global Health Initiative. As such, USAID programs support the provision of sustainable, accessible, and quality basic health services to its citizens. These services address family planning, maternal and child health, nutrition, infectious diseases, and other environmental and public health problems, while also building capacity at all institutional levels. These efforts are vulnerable to a range of projected climate changes. First, climate changes could have serious impacts on the spread of water-borne and vector-borne diseases such as cholera and malaria, respectively. Increasing temperatures can affect the distribution and abundance of malaria vectors. Flooding can cause increased contaminant-loading of the water supply, while increasing temperatures can promote bacteria growth in water. Second, drought and decreased water availability may impact sanitation and hygiene practices and behaviors. This could impede progress currently being made on Millennium Development Goals. Finally, climate change impacts on agriculture could have significant nutrition-related health impacts. Programs targeted at preventing and controlling infectious diseases, promoting maternal and child health, and improving nutrition rates will need to understand how future climate impacts could change disease vectors, affect water quality levels, and affect availability of food.

Democracy and governance: USAID is supporting the development of effective governance institutions in Nepal and promoting community inclusion within the political decision making process. While these programs are not directly vulnerable to climate changes, impacts such as food and water stress could jeopardize the political stability of the country and necessitate new or additional interventions.

Disaster risk reduction: USAID supports a disaster risk reduction program to prepare the Government of Nepal to respond to disasters in a timely manner, support stakeholder engagement in disaster risk reduction activities, and help implement disaster risk reduction measures in development programs. Climate change impacts could increase the frequency, severity, and/or type of natural disasters affecting Nepal, further stressing this program. Promotion of climate resilient siting, design, and construction of buildings and small infrastructure projects is one way USAID can account for these projected changes.

Actions underway[49]

USAID is supporting multiple programs in Nepal that directly address climate impacts, vulnerabilities, and future resiliency needs. For example, the Hariyo Ban program promotes biodiversity conservation by providing alternative livelihood opportunities and supporting policy development that recognizes the need for climate adaptation. A new, complementary program, the Initiative for Climate Change Adaptation (ICCA), works directly with communities to strengthen their resilience to climate-induced changes. The Hill Maize Research Program (HMRP) is developing drought-resistance maize varieties to improve Nepal's climate change resiliency and food security. In addition, disaster risk reduction efforts adopt many of the strategies used to promote climate resiliency, including capacity building for relevant stakeholders and government officials, construction of disaster-resilient infrastructure, and implementation of early warning systems. Despite existing efforts, USAID still needs to ensure that adaptation considerations are mainstreamed into all of its various programs and initiatives.

Challenges to adaptation

Nepal recently developed its National Climate Change Adaptation Plan of Action. However, the recommendations in this plan have yet to be implemented. There are significant challenges to

[49] Actions underway include those from direct adaptation funds and indirectly attributed funds. More information on U.S. climate finance can be found at http://www.state.gov/e/oes/climate/faststart/index.htm.

implementation, including shifting the country to a proactive, risk reduction approach for dealing with natural disasters. In addition, increased coordination between national and local government agencies and community stakeholders is needed in order to respond appropriately. Historically weak institutions have exacerbated the divide between government action and local needs. Lack of scientific research and data gaps are another major challenge. More disaggregated data (e.g., by geography, income, and ethnic groups) are required to understand the relative impacts of climate change and plan accordingly. Improved observations and forecasting methods are required to support the development of appropriate early warning and crop forecasting systems.

Resources

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CLIMATE VULNERABILITY PROFILE

Peru

US Foreign Assistance:[50] (thousands USD)	Requested FY 2012	Requested FY 2013
Estimated total:	**83,550**	**73,665**
Adaptation:	3,000	3,000
Priority Adaptation Country in 2011:	**Yes**	
Key Climate Stressors:	**Heat, Drought, Flooding, Sea level rise**	

Introduction

Peru is a large country on the western coast of South America with a population of over 29 million people. Despite recent economic growth, Peru faces challenges to reduce poverty and protect its natural and cultural resources. Peru also has significant income disparity: more than 30 percent of the population lives on less than US$2 per day and about 12 percent live on less than US$1 per day. Poverty is even more pronounced in rural areas, with approximately 60 percent of rural residents living in poverty. Illegal mining, coca production, deforestation, and poaching are major concerns that development projects seek to minimize. USAID programs in Peru are largely focused on providing economic alternatives to coca cultivation.

Projected weather and climate changes

Peru has three distinct climates: desert coastal lowlands along the Pacific Ocean, the Andes Mountain range, and the Andean highlands. The desert coastal lowlands are the location of the country's major cities and much of the mechanized agriculture. To the east, the Andes Mountain range runs north-south through Peru. In the Andean highlands, agriculture is rain-fed and dependent on precipitation cycles. Sixty percent of the land in Peru is east of the Andes and falls within the Amazon Basin, an expansive rainforest where illegal logging, poaching, and deforestation are concerns.

