USAID
FROM THE AMERICAN PEOPLE

USAID/ETHIOPIA
CLIMATE CHANGE RISKS AND OPPORTUNITIES REPORT

DECEMBER 2016

This document was produced for the United States Agency for International Development (USAID). It was prepared by The Cadmus Group, Inc. under the Global Environmental Management Support Project (GEMS II), award AID-OAA-M-13-00018.Until and unless this document is fully approved under 22 CFR 216, the contents do not necessarily reflect the views of USAID or the United States Government.

FRONT COVER: The PRIME project will help pastoralists reach livestock markets, transition to new livelihoods, and adapt to climate change. (USAID)

USAID/ETHIOPIA
CLIMATE CHANGE RISKS AND OPPORTUNITIES REPORT

DECEMBER 2016

Prepared by:

Emily Wasley, Charles Hernick, Kathleen Hurley, Dr. Arianne Neigh, and Fikadu Getachew

Prepared under:

The Global Environmental Management Support Project (GEMS II), award AID-OAA-M-13-00018.).

Submitted by:

The Cadmus Group, Inc.
100 Fifth Avenue, Suite 100
Waltham, MA 02451
617-673-7000 Fax 617-673-7001
www.cadmusgroup.com

ACRONYMS

ALT	Agriculture and Livelihoods Transformation
CDCS	Country Development and Cooperation Strategy
CRGE	Climate-Resilient Green Economy
DO	Development Objective
DCA	Development Credit Authority
EG&T	Economic Growth & Transformation
EO	Executive Order
EPACC	Ethiopian Program of Adaptation to Climate Change
FFP	Food for Peace
GCC	Global Climate Change
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GHI	Global Health Initiative
GTP-II	Growth and Transformation Plan
HAPN	Health, AIDS, Population and Nutrition
IMF	International Monetary Fund
INDC	Intended Nationally Determined Contribution
IPDC	Industrial Parks Development Corporation
MFI	Microfinance Institution
MOI	Ministry of Industry
NAMA	Nationally Appropriate Mitigation Actions
NAPA	National Adaptation Program of Action
OFDA	Office of Foreign Disaster Assistance
PAD	Project Appraisal Documents
PSNP	Productive Safety Net Program
SDG	Sustainable Development Goals
SME	Small & Medium Enterprises
SWC	Soil and Water Conservation
TVET	Technical Vocational Education and Trainings
UN	United Nations

UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
USAID	United States Agency for International Development

CONTENTS

TABLES

FIGURES

1. INTRODUCTION

1.1 BACKGROUND

Climate variation, variability and change are not new challenges for the people of Ethiopia. Pastoralists and farmers have managed diverse climates across the highland and lowland regions along with periods of heavy rain, high temperatures, and drought within each of those regions and throughout the country's history. However, the intensity, frequency, and severity of weather events have changed. Higher temperatures, erratic rainfall, and more frequent and intense droughts have been observed over the past several decades. These extremes are anticipated to be further exacerbated as global greenhouse gas emissions continue to increase. Global climate change projections confirm that further warming will continue over the next century at unprecedented rates, threatening Ethiopia's adaptive capacity to thrive.

Ethiopia already faces numerous development challenges that factor into its baseline vulnerability to climate change, including population growth, high levels of food insecurity, and ongoing conflicts over natural resources. Chronic food insecurity affects 10 percent of the population, even in years with sufficient rains. Roughly two-thirds of the population earns less than $2 per day and access to basic services is limited. Rainfed agriculture contributes nearly half of national Gross Domestic Product (GDP) and is the mainstay of livelihoods for over 80 percent of the population. These rural livelihood systems – crop cultivation, pastoralism and agropastoralism – are highly sensitive to climate variability and change. Food insecurity patterns are linked to seasonal rainfall patterns, with hunger trends declining significantly after the rainy seasons.

Climatic trends over Ethiopia indicate geographic variations in temperature and precipitation across the country. Overall, temperatures have risen across Ethiopia, with the exception of the eastern Rift Valley and lowlands; the strongest temperatures increases coupled with decline in precipitation were found along the Sudan border (Jury and Funk, 2013). Precipitation has declined over southern Ethiopia and on a country-level, there is an expectation that rainfall will decrease overall, in turn, reducing run-off. This trend has the strong potential to impact agriculture not only within Ethiopia, but in neighboring countries that rely upon run off from Ethiopia's highlands. In the southern Rift Valley, a steady reduction in the June-September rains has been recorded, while the March-May rains have demonstrated a small reduction (Jury and Funk, 2013). The Rift Valley is critical for agricultural production and reduced rainfall will impact farmers' ability to successfully cultivate traditional crops. Drought is the single most destructive climate-related natural hazard in Ethiopia and given the economy's dependence on agriculture and threatens GDP through impacts on agricultural productivity. The agricultural system and economy's sensitivity to climate change could aggravate existing social and economic problems (USAID, 2016a).

The Government of Ethiopia (GOE) recognizes the considerable risks and opportunities that climate variability and change pose to economic development, the health and well-being of its citizens, and social stability. The risk of destabilization in the Horn of Africa from fiercer competition for water, land, and other resources throughout the Nile Basin are key climate concerns. At the same time, if proper mitigation and adaptation measures are instituted, climate change may bring some opportunities for parts of Ethiopia. Given the variability of projections, it's possible some areas may see more rainfall and more favorable conditions for particular crops and livestock production. Indeed, some higher value crops could be introduced and grown and if systems are in place to capture and store additional water, more hydroelectric power could be generated.

Ethiopia's second Growth and Transformation Plan (GTP-II) is a national five-year plan created by the government to improve the country's economy and set an overall goal to transform Ethiopia into a middle-income country by 2025. Recognizing the role of a changing climate, in 2011, the government established the Climate-Resilient Green Economy (CRGE) framework, to move toward a greener and more competitive low-carbon economy. The integration of both mitigation and adaptation actions into Ethiopia's national policies, programs, and strategies is a critical step in shifting its development path toward a climate-resilient, low-carbon and green economy (CounterPoint, 2015a).

For over four decades, USAID has provided assistance to Ethiopia in agriculture, natural resources, education, health, and industry (USAID, 2016d). Other US government agencies, including the Centers for Disease Control and Prevention, the Department of Agriculture, and the State Department, are also supporting development activities in-country. With Ethiopia's notable federal-level political commitment and leadership and the continued support from the US and other international donors, adaptive capacity has been enhanced in many communities in recent years. However, full implementation of federal programs—adaptation- and mitigation-oriented—remains low and integration of climate considerations across all sectors is still in its infancy. Numerous opportunities exist for USAID to continue supporting its flagship programs, which are enhancing the country's adaptive capacity, but to also mainstream climate considerations into programs that have traditionally not had direct affiliations with climate considerations (e.g., education, health).

1.2 PURPOSE AND SCOPE

The purpose of this report is to document and synthesize:

1. What Government of Ethiopia (GoE) is doing to understand, assess, manage, and integrate climate considerations into its programs, policies, and activities;
2. What challenges and opportunities exist for effective implementation; and
3. What recommendations can USAID/Ethiopia implement to enhance existing efforts or develop new efforts to integrate climate change into its programs, areas where further information is needed, and where ongoing efforts or research exists that might contain this information.

The scope of this work was to conduct a country-wide *Climate Change Risk and Opportunities Assessment* that addresses the threats posed by climate change, with a particular focus on when and how USAID Development Objective (DO) teams can productively integrate understanding of climate change impacts into their programs. This report is the base of a comprehensive understanding of climate risks – one of the first steps in helping USAID understand what the climate impacts are and the various options that could be implemented to better integrate climate considerations into their flagship programs. However, this report is not a stand-alone climate vulnerability assessment and does not meet the criteria needed to meet Executive Order 13677, *Climate-Resilient International Development*. However, the information presented in this report can and should be used to inform the Country Development and Cooperation Strategy (CDCS) and Project Appraisal Documents (PAD), along with project-level planning with respect to climate change.

Concurrent with this assessment, USAID/Ethiopia prepared the Climate Risk Screening and the CDCS Climate Annex to meet the criteria set forth in the aforementioned Executive Order.

1.3 APPROACH AND METHODOLOGY

In order to achieve this the Assessment Team utilized a robust methodology (further detailed in the accompanying Tropical Forestry and Biodiversity (FAA 118/119) Assessment to review literature; utilize geographic information system (GIS) analysis; conduct workshops and interviews with key stakeholders, experts, officials; and conduct regional and local field visits; and informed by USAID comments and feedback on the draft consistent with the approved Scope of Work:

- Desk research (over 40 documents reviewed)
- Stakeholder consultations: Washington, DC, Addis Ababa, Bahir Dar, Jimma, Awassa, and Goba (over 60 individual consultations)
- Stakeholder workshop
- Analysis based on USAID's programming
    - Consistency with USAID/Biodiversity Policy
    - Consistency with USAID Global Climate Change Initiative definitions and guidance

2. DEVELOPMENT CONTEXT

Ethiopia is a large and diverse landlocked country in the Horn of Africa. Covering a land surface area (including water bodies) of 1,127,127 km², Ethiopia is currently divided into nine regional states and two city administrations (Schlüter, 2006). See Figure 1 for a political map of Ethiopia. The Oromo, Amhara, Somali, and Tigreans make up more than three-quarters of the population, but there are more than 80 different ethnic groups within Ethiopia. Pastoralism in Ethiopia supports close to 15 million (around 15 percent) of the country's total estimated population, and pastoralists own 40 percent of the livestock population (International Work Group for Indigenous Affairs, 2016). The political and economic situation of vulnerable peoples, including pastoralists, hunter-gatherer communities, and groups such as the Majang in the Gambela region, and people in the lower Omo Valley, Benishangul Gumuz, Afar, Somali and Oromia regions indigenous peoples in Ethiopia is a tenuous one, however, as their communities are increasingly marginalized, displaced, and deprived of traditional livelihoods and access to their natural environment. Ethiopia lacks a policy on indigenous rights and is not a signatory of the International Labor Organization's (ILO) Indigenous and Tribal Peoples Convention No. 169.

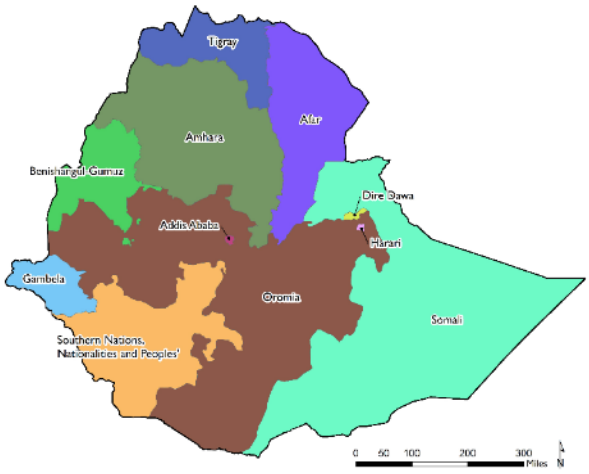


FIGURE 1. POLITICAL MAP OF ETHIOPIA

FIGURE 2. POPULATION DENSITY AS OF 2007 (MAP SOURCED FROM GAFSP, N.D.)FIGURE 3. POLITICAL MAP OF ETHIOPIA

2.1 POPULATION TRENDS

Ethiopia is one of the most populous countries in the world, with a total population of 99.4 million (2015) and a growth rate of 2.5 percent (The World Bank Group, 2016), with greatest population density in major cities (Figure 2). The country is also rapidly urbanizing at about 4.1 percent a year, and the United Nations (UN) estimates Ethiopia's urban population will continue expanding from 13 percent in 1990 to 19.0 percent in 2014, reaching 38 percent in 2050 (United Nations, 2014). As an indication of rapid urban growth, the capital city, Addis Ababa, is expected to double its population of 3.4 million by 2030 (The World Bank Group, 2015). At the current annual growth rate, Ethiopia's population is estimated to reach in excess of 135 million by 2030 and is projected to be among the world's top ten by 2050 (United Nations, 2015).

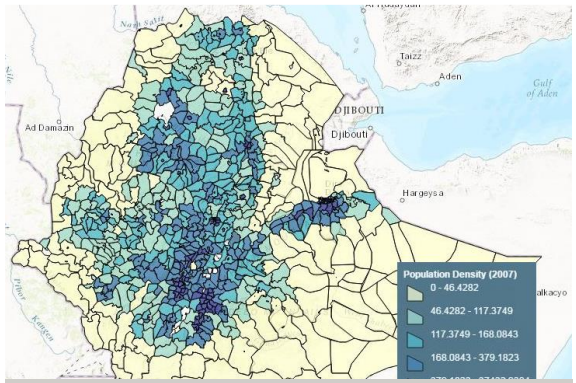


FIGURE 4. POPULATION DENSITY AS OF 2007 (MAP SOURCED FROM GAFSP, N.D.)

FIGURE 5. COMPARISON OF GTP -II AND USAID/ETHIOPIA MISSION OBJECTIVESFIGURE 6. POPULATION DENSITY AS OF 2007 (MAP SOURCED FROM GAFSP, N.D.)

Ethiopia is a country characterized by enormous internal human displacements taking place primarily as a result of three major driving forces: natural and manmade disasters (e.g., civil unrest, train derailment cyber-security, and terrorism), and development

actions (see Appendix 6.4). Environment-induced displacement and movement of populations in Ethiopia has been attributed to natural disasters from erratic rainfall, flooding, and drought, resulting in massive spontaneous and planned population movements. This has long been the case for Ethiopians dependent on agriculture, who have drifted from moisture-stressed and overpopulated northern and southeastern parts of the country to more fertile, wetter, and scarcely populated lowland areas. In the case of development actions, it's important to consider the unintended consequences of these that might result in continued movement of populations and to closely monitor and evaluate these types of impacts to the citizens of Ethiopia.

2.2 ECONOMY

Ethiopia remains one of the world's poorest countries with a per capita income of US$590 (Atlas Gross National Income, 2014), which is substantially lower than the regional average of US$1,630 (The World Bank Group, 2016). Ethiopia is also ranked 174 out of 187 countries on the Human Development Index (2014) of the United Nations Development Program. At the same time, the economy has experienced strong and broad-based growth over the past decade and made substantial progress on social and human development objectives. According to the International Monetary Fund (IMF), Ethiopia is now one of the top five fastest-growing economies in the world, averaging an annual growth rate in GDP of 10.9 percent between 2004 and 2014 (International Monetary Fund, 2016). This level of economic growth has helped reduce extreme poverty in both urban and rural areas by 9.1 percent, from 38.7 percent in 2004–05 to 29.6 percent in 2010–11 (The World Bank Group, 2016). However, because of high population growth the absolute number of poor has remained unchanged over the past 15 years. Ethiopia has achieved the Millennium Development Goals for child mortality and water, and there has also been encouraging progress in gender parity in primary education, HIV/AIDS and malaria.

Expansion of the service sector and agricultural sector account for most of Ethiopia's economic growth, while manufacturing sector performance remains relatively modest. The services sector employs 10 percent of the labor force, with Ethiopian Airlines leading the country's export income. As of 2013, there were 57 airports operating in Ethiopia with plans in place to expand major airports, as well as to build new ones. The agriculture sector employs 85 percent of the workforce; the primary products include cereals, coffee, oilseed, cotton, sugarcane, vegetables, khat, cut flowers, hides, cattle, sheep, goats, and fish. Recently, drought and flooding exacerbated by El Niño has led to further increases of food insecurity, most notably in the regions of Afar, eastern Oromia, and scattered sections of Somali. In 2016, 420,000 children under 5 years old will be affected by severe acute malnutrition (Government of Ethiopia and Humanitarian Partners, 2016). Smallholders form the backbone of the sector, and agricultural production is characterized by fragmented and dispersed land holdings (average plot size is 0.5 hectares), limited irrigation potential, a reliance on rain-fed farming, and relatively low yields.

3. ETHIOPIA'S STRATEGIC APPROACH TO CLIMATE ADAPTATION AND MITIGATION

3.1 BUILDING A CLIMATE-RESILIENT GREEN ECONOMY

Numerous medium and long-term development plans have been generated in Ethiopia; however, the GTP has been by far the most ambitious through its integration of sustainable development principles and objectives. The overarching objective of GTP-II is for Ethiopia to become a lower middle-income country by 2025, achieve an annual average real GDP growth rate of 11 percent, and pursue aggressive measures towards rapid industrialization and structural transformation. GTP-II is built on sectoral policies, strategies, and programs; lessons drawn from the implementation of GTP-1; and the post-2015 sustainable development goals (SDG) (see Appendix 6.4).

The specific objectives and strategies outlined in GTP-II are very complementary to the USAID/Ethiopia Mission objectives. Figure 7. **Comparison of GTP -II and USAID/Ethiopia Mission Objectives**

FIGURE 7. COMPARISON OF GTP -II AND USAID/ETHIOPIA MISSION OBJECTIVES

provides an illustration of these similarities.

FIGURE 8. CLIMATE PROJECTIONS AND KEY CLIMATE IMPACTS

Building a climate-resilient green economy is among GTP-II's strategic pillars. Thus, Ethiopia will focus on adaptation to climate change (e.g., capacity building, park development, urban agriculture growth strategies, housing and other social and physical infrastructure provisions, etc.) and mitigation of greenhouse gases emissions, (e.g., intensifying productivity of the crop and livestock sub-sectors, and protecting and rehabilitating forests for their economic and ecosystem services, etc.). In addition, expanding electricity power generation from renewable energy for domestic and regional markets, switching to modern and energy efficient technologies in transport, industry and buildings strategies will be a major agenda to build climate resilient green economy. The post -2015 sustainable development goals (see Appendix 6.4) related to green economy will be integrated and implemented aligned with the sectors' climate-resilient green economy development strategy.

Table 1 below summarizes all climate-related strategies, policies, programs, and partnerships in Ethiopia. Through these, certain overarching themes of Ethiopia's climate change efforts are evident. The country aims for significant economic development and they intend to have their mitigation and resilience measures encourage, support, and ultimately protect this development. Ethiopia furthermore recognizes the necessity of a holistic approach to this sustainable development. They are not simply focusing on increasing GDP or preserving land, but rather including many of the interdependent pieces as well, such as democratic and developmental good governance, and gender equality, so as to best facilitate resilience and truly sustainable development.

TABLE 1. NATIONAL CLIMATE STRATEGIES AND PLANS

TITLE	OVERVIEW	GOALS, OBJECTIVES, OR PILLARS	TIMEFRAME
Growth and Transformation Plan II (GTP-II) (2016)	As a vehicle for realizing Ethiopia's vision of becoming a lower middle-income country by 2025, GTP-II is built on sectoral policies, strategies and	**Economic Growth and Development:** Sustaining the rapid, broad-based and equitable economic growth and development witnessed during the last decade including during GTP-I.	2015/2016 – 2019/2020

TABLE 1. NATIONAL CLIMATE STRATEGIES AND PLANS

TITLE	OVERVIEW	GOALS, OBJECTIVES, OR PILLARS	TIMEFRAME
	programs; lessons drawn from the implementation of the first GTP; and the post-2015 SDGs. It has also taken into account global and regional economic situations with direct or indirect bearings on the Ethiopian economy.	**Productive Capacity and Efficiency:** Increase capacity and efficiency to reach the economy's productive possibility frontier by rapidly improving quality and competitiveness of the agriculture and manufacturing industries. **Domestic Private Sector:** Enhance the transformation of the domestic private sector into a capable development force. **Industry and Infrastructure:** Build the capacity of the domestic construction industry; bridge critical infrastructure gaps with particular focus on ensuring quality provision of infrastructure services. **Urbanization:** Proactively manage the on-going rapid urbanization to unlock its potential for sustained rapid growth and structural transformation of the economy. **Human Development and Technology:** Accelerate human development and technological capacity building and ensure its sustainability. **Governance:** Continue to build democratic and developmental good governance by enhancing implementation capacity of public institutions and actively engaging the citizens. **Women and Youth Empowerment:** Promote women and youth empowerment, ensure their effective participation in the development and democratization process, and enable them to equitably benefit from the outcomes of development. **Climate-Resilient Green Economy:** Build climate-resilient green economy.	
Intended Nationally Determined Contribution (2015)	Ethiopia intends to limit its net greenhouse gas (GHG) emissions in 2030 to 150MtCO_2e or lower. This would constitute a 255MtCO_2e reduction from the projected 'business-as-usual' emissions in 2030 or a 64 percent reduction.	Mitigate contribution of GHG emissions: carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O), which are considered priority gases in the CRGE. The plan to mitigate GHG emissions is built on the following four pillars:	2030

TABLE 1. NATIONAL CLIMATE STRATEGIES AND PLANS

TITLE	OVERVIEW	GOALS, OBJECTIVES, OR PILLARS	TIMEFRAME
		• Improving crop and livestock production practices for greater food security and higher farmer incomes while reducing emissions; • Protecting and reestablishing forests for their economic and ecosystem services, while sequestering significant amounts of carbon dioxide and increasing the carbon stocks in landscapes; • Expanding electric power generation for renewable energy-hydropower, wind power, and solar; • Switching to modern and energy-efficient technologies in transport, industry, and building sectors.	
Second National Communication (2016)	Describes the country's current biophysical, economic, and social circumstances, which will influence the impact that climate change will have on Ethiopia, as well as the plans in place to address climate change and meet Ethiopia's obligations under the United Nations Framework Convention on Climate Change (UNFCCC).	This Second National Communication has been compiled to meet Ethiopia's obligations under the UNFCCC. It describes national progress made to implement the Convention since 1994, after the First National Communication.	Submitted on 11 May 2016 following its first communication on 16 Oct 2001
Climate-Resilient Green Economy (CRGE) (2011)	Framework for achieving middle-income status by 2025; focuses on four key pillars: agriculture, forestry, power, and transportation. Ethiopia's CRGE is supported by UKaid, the Global Green Growth Institute, United Nations Development Programme (UNDP) Ethiopia, and Japan. It was rolled out in 2011 by the prime minister of Ethiopia at the	**Agriculture:** Improving crop and livestock production practices for higher food security and farmer income while reducing emissions. **Forestry:** Protecting and re-establishing forests for their economic and ecosystem services, including as carbon stocks. **Electric Power:** Expanding electricity generation of renewable energy for domestic and regional markets. **Transport, Industrial Sectors, and Buildings:** Leapfrogging to modern and energy-efficient technologies.	2011 – 2025

TABLE 1. NATIONAL CLIMATE STRATEGIES AND PLANS

TITLE	OVERVIEW	GOALS, OBJECTIVES, OR PILLARS	TIMEFRAME
	Durban negotiations (COP 18).		
CRGE Sector Resilience Strategies (2015)	The sector resilience strategies are a part of the GoE's strategic vision outlined in the CRGE in response to the challenges of climate change and environmental degradation and to leverage the opportunities of green growth while reaching middle-income status by 2025.	**Agricultural and Forestry Climate Resilience Strategy:** Focused on the challenges faced in the agriculture and forestry sectors related to current and future climate; the options to cope with these challenges; and financial sources to fund these options. **Water and Energy Climate Resilience Strategy:** Focused on identifying the economic and social impacts of current climate variability and future climate change on water and energy; identifying priority ways that the water and energy sectors can build climate resilience and reduce the impact of climate variability and climate change; and mapping the necessary steps to finance and implement measures in the water and energy sectors to build resilience and deliver an integrated CRGE.	2015 – ongoing
Lima Declaration (2011)	In 2011, Ethiopia entered a strategic partnership with Norway and the United Kingdom to promote collaboration on climate change policy, focusing on preventing deforestation, strengthening adaptation capacity in agricultural and pastoral communities, and supporting disaster risk management. This partnership includes the European Union and the US government.	The partnership based on Ethiopia's CRGE will focus on:	2011 – ongoing

		• Continuing to build a strong CRGE facility that has world class processes and systems; including in monitoring, evaluation, and safeguards; and is well integrated with the regular public financial management system. • Supporting the full mainstreaming process of green growth and climate resilience objectives with Ethiopia's national development plan (GTP-II). • Ensuring gender equality in CRGE implementation. • Supporting efforts to build Ethiopia's institutional capacity both in the public sectors and with other partners to respond to climate change, in particular the continued development of the CRGE initiative. • Strengthening efforts to avoid deforestation and forest degradation, increase reforestation and afforestation, and promote sustainable management practices in forestry and agriculture. • Supporting participatory land use planning and sustainable resource management through benefit sharing. • Strengthening climate adaptation in agricultural and pastoral production systems, making them more productive and climate-resilient. • Strengthening food security and disaster risk management systems to protect the poorest and most vulnerable from climate shocks. • Supporting increased access to sustainable energy through the use of renewable energy resources and increased energy efficiency. • Strengthening open and transparent governance of natural resources to ensure maximum benefits for the Ethiopian people and for the global good. • Establishing appropriate and transparent measuring, reporting, and verification systems that harmonize with the provisions under the UNFCCC – including independent international verification – for greenhouse gas emissions, focusing initially on the forest, agriculture, and energy sectors. • Reducing biodiversity loss through conservation of biodiversity hotspots.	