Temperature: Observed temperatures in Peru have already been increasing over the past few decades. According to the Second National Communication (SNC), since 1960, on average, high temperatures increased by 0.2°C per decade. This was accompanied by a decrease in the number of nights with freezing temperatures. The SNC projects that by 2030, high temperatures will increase by 1.6°C and low temperatures

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will increase by 1.4°C, with the greatest increases along the northern coast, north central highlands, and the Amazon. By 2050, the increases are projected to reach up to 2°C, according to the SENAMHI Global Circulation Models. The IPCC Fourth Assessment Report projects an increase of 1-4°C in temperatures in the Amazon by 2050. Additionally, by mid-century, ocean water temperature along the Peruvian coast is projected to rise about 3-4°C above current levels.

Precipitation: Rainfall projections vary by region. According to a synthesis report from the Adaptation Partnership, rainfall projections range from a 30 percent decrease to a 30 percent increase by 2030. Conversely, information from the World Bank's Climate Change Knowledge Portal (CCKP) projects that precipitation will decrease by 2050 in all regions: 10 percent in the north, 29 percent in central Peru, and 14 percent in the southern part of the country.

Extreme events: Flooding, landslides, droughts, frost, and hailstorms are ongoing concerns in parts of Peru. Some of these events are related to El Niño South Oscillation (ENSO). The CCKP suggests that climate changes may result in an increased frequency of ENSO occurrences.

Sea level rise: Precise sea level rise projections for the Peruvian coast are not available. However, the CCKP states that sea level rise by 2050 could lead to flooding in low lying areas, increased erosion, salt water intrusion, and increased damage along the coast.

Key climate impacts and vulnerabilities

Climate changes will likely impact several aspects of Peru. Freshwater resources, glaciers, marine ecosystems, agriculture, infrastructure, and human health and wellbeing could all be affected by projected changes. In particular, the availability of freshwater resources has cascading impacts on other sectors. Increased glacial melt, which is associated with climate change, is projected to cause significant reductions in water flow as early as 2030. In addition, changes in precipitation are expected to have a significant impact on highland populations that rely on rain-fed agriculture.

Key USAID program vulnerabilities

Agriculture: A significant portion of USAID Development Assistance Fund supports initiatives to replace coca production with alternative agricultural production or other economic activity. The potential effect of climate changes on these programs has not been systematically assessed country-wide, but the regional adaptation initiatives underway indicate that the effect of changing temperatures and precipitation patterns are of concern. Anticipated changes in precipitation and temperature may influence the efficacy of USAID programs by affecting agricultural production of alternative crops and stressing water supplies supporting public health.

Health: USAID health projects in Peru may be subject to climate change impacts. Even if current programs are not affected, changes to the freshwater supply and reductions in agricultural production and nutrient availability may create future needs for additional health projects in Peru. Any such changes will be evaluated as necessary and in the context of USAID's current Country Development Cooperation Strategy and strategic priorities.

Environment and natural resources: USAID is building the capacity of the Government of Peru to enforce environmental laws, primarily related to illegal logging, and training community members and municipal officers to ensure sustainable fresh water. Committed environmental management will be increasingly important as natural resources become stressed under a changing climate.

Actions underway[51]

Peru is recognized as one of the most advanced countries in Latin America in terms of planning for climate change. The Inter-American Development Bank and several other international development agencies are funding a wide variety of projects in collaboration with the Government of Peru. USAID is working with communities in the Andean highlands to help them adapt to changes in freshwater availability. For example, USAID worked with The Mountain Institute to train 200 community members and municipal officials to establish water conservation areas in the upper watersheds. USAID has also partnered with the local NGO AEDES to continue climate change adaptation work in the south. The program helps rural farmers incorporate climate change risk management into development decisions.

Challenges to adaptation

Challenges to adaptation in Peru may include distrust between vulnerable communities and the government. Some of USAID's work in Peru has centered on improving the public perception of the government and promoting public participation in local climate change policy. In addition, there is a gap in downscaled climate models that can project local impacts of climate change. These fine-tuned projections, particularly in regard to precipitation changes, will be necessary since Peru is a geographically and climatically diverse country. Many organizations, countries, and development agencies are involved in climate adaptation projects in Peru. A key challenge will be to promote effective coordination of efforts and understand how USAID can most effectively complement those efforts or address remaining gaps.

Resources

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[51] Actions underway include those from direct adaptation funds and indirectly attributed funds. More information on U.S. climate finance can be found at http://www.state.gov/e/oes/climate/faststart/index.htm.