TABLE 1. NATIONAL CLIMATE STRATEGIES AND PLANS

TITLE	OVERVIEW	GOALS, OBJECTIVES, OR PILLARS	TIMEFRAME
The Nationally Appropriate Mitigation Actions (NAMA) (2010)	NAMA is part of Ethiopia's CRGE initiative, which seeks to transform the country into a carbon-neutral green economy and attain lower middle-income status by 2025.	Established the intended nationally determined contribution and an approach for an environment financing mechanisms like the green climate fund. Some of the mitigation options described in the energy sector include: • Fuel switching to fuel types with lower emissions. • The use of efficient improved stoves by households to reduce charcoal consumption and conserve forests by reducing deforestation. • Improving the public transport system in Addis Ababa. • Improving vehicle efficiency. • Constructing an electric rail network for efficient freight transport[1]	2025
Ethiopian Program of Adaptation to Climate Change (EPACC) (2010)	The main objective of EPACC is to create the foundation for a carbon-neutral and climate-resilient path to development in the country. The program states that residents and farmers at the local and district levels will implement most of the solutions to climate change; thus, the role of the federal institutions will be to initiate, facilitate, and monitor activities, with the exception of some cases that need the intervention of the concerned federal organs.	The EPACC calls for the mainstreaming of climate change into decision-making at a national level and emphasizes planning and implementation monitoring. It identifies 20 climate change risks, mainly in the following areas: health risks (human and animal); agriculture production decline; land degradation; water shortages; biodiversity; waste; displacement; distributive justice. The EPACC also identifies institutions responsible for mitigating these risks. Specific adaptation objectives include: • Reducing impacts of droughts by seeding clouds with condensation-inducing agents, typically silver iodide, thereby causing the cloud's moisture to condense and fall, and increasing precipitation. • Establishing building and construction codes that ensure structures withstand extreme weather events.	Under implementation since 2011
Sustainable Land Management Program (2008)	The Sustainable Land Management Program addresses two of Ethiopia's most significant developmental and environmental problems: agricultural	The objective of the program was to reduce land degradation, improve agricultural productivity of smallholder farmers, and protect or restore ecosystem functions and diversity in agricultural landscapes. It consists of three parts:	2008 – ongoing

[1] NOTE: This may be considered realized since the Ethio-Djibouti rail is opening soon.

TABLE 1. NATIONAL CLIMATE STRATEGIES AND PLANS

TITLE	OVERVIEW	GOALS, OBJECTIVES, OR PILLARS	TIMEFRAME
	productivity and land degradation. The program is funded by the International Development Association and the Global Environmental Facility and was completed in September 2013. The Ministry of Agriculture and Natural Resources was the leading institution coordinating the program from the federal level down to the regional, woreda, and kebele levels, where the program has been implemented by regional Bureaus of Agriculture.	• Watershed management • Rural land certification and administration • Project management	
National Adaptation Program of Action (NAPA) (2007)	Frames priority adaptation programs/projects/activities. The document was developed to enable Ethiopia address its urgent and immediate adaptation needs caused by climate change and extreme weather events.	Identifying high-priority adaptation projects is the ultimate goal of the whole NAPA preparation process. The NAPA highlights several initiatives to address Ethiopia's vulnerability to the adverse impacts of climate change. The NAPA proposes an initial list of 37 activities that were further prioritized into 11 projects using a multi-criteria assessment approach. These projects focus on the following: • Human and institutional capacity building for implementation of policies and strategies • Improving natural resource management: programs that address climate change impacts. Vulnerability and adaptation measures should be treated as an integral component of programs utilization, development, and conservation. • Enhancing irrigation agriculture and water harvesting. • Strengthening early warning systems and awareness raising.	It is a process that needs to be incorporated in the overall development planning, including the design and implementation of projects and programs across relevant sectors.

Reference:

4. OVERVIEW OF PRIORITY DEVELOPMENT SECTORS AND CLIMATE CHANGE RISKS

Note: Please refer to the USAID Climate Change Risk in Ethiopia Fact Sheet for a full discussion of risk, impacts and vulnerabilities, and policy context.

4.1 ETHIOPIA'S CLIMATE

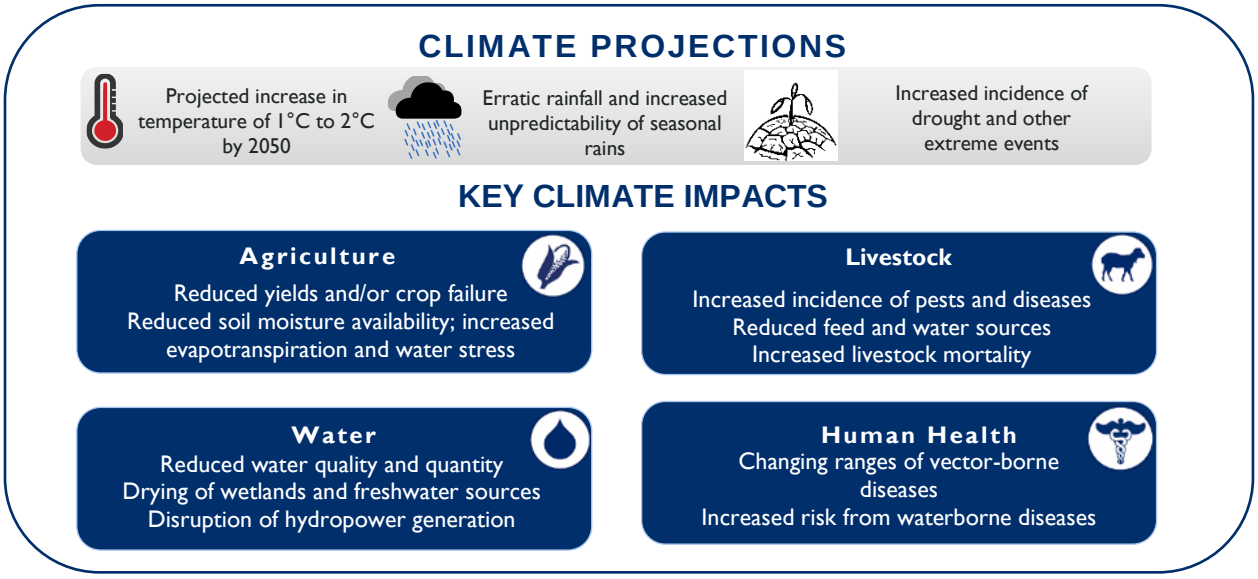
Around 45 percent of Ethiopia is a high plateau with mountain ranges divided by the East African Rift Valley. Almost 90 percent of the population resides in these highland regions, which have elevations greater than 1,500m above sea level. The surrounding lowlands (<1,500m) are mostly populated by pastoralists. Ethiopia's varied topography has traditionally been associated with three main climatic zones. These traditional agro-climatic zones are known as Kolla (warm semi-arid), <1,500m above sea level; Woinadega (cool sub-humid temperate zone), 1,500–2,400m above sea level; and Dega (cool and humid zone), mostly >2,400m above sea level. As the population increased and agricultural activities expanded, two more zones were added at the extreme ends of the agro-climatic spectrum. These are Bereha (hot arid) and Wurch (cold and moist) (Robinson, 2013). The highland areas of Ethiopia are potentially less vulnerable to climate change given the orographic effects on rainfall and temperature; however, this would likely increase pressure on the forests in those regions. The lowland arid areas will be subject to both reduced precipitation and increased temperatures; these trends are strongest in western and southwestern Ethiopia (Jury and Funk, 2013).

Much of Ethiopia is heavily dependent on rain-fed agriculture, and its geographical location and topography in combination with low adaptive capacity result in a high vulnerability to adverse impacts of climate change. The lowland arid areas of the country are expected to experience more significant changes in precipitation and temperature than the highland areas; as lowlands become less suitable for agriculture, pressure on highland ecosystems will increase as agriculture expands into more viable areas. Ethiopia's topography is characterized by large regional differences; it is considered an arid country, but precipitation trends exhibit high annual variability. Ethiopia has three seasons: June–September (kiremt), October–January (bega), and February–May (belg). Kiremt rains account for 50-80 percent of the annual rainfall totals, and most severe droughts usually result from failure of the kiremt. The lowlands in the southeast and northeast are tropical, with average temperatures of 25°–30°C, while the central highlands are cooler, with average temperatures of 15°–20°C. Lowlands are vulnerable to rising temperatures and prolonged droughts, while highlands are prone to intense and irregular rainfall (USAID, 2016a).

4.2 RISKS FROM CLIMATE VARIABILITY AND CHANGE

Regional projections of climate models indicate a substantial rise in mean temperatures in Ethiopia over the 21st century and an increase in rainfall variability, with a rising frequency of both extreme flooding and droughts due to global warming. These general patterns will not manifest uniformly across the country; for example, temperature increases are predicted to be most intense in the west, while somewhat less in the south and southeastern parts of the country. Similarly, rainfall is predicted to decrease most in the south and southwestern parts of the country, with a smaller decrease in the southeast. Rainfall in Ethiopia is highly erratic and most rain falls in convective storms, with very high rainfall intensity and extreme spatial and temporal variability. Since the early 1980s, the country has suffered eight major droughts (this includes the latest 2015–2016 drought), five of which led to localized famines, in addition to dozens of local droughts. Survey data show that between 1999 and 2004 more than half of all households in the country experienced at least one major drought shock. Major floods occurred in different parts of the country in 1988, 1993, 1994, 1995, 1996, and 2006. (Robinson, 2013). In particular, even though total rainfall is expected to decrease, it is expected to fall in larger events with potentially significant impacts related to flooding and landslides.

FIGURE 9. CLIMATE PROJECTIONS AND KEY CLIMATE IMPACTS



REFERENCE: USAID, 2016A.

TABLE 2. ETHIOPIA'S HISTORICAL AND FUTURE CLIMATE

HISTORICAL CLIMATE	FUTURE CLIMATE
Climate trends since 1960 include the following: • Mean annual temperature has increased by 1°C, an average rate of 0.25°C per decade, most notably in July through September. • The average number of "hot" nights increased by 37.5 percent between 1960 and 2003, while the average number of hot days per year increased by 20 percent. • More intense precipitation during extreme weather events, although long-term rainfall trends are difficult to determine. • The incidence of drought increased. • Belg rains are increasingly unpredictable.	**Future projections of temperature and rainfall patterns in Ethiopia exhibit a high degree of uncertainty, but most projections agree that:** • Mean annual temperature is projected to increase by 1°–2°C by 2050. • The frequency of hot days and nights will substantially increase. About 15–29 percent of days will be considered hot by 2060. • It is uncertain whether rainfall will increase or decrease; projections range from -25 percent to +30 percent by the 2050s. • Increases in the proportion of total rainfall that falls in "heavy" events, with annual increases of up to 18 percent.

Reference: USAID, 2016a.

4.3 IMPACTS ON ETHIOPIA'S PRIORITY DEVELOPMENT SECTORS

Ethiopia's priority development sectors, for the purposes of this report, are defined as not just the sectors within which USAID is programming, but the priority sectors for GTP-II. Table 3 summarizes the GTP-II priority sectors, USAID program areas, and CRGE pillars, and serves to demonstrate where there is alignment among each strategy or program's priorities.

TABLE 3. GTP-II PRIORITY SECTORS, USAID PROGRAM AREAS, AND CRGE PILLARS

GTP-II PRIORITY SECTOR	USAID PROGRAM AREA	ORIGINAL CRGE PILLARS*
Agriculture and Rural Transformation/Livelihoods**	Agriculture and Food Security, Feed the Future, Agriculture and Livelihoods Transformation (ALT) Food for Peace (FFP) – Productive Safety Net Program support (PSNP)	Agriculture, Forestry
Industry/Private Enterprise	Economic Growth and Trade	
Mining		
Energy (electricity) *[Hydro, Wind, Solar, Geothermal]*	Power Africa	Electric Power
Transportation / Infrastructure		Transport, Industrial Sectors, and Buildings
Education – Early Grade Reading Assessment	Education	
Health –Global Health Initiative (GHI)	Global Health and Nutrition	
Science and Technology		
	Democracy, Human Rights and Governance	
	Global Climate Change	
	Gender Equality and Women's Empowerment	
	Water, Sanitation and Hygiene (WASH)	
	Humanitarian Response	

*CRGE was originally developed around the four pillars of agriculture, forestry, energy, and transportation, but is now fully integrated into GTP-II through the CRGE Units that align with each priority sector.

**Includes crops, soil, livestock, natural resources management, forestry, disaster preparedness, land use

4.3.1 AGRICULTURE AND FOOD SECURITY

4.3.1.1 CLIMATE RISKS

Crop agriculture in Ethiopia is dominated by small-scale subsistence farmers who remain heavily dependent on rain (only 1 percent of cultivated land is irrigated), employ non-intensive technologies, and lack access to services. This leaves the sector highly vulnerable to changing rainfall and other climate patterns. Limited water storage capacity further increases vulnerability to climate risks. Many farmers grow slow-maturing, high-yield

"long cycle" crops that depend on two rainy seasons to reach harvest and are thus highly vulnerable to changes in seasonal rainfall. Most plots are less than 0.5 hectares and are insufficient to sustain household food security, much less generate adequate income, limiting household capacity to invest in improved farming practices that could increase climate resilience. Recurring drought and increasing desertification resulting from land use pressures have resulted in significant losses of arable land and rendered the country increasingly dependent on food aid. Crop productivity may increase in the short term due to warmer temperatures, but continued high temperatures will result in heat stress and crop failure. The southern Rift Valley and western Ethiopia are predicted to experience the most acute effects of reduced precipitation and higher temperatures. Two factors will further impact precipitation in Ethiopia – cool-moist transport of air from the Indian Ocean and moist transport from the Congo basin into southern Ethiopia will be disrupted influencing rainfall (Jury and Funk, 2015). While highland areas may initially be more resilient because orographic effects of rainfall will help mitigate overall precipitation losses, they will simultaneously become more vulnerable. As viable land for crops becomes scarcer in the lowlands, agriculture may expand into highland forests that are critical for hydrological cycle and provision of water downstream, not only within Ethiopia, but in neighboring countries. Livestock production will be impacted by changes in growth and quality of forage, shifts in composition of pasturelands that will be accompanied by change in nutritional value. Thus, with increasing frequency of drought, loss of livestock will be more likely as forage quality and quantity decrease (Thornton et al, 2009). By one estimate, Ethiopia will forgo more than 6 percent of each year's agricultural output if the current decline in average annual rainfall levels continues in the medium term (USAID, 2016a). Table 4 below outlines these risks to Ethiopian agriculture, the potential impacts, and several actions USAID could enhance to advance the adaptive capacity in Ethiopia.

TABLE 4. CLIMATE RISKS, POTENTIAL IMPACTS, AND ADAPTATION ACTIONS FOR AGRICULTURE

CLIMATE RISK	POTENTIAL IMPACTS	USAID ADAPTATION ACTIVITIES
Increased minimum and maximum temperatures **Increased intensity of precipitation events** **Drought and erratic rainfall**	Increased heat stress, evapotranspiration and reduced soil moisture content, negatively impacting crop yields Loss of arable land due to shifting agro-ecological zones Increased incidence of floods and landslides, damaging crops and increasing soil erosion Altered growing cycles (delayed planting and early harvests) Increased incidence of pests and diseases such as maize lethal necrosis, wheat rust, and fava bean leaf and stem gall	▪ Early warning systems (e.g., Famine Early Warning Systems Network) ▪ Income/livelihood diversification ▪ Off farm job creation initiatives at various scales ▪ Access to credit ▪ Savings and insurance schemes ▪ Use of drought-tolerant and early-maturing crops ▪ Higher education support on disaster risk reduction experts training ▪ Short-term technical assistance to government institutions – support EMA for climate services improvement ▪ Collaborating with the Ministry of Environment, Forests and Climate Change, Ministry of Industry, and the International Programme for the Development of Communication to support implementation of CRGE ministerial mandates ▪ Ad hoc sustainable land management practices are being implemented, such as: o Crop rotation o Diversification o Improved seed variety o Inter-cropping o Organic agriculture o Green manure/cover crops o Sustainable grazing management o Integrated crop-livestock systems o Agroforestry systems o Dedicated climate change units well versed in climate risks and potential adaptive measures ▪ Capacity building of agriculture extension agents ▪ Watershed management/restoration ▪ Water harvesting ▪ Small-scale irrigation ▪ Soil and water conservation ▪ Conservation agriculture ▪ Rangeland rehabilitation

4.3.1.2 ETHIOPIA'S APPROACH TO ADDRESS THESE RISKS THROUGH GTP-II

According to GTP-II, the agricultural sector development plan has the following objectives:

- Bring about accelerated and sustained growth of agriculture through the CRGE strategy that equitably benefits people and that realizes structural transformation of the sector and the overall economy;
- Bring about a significant shift in agricultural productivity and thereby enhance the contribution of the sector to the economy and stabilize the macro economy; and
- Enable women, youths, and other stakeholders to participate in development in a structured and organized manner and to benefit from their contributions.

Prior to being mainstreamed into GTP-II, the CRGE generated sector-specific plans outlining specific actions each sector would take to address climate risks. In the case of agriculture, the Agriculture and Forestry Climate Resilience Strategy for was launched in August 2015 along with the Water and Energy Climate Resilience Strategy, which collectively cover the agriculture, forestry, water, irrigation and energy sectors. Table 4 summarizes the adaptation actions USAID is taking to address the impacts of climate change to the agricultural sector, whereas Table 5 summarizes the adaptation actions Ethiopia is taking to address the impacts of climate change to the agricultural sector and the existing USAID flagship programs that can support these actions.

4.3.1.3 STRATEGIC RECOMMENDATIONS AND SPECIFIC ACTIONS

Given the importance of the agriculture sector to Ethiopia, action to address the risks climate change poses to their agricultural practices is already underway. USAID and other international donors have been instrumental to this and their continued support is crucial. Table 5 outlines several examples of the adaptation actions described in the *Agricultural and Forestry Climate Resilience Strategy* having relevance to several USAID flagship programs (e.g., Education, Global Health, Agriculture and Food Security, etc.) that traditionally do not incorporate climate considerations but have the potential to in the future.

TABLE 5. CRGE AGRICULTURE ADAPTATION ACTIONS AND SUGGESTED AREAS FOR USAID TO FURTHER INTEGRATE CLIMATE CONSIDERATIONS

THEME	PRIORITIZED OPTIONS	EXAMPLE INTERVENTIONS
Capacity Building and Institutional Coordination	Climate information, research, and enhanced coordination	Training and the use of networks to coordinate resilience responses between communities and delivery agencies. Also, research on climate, future climate change responses.
	Institutional strengthening and building	Ensuring the correct institutions are strengthened and built to influence uptake of resilience measures. A key area is land security.
Information and Awareness	Meteorological and agro-metrological data	Ensuring the collection and communication of data to farmers
	Agricultural research and development	Research programs to develop new seed varieties, test promising options, and monitor changes
	Enhanced extension services	Ensuring dissemination of information to promote effective climate resilience so that options can be implemented in the local context
Livestock	General animal and value chain improvements	Cooperatives, improved feeding systems, management techniques, improved extension services, livestock products processing/value addition
	Herd diversification	Changing to species that are more resilient to climate change, for instance, switching from cattle to sheep, goat, and camel
	Breeding programs	Breeding of climate resistant livestock, support breed improvement interventions for intensification, support the national Artificial Insemination (AI) service
	Improved animal health	Veterinary services, vaccines, changing practices
	Fodder and seed improvement and resilience	Addressing food shortage, forage development, natural pasture improvement, changing feeding practices, develop fodder and feedlot sector
	Rangeland rehabilitation and management	Rotation of grazing, promotion of stall feeding, natural pasture improvement, invasive species control and management
	Resilient animal housing	Shading and cooling, suitable housing for poultry farming

TABLE 5. CRGE AGRICULTURE ADAPTATION ACTIONS AND SUGGESTED AREAS FOR USAID TO FURTHER INTEGRATE CLIMATE CONSIDERATIONS

THEME	PRIORITIZED OPTIONS	EXAMPLE INTERVENTIONS
Sustainable Agriculture and Land Management	Conservation agriculture	Zero or low tillage, cover crops, crop residues for mulching and soil cover
	Soil and water conservation (SWC) structures	Bunds, trees, grass strips, contour leveling, terraces, shade trees, waterways, river and flood diversion for natural pasture recovery
	SWC cover crops and wild plants	Perennial grasses and legumes
	SWC water harvesting	River basin planning, improved land management
	Soil management	Residue and manure crop fertilization, agro-forestry, efficient use of fertilizers
	Land use planning and improved use right	Community based participatory NRM, improved access to key resources in the lowland supporting mobility
	Agroforestry	Integration of forage legumes into agro-forestry systems
Natural Resources Conservation and Management	Using forests for adaptation	Encouraging forest growth, removing incentives for deforestation, integrated land use planning, developing programs that focus on survival as part of GoE afforestation policy
	Resilience measures for forests	Support R&D, develop a national monitoring system for forests, ensure forest and species selected for afforestation and PSNP programs are resilient to changing climate
	Conservation and rehabilitation	Improving biodiversity while considering environmental needs for rehabilitation and what makes sense for economic income generation and ecosystem services; wetland protection
	Promoting biodiversity in agriculture	Control and management of pest and diseases, institutions for biodiversity promotion, regional level monitoring systems
	Payment for ecosystem services	Develop policy with a focus on watershed valuation of ecosystem services in regard to the supporting resilience to shocks and sustainability in the energy sector
Disaster Risk Reduction	Early warning systems	Enhancing drought and flood warning systems, flood forecasting and drought monitoring system, proper use of climate information, Behavioral Change Communication (BCC)
	Disaster risk management planning	Information, risk profiling, risk screening
	Structural protection	Natural and manmade approaches to stop floods (e.g., river dikes)
Social protection for high priority groups including women and children	Safety nets	Income supplementation, social support
	Asset creation and protection	Community assets, restoration of homes, food storage facilities
	Access to credit	Microfinance, improved information
	Livelihood diversification	Income diversification both on-farm and off-farm and livelihoods transition to off farm activities supporting effective rural-urban migration/urbanization and urban rural linkages
	Resettlement/migration	Relocation of vulnerable communities from areas of high climatic risk

CRGE Agriculture and Forestry, 2015.

4.3.2 EDUCATION

4.3.2.1 CLIMATE RISKS

Increasing temperatures in Ethiopia are expected to have a relatively minimal impact on education in the highlands of Ethiopia. The highest risk is likely in the lowlands where temperatures are already high and increasing temperatures may induce increased prevalence of heat stress. However, many of the schools in the lowland areas have flexible schedules, which allows for some mitigation of this risk. C**hanges in rainfall** are also likely to have a relatively minimal impact on education in Ethiopia, as most schools are closed during the rainy season. It is possible that projected shifts in the start or end of the rainy season or increased rainfall during the school year could affect access to schools owing to flooding (USAID, 2016b.).

Current levels of and projected increases in the frequency of **drought,** on the other hand, present the clearest climate risk to education in Ethiopia, especially primary school attendance in the lowland areas. For example, an estimated 2 million students out of a primary school population of 17–18 million were pulled out of school during the current 2015–16 drought, mostly in the lowlands. As a result, some youth migrated to growing urban areas within and outside of Ethiopia in search of job opportunities (Save the Children, 2016). While this presents a clear climate risk, it is unclear how important this risk is relative to other stresses on the education system (e.g., low literacy levels of parents, poor teacher training, lack of learning resources). The long term impacts of droughts on the literacy levels of Ethiopians, especially on those pulled out of school, are also unclear, especially as droughts occur infrequently. Furthermore, little is known concerning the impact of drought on the students who remain in school even as their families' livelihoods are negatively affected (e.g., students may remain in school but be undernourished) (USAID, 2016b). Table 6 outlines these risks to Ethiopian education, the potential impacts, and a variety of actions USAID could enhance to advance adaptive capacity for Ethiopia.