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CLIMATE VULNERABILITY PROFILE

Barbados and the Eastern Caribbean

US Foreign Assistance:[52] (thousands USD)	Requested FY 2012	Requested FY 2013
Estimated total:	**34,240**	**35,200**
Adaptation:	8,000	5,500
Priority Adaptation Country in 2011:	**Yes**	
Key Climate Stressors:	**Heat, Drought, Flooding, Sea level rise**	

D. INTRODUCTION

The Barbados and Eastern Caribbean Mission supports development assistance programs in Barbados, Antigua and Barbuda, Dominica, Grenada, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Suriname, and Trinidad and Tobago. Spread across the Caribbean Sea, these islands' populations range from around 50,000 in St. Kitts and Nevis to 1.2 million in Trinidad and Tobago. The region is characterized by differing levels of economic development and income across and within these nations. Different countries depend on different natural resources and industries for their income (e.g., bananas, spices, tourism, and international business services). However, all of these nations remain inherently vulnerable to natural disasters and future climate change impacts.

E. PROJECTED WEATHER AND CLIMATE CHANGES

Climate and weather patterns differ across these nations. The following table indicates the trends.

[52] US foreign assistance includes both USAID and Department of State program funding, but in most cases the bulk of this funding is implemented through USAID. In order to have comparable figures in these categories, all country profiles use figures from the Congressional Budget Justification (CBJ) (see http://transition.usaid.gov/performance/cbj/185016.pdf and http://transition.usaid.gov/performance/cbj/158269.pdf). Between the time of the budget request and the 653(a) report to Congress, these figures can change significantly.

Table 1. Project weather and climate changes in Barbados and the Eastern Caribbean

Climate Factor	Barbados	Antigua and Barbuda	Dominica	St. Kitts and Nevis	St. Lucia	Grenada	St. Vincent and the Grenadines	Trinidad and Tobago	Suriname

Climate Factor	Barbados	Antigua and Barbuda	Dominica	St. Kitts and Nevis	St. Lucia	Grenada	St. Vincent and the Grenadines	Trinidad and Tobago	Suriname
Precipitation	The wet season occurs between May and October, providing about 150-200 mm per month of rainfall. Projections from models indicate that rainfall will decrease in the future. Heavy rainfall events are projected to decrease in intensity by the 2090s from the 1970-1999 baseline.	Average rainfall has increased significantly since 1960 in all seasons. Projections of mean annual rainfall indicate decreasing rainfall, especially during the June-August period.	Average rainfall has increased between March and August, but is offset by decreases between December and February. Projections indicate decreased rainfall by the 2090s from the 1970-1999 baseline.	The rainy season occurs between July and December, during which the islands receive around 150-250 mm rainfall per month. Average rainfall has not changed with any significant trend since 1960. Projections indicate decreases in rainfall by the 2090s from the 1970-1999 baseline.	These areas receive around 300 mm of rainfall per month between May and October. Projections from models indicate that rainfall will decrease in the future. Heavy rainfall events are projected to decrease in intensity by the 2090s from the 1970-1999 baseline.		Most rainfall occurs between May and October, and averages around 150-200 mm rainfall per month. Average precipitation has shown a decrease of 8.2 mm per decade in 1960-2006. This decline is most marked between June and November. Projections indicate decreases in rainfall, occurring mostly during the June-November period by the 2090s from the 1970-1999 baseline, and more so in the south than in the north.	Wet season occurs between June and December, with the islands receiving between 200-250 mm rainfall per month. Average rainfall has not changed significantly since 1960. Projections from models indicate that rainfall will decrease in the future. Heavy rainfall events are projected to decrease in intensity by the 2090s from the 1970-1999 baseline.	The country experiences two wet seasons: during May-July (~250-400 mm per month) and in November- January (~150-200 mm per month). Average annual rainfall has not changed with any discernible trend since 1960. Precipitation projections indicate a decrease in rainfall by the 2090s. Models are inconclusive on changes in the frequency of heavy rainfall events by the 2090s from the 1970-1999 baseline.

Climate Factor	Barbados	Antigua and Barbuda	Dominica	St. Kitts and Nevis	St. Lucia	Grenada	St. Vincent and the Grenadines	Trinidad and Tobago	Suriname

Climate Factor	Barbados	Antigua and Barbuda	Dominica	St. Kitts and Nevis	St. Lucia	Grenada	St. Vincent and the Grenadines	Trinidad and Tobago	Suriname
Extreme Events	These countries experience extreme rainfall and hurricanes between August and October. Model projections are inconclusive as to the future intensity and frequency of such extreme weather events.					These countries lie on the edge of the hurricane belt and are only rarely affected by tropical cyclones.			
Temperature	Average annual temperature is around 26-27°C, and is about one degree cooler during the winter months (December-February). Temperature has increased by about 0.6°C since 1960, at an average rate of 0.14°C per decade. Temperature is projected to increase by 0.4-2.1°C by the 2060s and 1.0-4.1°C by 2090s from the 1970-1999 baseline. The number of days and nights considered as 'hot' will increase. A 'hot' day or 'hot' night is defined as the temperature exceeded on 10% of days or nights in the current climate of that region and season.								Average annual temperature nationwide is around 25°-27°C. In the southern regions, average annual temperature is slightly cooler, around 23-25°C. Temperatures have increased by 0.2°C since 1960, and are projected to increase by 0.8-3.1°C by 2060 and 1.3-4.7°C by the 2090s from the 1970-1999 baseline. Temperature is projected to increase more quickly in the south then in the north.
Sea Level Rise	Sea levels are projected to rise between 0.13 m and 0.56 m by the 2090s, relative to the 1980-1999 baseline.								

F. KEY CLIMATE IMPACTS AND VULNERABILITIES

The countries in this region have different vulnerabilities and will experience different impacts from climate change. Dominica, St. Kitts and Nevis, St. Vincent and the Grenadines, Grenada, and Trinidad and Tobago's agricultural production is vulnerable to changes in rainfall and temperature. Of these countries, Dominica and St. Vincent and the Grenadines are more dependent on agricultural production. Trinidad and Tobago has a more diversified economy compared to the other countries in the region and may not be as vulnerable to climate change impacts on agriculture.

All countries in this region are dependent on tourism and associated industries. Temperature increases, sea level rise, and extreme events can impact the number of days suitable for tourism and have resulting impacts on these countries' economies. These countries also tend to have aging infrastructure (e.g., roads, hospitals, water facilities); poor infrastructure conditions make them more vulnerable during extreme events such as the annually returning cyclone and hurricane season.

Further, these countries are rich in biodiversity, specifically in their forests and marine ecosystems. Continued exploitation of the resource base, changes in land use, decreases in water quantity and quality, declining aquaculture, and loss of shorelines due to coral reef degradation could each increase the vulnerability of these countries' economies to climate changes.

G. KEY USAID PROGRAM VULNERABILITIES

Economic growth: USAID supports countries in this region through enterprise development, training of the labor force, and livelihoods development. These programs are targeted at youth to provide employment opportunities and alternatives to the drug trade. Projects under these programs are targeted at training and capacity building, and so are not immediately vulnerable to the impacts of climate change. However, as climate affects the viability of agriculture, tourism, or other climate-dependent economic sectors, the focus of enterprise and workforce development may need to be assessed.

Caribbean Basin Security Initiative: This program is aimed at preventing further expansion of the drug trade and associated crime, through microenterprise and workplace development. This program is critical in maintaining peace and security within the region and can be jeopardized if climate stressors threaten the livelihoods of populations within the region. The initiative applies to Barbados, the Organisation of Eastern Caribbean States (OECS), Trinidad and Tobago, and Suriname.

H. ACTIONS UNDERWAY[53]

Through strategic partnerships with regional, national, and local government entities in Barbados and the Eastern Caribbean community, and with dedicated adaptation funding, USAID is actively working to reduce the region's vulnerability and increase its resilience to the impacts of climate change. Assistance is specifically provided to increase the capacity of technical and educational institutions in fields such as meteorology, hydrology, and coastal and marine science. USAID is currently supporting coastal zone and freshwater resources management and resilience programs that build on previous biodiversity conservation and management programs. The programs directly address the climate change challenge and are helping local and national level governments respond to climate changes by reducing vulnerabilities and increasing resilience. The programs apply to Barbados and OECS states. USAID is also providing support to decision makers who need to understand how to utilize relevant information in enacting policies and implementing projects through initiatives, including support for the Caribbean Institute of Meteorology and Hydrology. Further, USAID is supporting efforts to educate communities and local stakeholders about climate change impacts

[53] Actions underway include those from direct adaptation funds and indirectly attributed funds. More information on U.S. climate finance can be found at http://www.state.gov/e/oes/climate/faststart/index.htm.

and the steps being taken to adapt to these impacts through the Reducing Risks to Human and Natural Assets program.

I. CHALLENGES TO ADAPTATION

Despite significant investments in disaster risk reduction and response, the countries in this region will need to rebuild damaged infrastructure with more resilient structures, improve coordination across agencies, and better educate their citizens about climate change. As identified in the USAID Regional Strategic Plan, reliable and consistent sources of funding are limited and are coupled with regulatory and institutional gaps. These barriers hamper a holistic approach to mainstreaming climate change considerations across the differing governments operations.

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