TABLE 6. CLIMATE RISKS, POTENTIAL IMPACTS, AND ADAPTATION ACTIONS FOR EDUCATION

CLIMATE RISK	POTENTIAL IMPACTS	USAID ADAPTATION ACTIONS
Increased minimum and maximum temperatures **Increased intensity of precipitation events**	Increased heat stress in lowland areas where temperatures are already high and are projected to increase	
	Access to schools (owing to flooding)	
	Primary school attendance in the lowland areas – students being pulled out of school during drought, potential low literacy skills in the long-term	

Shifts in the start/end of rainy seasons **Drought and erratic rainfall**	Undernourished children	• Improving the reading and writing skills of students in primary schools, with an increasing focus on vulnerable populations and traditionally underserved communities • Developing relevant national curriculum • Providing quality materials to support instruction and out-of-school activities • Improving the professional capacity of grade 1-8 teachers • Improving the planning and management capacity of the primary education system at national, regional, district, and community levels • Strengthening parental and community involvement • Introducing or strengthening climate resilient school and services construction design • Improving water, sanitation and hygiene (WASH) in school in collaboration with the Office of Foreign Disaster Assistance (OFDA), Economic Growth & Transformation (EG&T), Health, AIDS, Population and Nutrition (HAPN), and WASH activities • Incorporating Crisis Modifier intervention in the drought or flood prone areas to provide timely emergency response to school students as support for supplementary school feeding programs

It is possible that larger climate risks exist, but that these risks will materialize through other sectors (e.g., human health, livelihoods). Thus, while the direct risk to education may be minimal, indirect impacts may be larger. However, it is unclear if the climate risk, especially the indirect risk, is best addressed through the education system, or via other sectoral programs. This is especially true of the impact of droughts where most students are pulled from school owing to negative impacts on their families' livelihoods (most often agriculture) and not owing to a direct impact on the education system (USAID, 2016b)

4.3.2.2 ETHIOPIA'S APPROACH TO ADDRESSINGCLIMATE RISKS

The main objective of the education sector development plan within GTP-II is to ensure effective and efficient education and training systems that enhance quality, relevance, equity, and access at all levels. This will be achieved by building sectoral implementation capacity and the development of and adherence to competency criteria (National Planning Commission, 2016a). USAID's continued support to the Ministry of Education and donors to improve student learning outcomes is imperative to minimize the impacts of climate variability and change across the country.

4.3.2.3 STRATEGIC RECOMMENDATIONS AND SPECIFIC ACTIONS

There are a variety of education activities USAID has invested in already that are indirectly enhancing adaptive capacity throughout the country. However, there are a number of additional adaptation opportunities that could directly enhance adaptive capacity. Table 7 below lists several education strategies being undertaken via GTP-II and example methods for USAID to further integrate climate considerations.

TABLE 7. EXAMPLE GTP-II EDUCATION IMPLEMENTATION STRATEGIES AND METHODS FOR USAID TO FURTHER INTEGRATE CLIMATE CONSIDERATIONS

GTP II EDUCATION IMPLEMENTATION STRATEGIES	EXAMPLE METHODS FOR USAID TO FURTHER INTEGRATE CLIMATE CONSIDERATIONS
Curriculum Development, Technical and Vocational Education, and Training: Addressing the shortage of teachers across the country and linking the curriculum with technology, sustainable development, and national and international partnership principles. The public, the private sector, and other actors will work in a coordinated manner to ensure that the chamber of industries takes on the task of occupational standard development and certification.	Climate change issues could be addressed within the literacy materials developed for all levels of education. **Introducing primary students to issues associated with climate change early on** makes it more likely they will be able to adapt to its consequences later in life. **Include sustainability and resilience components into occupational standard development and certification.** Technical vocational education and trainings (TVET) could be supported technically to offer **short term off arm skill training required by employers in urban and pre-urban areas where drop out youth are migrating to or start their own business accessing finance from Microfinance Institutions (MFIs)** (e.g., hotel/restaurant management, woodwork, metal work, dress making, electronics maintenance, carpentry, missionary, petty trading, driving and maintenance, etc. **Encourage the integration of sustainability and resilience considerations into new technology development** (e.g., when new technology is developed, making sure it is energy efficient, minimizing GHG emissions, and resilient to a variety of climate impacts). This can spur innovation and economic growth in the technology industry. Given the uncertainty currently surrounding the impact of droughts, **the current systems developed to monitor the literacy rate of primary grade students could be compared to or supplemented by drought early warning systems to help develop a better understanding of the short-and long-term impacts of drought on the education level of students,** especially in the lowland areas.
Private Investments: Private investors will be encouraged to participate extensively in the education sector. **The necessary support and appropriate monitoring will ensure that standards and requirements are met.**	**Encourage private investors to integrate climate change mitigation and adaptation measures into education support and monitoring efforts** so as to further support the government's efforts for a climate resilient green economy. **Encourage experience sharing on adaptation and mitigation technologies or systems,** downscaled data and modeling techniques, incentives provision to private sector mainstreaming adaptation and mitigation, technical assistance and financing or Development Credit Authority (DCA) support for private sector implementing the CRGE.

TABLE 7. EXAMPLE GTP-II EDUCATION IMPLEMENTATION STRATEGIES AND METHODS FOR USAID TO FURTHER INTEGRATE CLIMATE CONSIDERATIONS

GTP II EDUCATION IMPLEMENTATION STRATEGIES	EXAMPLE METHODS FOR USAID TO FURTHER INTEGRATE CLIMATE CONSIDERATIONS
Workforce Skill Development: In order to improve the achievement of preparatory secondary school students admitted to higher education, universities and preparatory secondary schools will collaborate, with emphasis on improving achievement in mathematics and science. In addition, during the next five years, training programs will focus on science and technology fields and their quality will be improved to bring them on par with similar institutions in other countries. Special support will be given to science and technology universities and selected technology institutions.	Through increased focus on mathematics and science subjects in higher education, **adaptation and mitigation will bring new employment opportunities** (e.g., solar panel repair, adaptive farming practices), which could be harnessed, as appropriate.

All of these opportunities need to be evaluated in the context of their impact on the primary goals of USAID's education programs. Perhaps the best opportunities lie in potential synergies with other efforts (e.g., Productive Safety Net Program, FFP emergency programs) that could be harnessed in order to encourage families to keep their children in school during droughts (USAID, 2016b).

4.3.3 HUMAN HEALTH AND NUTRITION

4.3.3.1 CLIMATE RISKS

Climate change can have major direct and indirect effects on human health. It can alter the severity or frequency of health problems that are already affected by climate or weather factors and create unprecedented or unanticipated health problems or health threats in places where they have not previously occurred. Ethiopia already has a high incidence of climate-sensitive diseases. Roughly 70 percent of the population lives in malaria-endemic areas and outbreaks that occur every five to eight years account for up to 20 percent of deaths in children under the age of 5.

Increased temperatures will likely expand the range of malaria to highland areas, and increased **flooding** will facilitate the spread of waterborne diseases like cholera and dysentery. More than 70,000 deaths annually are tied to indoor and outdoor air pollutants, which a hotter, more drought-prone climate will aggravate. The link between **drought** and health is a major concern. Evidence suggests that children born during a drought are 36 percent more vulnerable to diseases and malnourishment. At present, one of the worst El Niño droughts in 50 years has left 10 million Ethiopians in need of emergency food aid and 5.8 million without access to water, sanitation, and hygiene services (USAID, 2016a). Given Ethiopia's vulnerability to diseases and health issues, climate change will only exacerbate and intensify the impacts that these diseases have on its citizens. It's important to note that some health issues are likely to be more sensitive to climate change than others, however, additional research would help to refine this conclusion. For example, health issues related to vector and water borne diseases and malnutrition may be more likely to be impacted by changes in the climate (e.g., higher temperatures, changes in precipitation patterns, etc.) than health issues related to HIV/AIDS. Additional research in this area would help USAID prioritize its investments in climate and health. Table 8 below outlines these risks to human health and nutrition, the potential impacts, and several actions USAID could enhance to advance the adaptive capacity in Ethiopia.

TABLE 8. CLIMATE RISKS, POTENTIAL IMPACTS, AND ADAPTATION ACTIONS FOR HUMAN HEALTH AND NUTRITION

CLIMATE RISK	POTENTIAL IMPACTS	USAID ADAPTATION ACTIONS

Increased temperatures	Expansion of range of malaria to highland areas	• Improve health outcomes through strengthened health systems
		  ○ Bolstering the health of women, newborns, and children by combating infectious diseases
		  ○ Providing quality health services in an integrated way that treats all the health needs of a person in an effective and efficient way
		• Health extension worker program
		• Integrated health care program
		  ○ Improving maternal, neonatal, and child health
		  ○ Voluntary family planning and reproductive health
		  ○ Preventing, controlling, and treating infectious diseases including HIV/AIDS, tuberculosis, and malaria
		  ○ Increasing access to clean water and sanitation, improving behavior to use water and sanitation services
		  ○ Improving the nutritional status of women, infants, and young children
		• Family planning
		• Malaria
		• Maternal and child health
		• Nutrition
		• Tuberculosis
		• WASH

Increased intensity of precipitation	Increased incidence of waterborne illnesses, such as diarrhea, cholera, and dysentery	
Increased variability of rains, especially the belg	Aggravation of respiratory diseases caused by allergens and air pollution	
Recurrent drought	Increased malnutrition, exacerbating vulnerability to diseases	
	Negative implications for the productivity of agricultural workers when heat waves coincide with the key stages of crop development	

Reference: (USAID, 2016a.; USAID, 2015e;, and USAID 2016c.)

4.3.3.2 STRATEGIC RECOMMENDATIONS AND SPECIFIC ACTIONS

The general objective of the health sector development plan for GTP-II is to improve the health outcomes of citizens through provision of equitable, accessible, and quality health services and to enhance public awareness so that citizens can protect themselves from various health hazards (National Planning Commission, 2016a).USAID continues to support the Ministry of Health in achieving these objectives. Overall, the best opportunity to enhance adaptive capacity is to ensure that as the health system is strengthened, climate is considered. More specifically, and as stated in GTP-II, the government is planning to implement several strategies that could be enhanced through USAID's continued support and climate integration, as described in **Table 9**.

TABLE 9. EXAMPLE GTP-II HEALTH IMPLEMENTATION STRATEGIES AND METHODS FOR USAID TO FURTHER INTEGRATE CLIMATE CONSIDERATIONS

GTP II IMPLEMENTATION STRATEGIES	EXAMPLE METHODS FOR USAID TO FURTHER INTEGRATE CLIMATE CONSIDERATIONS
Skill Development, Staff Retention, and Training: Improve the number and skills, the mix of professionals, and the management of health workers through the full implementation of the second phase of the health extension program; reduce the turnover of health professionals. Training of health professionals will be undertaken to increase their numbers significantly.	**Increase training for health extension workers on the connection between climate and malaria** to strengthen the health monitoring system. This could allow the detection of malaria cases to occur earlier, allowing support to be directed to suppressing local outbreaks before they begin. **Enhance storage capacity for medicines and vaccines in areas that are subject to higher temperatures.** Temperature increases will affect the efficacy of medicines and vaccines unless proper storage with cooling facilities are in place.
Private Investments: Increase support to private investors to establish highly specialized hospitals and increase their participation in the pharmaceutical industries, production of medical equipment, and in other areas with service gaps; various incentives and motivational systems will be implemented in accordance with the government's investment policy.	**Encourage private investors to integrate climate change mitigation and adaptation measures into investments** so as to further support the government's efforts for a climate-resilient green economy. **Review infrastructure design and engineering standards for new hospitals** to identify where climate projections, greenhouse gas emission reduction, and resiliency measures can be incorporated.
Health System Transformation: Provide quality health service to all citizens at any time regardless of socioeconomic status and place of residence, which includes transforming health service delivery, analyzing the partnership with the community and institutions, and understanding the characteristics of the community and the patient in depth.	**Leverage the access of health services to all citizens and network** to provide critical services and materials in the event of a climate-related disaster. With improved access to services during disasters, adaptive capacity can be strengthened. To **improve access for health services in rural areas** where the government system is not as strong, private health services could be used through a voucher system to address vulnerable populations utilizing the crisis modifier model that is frequently used in the livestock sector.
Data Collection and Information Management Systems: Strengthen survey and surveillance systems, build research capacity in health or other relevant disciplines, and revolutionize information management through improvement of access and organization of data.	**Early warning systems that depend on the provision of accurate, timely, and relevant information** could be leveraged to include climate change information packaged for health extension workers. Health monitoring systems designed to detect and address specific diseases could be tweaked to **record information necessary to learn more about how environmental factors affect outbreaks of these diseases.**

Reference: FDRE, 2016a; and USAID, 2016b.

4.3.4 INFRASTRUCTURE (INCLUDES POWER GENERATION)

4.3.4.1 CLIMATE RISKS

Climate change poses a series of interrelated challenges to critical infrastructure in Ethiopia. Both urban and rural populations depend on infrastructure, like water and sewage systems, roads, bridges, buildings and power plants that are already aging and in need of repair or replacement. Much of Ethiopia's long-lived infrastructure will be vulnerable to the potentially harsher climate of the future. **Increasing temperatures** are likely to induce uneven risk to infrastructure, including for power generation. A study of the impact of climate change on Lake Tana indicated that more than 60% of the hydrological loss is related to evapotranspiration (Setgen SG, et al. 2011). Generally speaking, increasing surface air temperatures will result in higher rates of evapotranspiration, thus impacting the volume of surface water bodies as well as recharge of groundwater. Risks from climate change are likely to be highest in the lowlands where temperatures are already the highest. While increased temperatures are likely to result in increased evaporation, especially from large hydropower dam reservoirs, this risk is likely to be low relative to other risks and stresses.

Changes in rainfall, especially increases in extreme precipitation events, may induce some climate risk to infrastructure, especially in flood-prone areas. Changes in rainfall variability are likely to induce only low levels of climate risk. In terms of power generation, Ethiopia is highly dependent on hydropower, which could be at climate risk depending on the net change in rainfall and evapotranspiration rates in a particular area. However, other renewable energy sources, such as solar and geothermal, are unlikely to be affected significantly by changing rainfall patterns, and therefore may mitigate some of the climate risk to Ethiopia's power generation through diversification.

The actual impacts of **drought**, both current and possible increases in frequency, on hydropower infrastructure are somewhat unclear. Depending on the location, groundwater infiltration rates, and changes in surface and groundwater usage, the impact will vary. A regional drought, especially increases in the frequency of such a drought, likely would have a significant impact on Ethiopia's ability to generate hydropower. However, localized droughts in the lowlands are less likely to impact hydropower, as most of the country's rain falls in the highland areas. Other types of renewable energy are less likely to be affected by increases in the frequency of drought.

Depending on geography, **high wind and storms** could induce a low level of climate risk; however, it is unclear how winds and storms will change, and thus the future climate risk to infrastructure is unknown (though it is likely to remain relatively low in most parts of Ethiopia). It is possible that changes in wind velocity could affect power generation from wind, but this climate risk is likely to be low relative to other stresses (USAID, 2016b). Table 10 below outlines these risks to Ethiopian infrastructure, the potential impacts, and several actions USAID could enhance to advance the adaptive capacity in Ethiopia.

TABLE 10. CLIMATE RISKS, POTENTIAL IMPACTS, AND ADAPTATION ACTIONS FOR INFRASTRUCTURE

CLIMATE RISK	POTENTIAL IMPACTS	ADAPTATION ACTIONS
Increased minimum and maximum temperatures **Increased intensity of precipitation events** **Drought and erratic rainfall**	Increased heat stress, evapotranspiration – especially from large hydropower dam reservoirs and ponds, water supply dams in the lowlands	• Diversification of energy sources to solar, wind, geothermal (Power Africa) • Watershed management to reduce siltation of water reservoirs. (Since siltation decreases the surface area of the reservoirs and increases evapo-transpiration, lake Alemaya in Oromia region dried up because of this reason)
	Flooding where infrastructure resides in flood-prone areas	
	High dependence on hydropower for base load power could induce significant climate risk in Ethiopia's energy production sector as rainfall becomes more variable and less predictable	
	Depending on the location of the drought, underlying geologic material, and changes in usage, the impacts will vary	
	A regional drought, especially increases in the frequency of such a drought, likely will have a significant impact on Ethiopia's ability to generate hydropower	

The overall climate risk to infrastructure in Ethiopia, including power generation, is likely to remain low, at least in terms of how USAID/Ethiopia is currently programming in this area. In terms of general infrastructure development, USAID/Ethiopia programs in this area small component of its sectoral programming. It is possible that in some geographies and under some contexts climatic factors will need to be considered within the structural design, but a changing climate is unlikely to significantly change design criteria. Similarly, in the past few years the government of Ethiopia has recognized the climate sensitivity of hydropower, and so has sought to diversify its energy generation portfolio. As a result, USAID/Ethiopia's Power Africa portfolio now focuses more on other sources of renewable energy sources such as solar and wind, which are at much lower risk from climate change (USAID, 2016b.).

4.3.4.2 ETHIOPIA'S APPROACH TO ADDRESS CLIMATE RISKS

Ethiopia seems to be proactively considering how to best address climate risks to its power generation system. For example, the government is already developing a plan to use wind and solar power, when available, to save water behind the hydropower dams to preserve base load energy generation capacity in the face of declining reservoir levels. As Ethiopia's large-scale energy generation relies on clean, renewable energy, improvements to the energy generation and distribution system could help reduce Ethiopia's GHG emissions by displacing diesel generators as well as reducing Ethiopia's dependence on biomass-based fuels (USAID, 2016b).

4.3.4.3 STRATEGIC RECOMMENDATIONS AND SPECIFIC ACTIONS

USAID Ethiopia does not work on infrastructure directly; however one component of the GTP II focuses on industry and infrastructure with a goal to build the capacity of the domestic construction industry and bridge critical infrastructure gaps. Some USAID/Ethiopia programs (e.g., FtF, Health) have infrastructure as a

component of their projects. Similarly, Power Africa works on both transactions and the enabling environment to increase the generation of renewable energy in Ethiopia.

In the face of a changing climate and in an effort to increase resilience from shocks, it is important to find ways to protect the energy infrastructure. Although the current USAID/Ethiopia portfolio does not necessarily consider this resiliency as it relates to IR1.4, it is an area where there is need and could also be partly linked to more traditional resiliency activities in which USAID/Ethiopia is already engaged, such as watershed protection and reforestation.

Degradation of lands around hydropower resources is one threat that is also linked to resiliency and that may become more pronounced with climate change. The implications of this interaction were visible during Assessment Team visits to hydropower-producing regions. In the Gibe watershed, the landscape was highly eroded, and the river itself was extremely sedimented (Devi et al., 2008). Sedimentation results in silting of dams, reducing the dams' lifetime (Demissie et al., 2013). Land degradation amplifies runoff events in place of infiltration of water and slow release into streambeds (Vogl et al., 2016). These factors lead to energy infrastructure having to withstand extremes in flow (high and rapid waters in the rainy season and little water in the dry season). Other watersheds nearby with protected sources, such as the Gojeb River (protected by the Kaffa Biosphere Reserve and the Bonga National Forest Priority Area), are comparably unsilted and have regulated flow over the course of the year. In one study of five hydropower systems in India, soil and water conservation measures led to a 44 percent reduction in sediment transport (Vogl et al. 2016).

Since water is a critical input to most types of energy production, the energy sector can be fortified against threats described above through improved watershed management and restoration, reducing the likelihood of damage during their 20-50 year lifespans. Risks from shocks and disasters can also be mitigated by diversifying energy sources, improving the transmission grid, and integrating climate-resilient design into infrastructure planning. One opportunity for USAID to enhance adaptive capacity of Ethiopia's infrastructure sector includes continued support for diversifying to solar and wind. This approach not only reduces greenhouse gas emissions, but can minimize the impacts of changing rainfall patterns on hydropower generation (USAID, 2016b). USAID is already looking at means by which Power Africa can contribute to clean energy development in Ethiopia and across the region as part of the East African Power Pool, where the principles of payment for ecosystem services and watershed rehabilitation can be applied. Power Africa could also assist with creating incentives for ecosystems services in independent power producers design. Power Africa in Ethiopia is currently contributing to development of new laws and regulations that will facilitate private-sector investments in geothermal, solar, wind, hydro, and biomass projects. Power Africa is also assisting in the planning, operation, and maintenance of generation, transmission, and distribution systems and improving GoE contracting for supply, installation, and construction to ensure full realization of lifecycles for equipment and facilities. Pilot projects to demonstrate how to integrate watershed management into new power projects could be another area for Power Africa to focus on.

Strategic recommendations include:

- Capacity building for design and engineering of climate-resilient infrastructure that accounts for variability in rainfall intensity.
- Technical assistance for climate-resilient design and engineering of priority domestic infrastructure;
- Provide technical assistance on strategic planning for fortifying Ethiopia's electrical transmission network to mitigate GHG emissions through more efficient transmission of power as well as enhancing the adaptive capacity of the grid;
- Enhance adaptive capacity of Ethiopia's infrastructure sector include continued support for diversifying to solar and wind, especially in light of potential future impacts on hydropower generation;
- Support and promote watershed restoration as an adaptation mechanism to protect the longevity of infrastructure located in lower watersheds.

4.3.5 GOVERNANCE, PEACE, AND SECURITY

4.3.5.1 CLIMATE RISKS

Field observations have shown that **increased temperatures** and drought result in reduced availability of pasture and water which causes abnormal migration of pastoralists and their herds, which ultimately causes conflict within pastoralists and neighboring farming communities and pastoralists. Most of the climate risk at the strategic level is likely to result through local conflicts, which are most often due to the limited availability of natural resources. As increasing temperatures may decrease the availability of soil moisture, reduced pasture in lowlands areas could result in increased local conflict between pastoralists and farmers. Similarly, the general negative impacts on livelihoods associated with increased temperatures (most likely to materialize through agriculture) could lead to increased dissatisfaction with the government. It is likely that this climate risk is relatively higher in the lowlands where natural resource management conflicts are already more prevalent.

Similar to temperatures, **changes in rainfall, including increased variability and frequency of extreme events,** are likely to affect governance, peace, and security through impacts on natural resources. Decreased rainfall and decreased grassland productivity owing to a delay in the start of the rainy season could induce local conflicts over limited natural resources as pastoralists seek new grazing areas for their livestock. Increased flooding could also negatively impact the availability of natural resources, resulting in increased conflict. These risks are likely higher in the lowland areas.

Drought offers a clear risk to governance, peace, and security especially in the lowlands, though the pathways are likely to be complex. Drought results in decreased availability of natural resources, which, given the reduced ability of pastoralists to migrate, is likely to result in increased localized conflict. Through its impact on general livelihoods, especially in lowland areas, drought might also increase the general discontent of populations with the current government.

Table 11 below outlines these risks to governance, peace and security, the potential impacts, and several actions USAID could enhance to advance the adaptive capacity in Ethiopia.

TABLE 11. CLIMATE RISKS, POTENTIAL IMPACTS, AND ADAPTATION ACTIONS FOR GOVERNANCE, PEACE AND SECURITY

CLIMATE RISK	POTENTIAL IMPACTS	USAID ADAPTATION ACTIONS
Increased minimum and maximum temperatures **Increased intensity of**	Limited availability of natural resources (higher in lowland areas where conflicts over natural resources are already more prevalent)	Strengthening social cohesion, peacebuilding, and collaboration among pastoral and agricultural communities in southern Ethiopia (SNNP and Oromia regional states) through sustainable natural resource management, fodder production, land use agreements, and livelihood opportunities, strengthening customary NRM system.

precipitation events **Drought and erratic rainfall**	Decreased availability of soil moisture, reduced pasture and water supply in lowland areas (resulting in increased local conflict between pastoralists and farmers)	Mitigating identified and existing risk factors, within the Borena Zone, that will likely trigger or drive potential conflict and to increase the capacity and confidence of households, communities, and customary/formal institutions to become more adept and resilient in anticipating, absorbing, and recovering from future shocks.
	General negative impacts on livelihoods associated with increased temperatures (most likely to materialize through agriculture and livestock production) could lead to increased dissatisfaction with the government	Supporting communities and Gambella's regional and local governments to promote peacebuilding and stability in western Gambella's Akobo and Wantowa woredas though inter-communal dialogue, good governance, and diversified livelihood opportunities. Strengthening the institutional capacity of local Ethiopian organizations partnering directly with USAID for the first time in the areas of financial management, activity management, and monitoring and evaluation skills through USAID Forward.

4.3.5.2 STRATEGIC RECOMMENDATIONS AND SPECIFIC ACTIONS

USAID/Ethiopia works mostly in localized conflict in the lowland areas, on the rule of law, and more widely on conflict sensitive development programming (e.g., do no harm approach) to make sure that their development initiatives will not be a source of conflict between communities. Localized conflicts associated with limited natural resources in the lowland areas tend to occur during insufficient rainfall or drought, when pasture and water availability decrease below sufficient levels. They also tend to occur as a result of boundary issues among different bordering tribes following the restructuring of administrative boundaries. That said, increases in the frequency of droughts and/or insufficient rainfall will likely contribute to increased incidence of localized conflict. There is also the potential for peace and security to be undermined by a general decrease in livelihoods associated with the negative impacts of climate change, especially on agriculture, which may result in increasing dissatisfaction with the government. However, the relative importance of this climate risk is extremely difficult to estimate, and likely extends beyond USAID's manageable interest. It should also be noted that the pathways through which climate affects conflict are complex, poorly understood, and context-dependent. For example, changes in climate are likely to be having a larger impact on pastoralist communities owing to other changes in Ethiopia that restrict the ability of these communities to migrate to new pastures (USAID, 2016b).

Adaptive capacity as related to localized conflicts derives from a number of sources. For example, adaptive capacity can derive from programs like the PSNP, which seeks to address environmental factors (e.g., poor land management) that contribute to limited natural resources availability. By making the lowland ecosystems more resilient to changes in climate, USAID/Ethiopia's programs are already working to mitigate future conflicts. Similarly, some local systems exist to mitigate and mediate conflicts as they arise, though the general governance capacity in the lowland and pastoralist areas is lower than in other parts of the country. In GTP-II, the government of Ethiopia recognizes that improved governance is essential criteria for achieving its development objectives (USAID, 2016b).

A number of opportunities exist with the governance sector, many of which USAID/Ethiopia is already taking advantage of. Given that most localized conflicts occur in the lowland areas and are associated with limited natural resources, improved governance of those resources could go a long way toward reducing the incidence

of conflict. Such management needs to be flexible enough to not only effectively deal with current climate, but also future climate as well. Such governance frameworks need to be able to address both normal interannual variability, as well as significant crises, such as the current 2015–16 drought. Such flexible management systems could help build the general capacity of lowland populations to deal with all conflicts, including those derived from non-natural resources sources. These governance programs could be more explicitly tied to other assistance programs that seek to address the underlying causes of the localized conflicts (USAID, 2016b).

4.3.6 DISASTER RISK READINESS

4.3.6.1 CLIMATE RISKS

The majority of disasters that occur in Ethiopia are climate-based, such as drought and flooding. The highland areas are impacted by floods, while the lowland areas are impacted by both floods and droughts. Flooding is often localized and short-term, while droughts can extend over much larger areas for longer periods of time. The overall climate risk to disaster risk readiness in Ethiopia closely resembles the climate risk in lowland areas to agriculture. Drought is the largest driver of disasters in Ethiopia, and predominately negatively affects the lowland areas, which receive less rainfall. This risk is likely to increase as the frequency of drought increases, reducing the resilience capacity of Ethiopian populations and systems. There is also the potential for an increased localized risk from flooding disasters in both the highland and lowland areas owing to an increasing frequency of extreme events. However, these flooding disasters are likely to be more localized in impact and occur over shorter time scales. Given that drought is typically a slow onset disaster and flooding is a fast onset disaster, they will likely require different types of disaster risk readiness (USAID, 2016b). Table 12 below outlines these risks to disaster risk readiness, the potential impacts, and several actions USAID could enhance to advance the adaptive capacity in Ethiopia.

TABLE 12. CLIMATE RISKS, POTENTIAL IMPACTS, AND ADAPTATION ACTIONS FOR DISASTER RISK READINESS

CLIMATE RISK	POTENTIAL IMPACTS	USAID ADAPTATION ACTIVITIES
Increased minimum and maximum temperatures **Increased intensity of precipitation events** **Drought and erratic rainfall**	If temperatures rise to the point where crop failure (owing to either reduced soil moisture, increased pest prevalence, or crop temperature thresholds being reached) increases	• Enhancing drought and flood warning systems, flood forecasting and drought monitoring system, proper use of climate information • Information gathering/data collection, risk profiling, risk screening • Natural and manmade approaches to stop floods (e.g., river dikes) • Investments in the Pastoralist Areas Resilience Improvement Market Expansion (PRIME) and PSNP • Promoting sequencing, layering, and integrating emergency and development intervention under different sectors for resilience (within and outside USAID investments)
	Impacts on agriculture in lowland areas from drought	
	Increases in the frequency of extreme events may both affect agricultural productivity and increase localized flooding	
	Increases in the frequency of drought events could greatly reduce the capacity of local communities and the systems they rely on	
	Increased incidence of pests and diseases such as maize lethal necrosis, wheat rust, and fava bean leaf and stem gall	

4.3.6.2 ETHIOPIA'S APPROACH TO ADDRESS CLIMATE RISKS

According to GTP-II and CRGE, Ethiopia is taking several actions to enhance resilience to disasters such as floods, drought, and heatwaves. These include, but are not limited to the following:

- Enhancing drought and flood warning systems, improving flood forecasting and drought monitoring system, and enabling the proper use of climate information
- Information gathering/data collection, risk profiling, risk screening
- Natural and manmade approaches to stop floods (e.g., river dikes)

4.3.6.3 STRATEGIC RECOMMENDATIONS AND SPECIFIC ACTIONS

Significant opportunities exist within the framework of disaster risk readiness, many of which USAID/Ethiopia is already aware of and implementing. The PSNP is an excellent example of this. PSNP has been considering not just climate variability but also projected changes in climate for several years. Similarly, improved climate and weather prediction, especially as associated with the impacts of large-scale events like El Niño and La Niña, may provide better warning of the conditions that are likely to lead to significant drought in Ethiopia. Flooding disasters are harder to predict, but better hydrological modeling could help the government of Ethiopia provide at least some warning to downstream communities, as well as target relief efforts once flooding has occurred. The biggest opportunities here likely relate to other sectors. For example, improved disaster risk readiness could work to ensure that primary level students remain in school during droughts, and that nutrition is properly maintained. Similarly, disaster risk reduction could be combined with the governance programs to ensure conflict does not increase during droughts (USAID, 2016b).

5. STRATEGIC RECOMMENDATIONS AND SPECIFIC ACTIONS

Based on the information collected through the conduct of this assessment, in Table 13 we have summarized the following strategic recommendations and specific actions necessary to enhance Ethiopia's adaptive capacity and integrate climate considerations into US investments:

TABLE 13. STRATEGIC RECOMMENDATIONS AND OPPORTUNITIES FOR USAID/ETHIOPIA MISSION

STRATEGIC RECOMMENDATION	OPPORTUNITIES FOR USAID/ETHIOPIA MISSION
1. Prioritize interventions which will reduce GHG emissions within the sector.	• Implement projects with a low carbon footprint, or with offsets for emissions • Once Ethiopia establishes a national cap on GHG emission or other limiting regulations, establish a framework for carbon accounting and emissions trading between projects within Ethiopia
2. Support the monitoring and evaluation of the effectiveness of GTP-II and its subsequent implementation at the zonal, woreda, and kebele levels using sustainable development goals and GTP-II indicators.	See August 2016 USAID/Ethiopia Tropical Forest and Biodiversity (FAA 118/119) Assessment
3. Continue to promote CBNRM especially that is inclusive of payment for	

TABLE 13. STRATEGIC RECOMMENDATIONS AND OPPORTUNITIES FOR USAID/ETHIOPIA MISSION

STRATEGIC RECOMMENDATION	OPPORTUNITIES FOR USAID/ETHIOPIA MISSION
ecosystem services that moves toward minimum standards for REDD+ accounting, and finds mediated approaches for adherence to mutually agreed upon use of natural resources.	
4. Promote development and diversification of the economy through support to SME focused on green business, financing options, interest free lending, and banking solutions across all SME investments.	
5. Continue support to and alignment with Ethiopia's GTP-II for integration of climate resilience (adaptation) and green economy (mitigation) into development objectives.	**EDUCATION** • Integrate climate change issues into literacy materials developed for primary education. • Youth workforce skill development (e.g., solar panel repair, adaptive farming practices) on less climate sensitive off farm activities to help the transition out/permanent migration efforts. • Monitoring and evaluating the literacy rate of primary grade students (to better understand the short- and long-term impacts of drought on the education level of students in the lowland areas). • Identification of synergies with other efforts (e.g., PSNP, FFP emergency programs) to encourage families to keep their children in school during droughts (e.g., programs that tackle the root cause of students being pulled out of school). **HEALTH AND NUTRITION** • Malaria early warning system to (in addition to detecting outbreaks) record information necessary to learn more about how environmental factors affect outbreaks of diseases. • Increased training for health extension agents on the connection between climate change and malaria. • As the overall Ethiopian health system is strengthened, include climate considerations where appropriate (see Human Health and Nutrition Section 4.3.3).

TABLE 13. STRATEGIC RECOMMENDATIONS AND OPPORTUNITIES FOR USAID/ETHIOPIA MISSION

STRATEGIC RECOMMENDATION	OPPORTUNITIES FOR USAID/ETHIOPIA MISSION
6. Continue supporting efforts working to minimize crises and conflict and enhance resilience.	• Proactively increase the ability to respond to and mitigate the negative consequences of drought, especially in the lowland areas. • Increase the resilience of both local populations and the natural resources upon which they depend. • Implement drought early warning systems that predict the conditions likely to result in the onset of drought. • Enhance the capacity to significantly scale up safety net programs over short periods of time. • Improve governance of the limited natural resources in the lowland areas (where most localized conflicts occur) to reduce the incidence of conflict. • Flexible management of natural resources to effectively deal with current and future changes in the climate and build general capacity of lowland populations to deal with all conflicts (including those with human causes). • Governance frameworks to address both normal inter-annual variability and significant crises (e.g., 2015–16 drought).
7. Support investments in science, data, tools, and technology needed to implement Ethiopia's GTP-II at multiple scales.	• Strengthening research and data collection to support planning and implementation of adaptation strategies. • Improve decision-making tools related to climate change impacts to better target interventions in vulnerable areas, sectors, and groups. • Fundamental research on analyzing the integrated response of different sectors to climate change.
8. Improve coordination for resilience within and outside USAID.	• Enhance coordination within USAID under the new system established and staffed to coordinate resilience efforts. • Improve coordination outside the mission through strengthening existing national and regional platforms under Rural Economic Development Food Security (RED-FS) sector working groups through partnership and technical assistance.

Although Ethiopia has shown considerable leadership and movement towards the development of policies, strategies, and sector-based planning and implementation for a climate-resilient green economy, the actual implementation and monitoring of the initiatives has been slow. In order for Ethiopia to successfully achieve its vision to become a lower middle-income country by 2025, reduce its overall greenhouse gas emission levels

by an aggressive 64 percent relative to 2010 levels, and enhance its overall resilience, considerable steps and action need to be taken on implementation. In addition, in order for the government to avoid indirectly increasing GHG emission and maladaptation, strict measurement, reporting, and verification mechanisms need to be established and enforced, especially when private sector industries begin investing in Ethiopia. Additional gaps include the following:

Insufficient and uncertain data: Data inventory particularly with regard to potential emissions from different sectors needs improvement to reduce uncertainties; most data are acquired from secondary sources that are not up-to date and this most likely creates uncertainties. In regards to data necessary for Measurement, Reporting and Verification (MRV), the Enhancing Capacity for Low Emission Development Strategies (EC-LEDS) initiative is starting to work on rendering emission reductions measurable, reportable, and verifiable for several countries in Africa and elsewhere. Information gathered through this initiative will help with the lack of sufficient and uncertain data for mitigation, but it's unclear as to what scale the data is being provided (e.g., national, regional, or local).

Lack of data sharing scheme: There is also a need to develop agreements on the confidentiality and level of data sharing with the industrial and manufacturing associations in Ethiopia, since data on industrial processes and product use are usually confidential. It should be noted that EC-LEDS is starting to work on this through embeds at the Ethiopian Ministry of Industry (MOI) and the Industrial Parks Development Corporation (IPDC).

Adaptive capacity: Adjustments may be needed to optimize climate change adaptation gains from ongoing initiatives and to ensure coordinated implementation of these initiatives. According to the Second National Communication delivered to the UNFCCC, barriers to enhanced adaptive capacity include:

- Inadequate current and reliable impact assessments for some of the sectors;
- Inadequate overall coordination mechanisms both at the federal and regional levels;
- Inadequate guidelines for mainstreaming climate change adaptation into the relevant policies and programs;
- Inadequacy of cross-sectoral links between ministries, departments, and agencies;
- Inadequate linking elements such as cross-sectoral federal committees;
- Low levels of capacity at different levels, including the absence of a center or an institution for research and development on climate change adaptation;
- Inadequate outreach to involve local communities in environmental decision-making;
- Neglect of the long-term environmental impacts of activities with short-term economic benefits;
- Economic challenges, i.e., limited finance for environment and climate change;
- Low levels of awareness and public literacy; and
- High levels of poverty.

For Ethiopia to realize the gains of climate change adaptation and related initiatives, the above barriers, among others, need to be addressed.

6. APPENDICES

6.1 BIOGRAPHICAL SKETCHES OF TEAM MEMBERS

Ms. Emily Wasley – Ms. Wasley (The Cadmus Group, Inc.) is a senior climate risk and resilience specialist and serves as Director of Cadmus' Climate Security, Adaptation, and Resilience (CSAR) Initiative. Ms. Wasley has more than 10 years of experience working with a variety of private, nonprofit, academic, and government organizations on domestic and international climate change research, policy, and strategy. Her expertise lies within the climate adaptation and resilience space—conducting exercises, translating science, and identifying co-benefits and dual adaptation and mitigation strategies to enhance community resilience. Through her role as director of CSAR, Ms. Wasley plans and leads projects to prepare for and respond to the impacts of global and climate change for federal, regional, state, and local governments and organizations. This involves providing expertise on issues such as climate impacts, risks, and adaptation under various future scenarios affected by global climate change. She leads integrated project teams with a range of technical, scientific, and policy expertise. In her previous role as the Inform Decisions and Adaptation Science Program Manager for the U.S. Global Change Research Program's National Coordination Office, Ms. Wasley served as a science translator for Federal agencies developing their Agency Adaptation Plans, technical climate expert supporting the Administration's Preparedness Pilots, and contributing author of the Third National Climate Assessment's Adaptation Chapter. Ms. Wasley is certified as a Change Management Advanced Practitioner (CMAP) from Georgetown University and Decision Making for Climate Change professional from the University of Washington. She holds an M.A. in Environmental and Natural Resources Policy from The George Washington University and a B.A. in Public Policy and Environmental Studies from Hamilton College. Ms. Wasley also serves as an Adjunct Fellow for the American Security Project and a member of the U.S. Green Building Council's LEED Resilience Working Group.

Mr. Charles Hernick (Team Leader) – Mr. Hernick (The Cadmus Group, Inc.) is an expert on USAID environmental compliance requirements, including FAA Sections 118 and 119, most recently demonstrated as Team Leader for the Senegal and Mali ETOAs (both 2015), through his contributions to assessments in Peru and South Sudan, and his management of a tropical forestry/biodiversity and climate change vulnerability assessment for 10 Caribbean countries. He has six years of ecology field- and laboratory-based research experience. He has leveraged his background in ecology and economics to conduct environmental impact assessments for development projects in Asia, Africa, and Central America. He has conducted trainings and guest lectured on numerous environmental issues in the U.S., Latin America, and Africa. He has managed extensive policy and finance research and analysis, and has facilitated expert consultations in the design of U.S. policy for mitigating the financial risks associated with environmental liabilities (i.e., polluter pays principle/financial assurance). Mr. Hernick has a B.S. in Ecology from the University of Minnesota and an M.A. in International Relations and Environmental Policy from Boston University.

Ms. Kathleen Hurley – Ms. Hurley (The Cadmus Group, Inc.) is an environmental management professional with more than 15 years of experience in all phases of project development. She is a biologist by training and has expertise in environmental and social safeguards for USAID, multilateral development banks, and domestic US environmental policy. She is a Latin American rural community development and tropical ecology expert, who has conducted community development work in Costa Rica, specifically with coffee value chains and rural agriculture, as well as tropical ecology research. Ms. Hurley has provided environmental compliance support in Asia, Latin America, the Caribbean, and Africa, with a particular focus in Latin America. Ms. Hurley was the technical lead for the 10-country Caribbean FAA 118/119 and the South Sudan FAA 118/119 assessments for USAID; she led the environmental audit for the Rural Value Chains Project in Guatemala, and leads multi-lateral development bank ESIA gaps analyses. She is experienced with USAID environmental compliance procedures and regularly facilitates workshops on USAID environmental compliance. Ms. Hurley has a B.A. in Biology and Environmental Studies from the University of St. Thomas (MN), an M.S. in Environmental and

Marine Science from Western Washington University, and a M.A. in International Affairs, with a focus on environmental policy and governance from The Fletcher School at Tufts University.

Dr. Arianne Neigh (Natural Resource and USAID Programming Specialist)- Dr. Neigh is a senior technical advisor and policy analyst with 15 years working experience in natural resource management, international development, risk assessment, and toxicology in municipal, federal, military, and private contexts with 14 publications and more than 40 presentations on the subjects. She has extensive experience in applying EIA practices both domestically and across more than 30 countries. As USAID Post-Crisis Environmental Advisor and Interim Regional Environmental Advisor to the USAID/Southern Africa Regional Mission, Dr. Neigh was responsible for evaluation and oversight of the environment safeguards, climate change integration, and human health and safety of USAID-funded programs. Under GEMS II, Dr. Neigh focuses largely on issues of environmental safeguards and human health and safety in sub-Saharan Africa. She also provides 22 CFR 216 audit services for USAID/Missions, conducts evaluations of Indoor Residual Spray campaigns, and frequently drafts 22 CFR 216 documentation and Mission planning reports for Africa Bureau, Global Health Bureau, and the Bureau for Democracy, Conflict, and Humanitarian Assistance. Previously in Ethiopia, Dr. Neigh has participated in the Food for Peace (FFP) M&E workshops for implementing partners, worked on the FFP Roads PEA and Fumigation PEA, and most recently, conducted a consultative assessment of non-governmental and private voluntary organizations working with FFP to document their level of capacity for climate change adaptation programming, and provide field level review of their activities in the area of climate smart agriculture, disaster risk reduction, infrastructure, WASH, and remediation of environmental degradation. Dr. Neigh has a dual Ph.D. in Environmental Toxicology and Zoology from Michigan State University as well as a B.S. in natural resource management.

Mr. Fikadu Getachew- Fikadu Getachew (**M.Sc.** in Farm forestry and **B.Sc**. in Forestry) is an independent consultant based in Ethiopia working in the area of project management (senior project planning, monitoring and Evaluation advisor), forestry, environment, and natural resource management and climate change sectors. Fikadu worked in Ethiopia for more than 13-years in government and non-governmental organizations. He worked for African Development Bank (AfDB), US-AID and EU funded projects with ACDI/VOCA and GIZ across Ethiopia. He also worked with private organization and development organizations as business development consultant. Fikadu has published one journal and over 15-nationally published working documents on environment and development related issues. He also took a lot of short term trainings in Israel and Kenya and in the country to boost his career. He is well known to Ethiopia Government development policies and strategies and has sound knowledge of environment, forest and climate change related elements. For this USAID assignment commissioned to CADMUS group, Fikadu is contacted by the group staff and worked in Ethiopia as environmental policy analyst.

6.2. LIST OF PERSONS CONTACTED

Please refer to USAID 118/119 for the list of persons contacted for this assessment.

6.3 BIBLIOGRAPHY

Bryan, E. Deressa, T. Gbetibouo, G. Ringler, C. 2009. *Adaptation to climate change in Ethiopia and South Africa: options and constraints.* Environmental Science & Policy. 12 (2009) 413-426.

Conway, D. Schipper, E. 2010. *Adaptation to climate change in Africa: Challenges and opportunities identified from Ethiopia.* Global Environmental Change. 21 (2011) 227-237.

CounterPoint. 2015a. *Assessment of Ethiopia's Transport Sector.* October. Available at: not currently available online.

Deressa, T. 2007. *Measuring The Economic Impact of Climate Change on Ethiopian Agriculture: Ricardian Approach.* Policy Research Working Paper 4342. The World Bank. Development Research Group. Sustainable Rural and Urban Development Team. Available at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1012474

Deressa, T. Hassan, R. Ringler, C. Alemu, T. Yesuf, M. 2009. *Determinants of farmers' choice of adaptation methods to climate change in the Nile Basin of Ethiopia.* Global Environmental Change. 19 (2009) 248-255.

Demissie, T.A., Saathoff, F., Seleshi, Y., Gebissa, A. 2013. Evaluating the effectiveness of best management practices in Gilgel Bige Basin Watershed- Ethiopia. Journal of Civil Engineering and Architecture 7(10): 1240-1252. Retrieved from www.davidpublishing.com/DownLoad/?id=14319.

Devi, R., Subalewu, T., Worku, L., Bishaw, L., Abebe, B. 2008. Assessment of siltation and nutrient enrichment of Gilgel Gibe dam, Southwest Ethiopia, Biological Resource Technology 99:975-979.

Government of Ethiopia and Humanitarian Partners. 2016. *2016 Ethiopia Humanitarian Requirements Document Mid-Year Review.* Available at: http://reliefweb.int/sites/reliefweb.int/files/resources/ethiopia_hrd_-_mid_year_review_12_august_2016.pdf

International Monetary Fund. 2016. The Federal Democratic Republic of Ethiopia and the IMF. August 2016. Available at: http://www.imf.org/external/country/ETH/

LD. 2014. *Ethiopia and Climate Partners Joint Communique – Lima Declaration*. December 2014. Available at: https://www.regjeringen.no/globalassets/upload/kld/kl/klima-og-skogprosjektet/141210limadeclaration-signed.pdf

National Planning Commission. 2016a. *Federal Democratic Republic of Ethiopia Growth and Transformation Plan II (GTP II) (2015/16-2019/20).* Volume I: Main Text. May 2016. Available at: not currently available online.

Oxford Committee for Famine Relief (OXFAM). 2016. *El Niño strikes Ethiopia: Without water we are no more.* Available at: https://www.oxfam.org/en/ethiopia-drought-ethiopia/el-nino-strikes-ethiopia-without-water-we-are-no-more

Save the Children International. 2016. *Two Years of Drought Response in Ethiopia: June 2014 – 2016*. July 2016. Available at: https://www.savethechildren.net/sites/default/files/Two%20Years%20of%20Drought%20Response%20in%20Ethiopia_June%202016_0.pdf

Setgen SG, Rayner D, Melesse A, Dargahi B, and Srinivasan R. 2011. *Impact of Climate Change on the Hydroclimatology of Lake Tana Basin, Ethiopia.* Water Resources Research: An AGU Journal Vol 47(4), April 2011. Available at: http://onlinelibrary.wiley.com/doi/10.1029/2010WR009248/full

Thornton, PK, van de Steeg J, Notenbaart A, and Herrero, M. 2009. *The impacts of climate change on livestock and livestock systems in developing countries: A review of what we know and what we need to know.* Agricultural Systems 101(3):113-127. Available at: http://www.sciencedirect.com/science/article/pii/S0308521X09000584

United Nations International Children's Emergency Fund (UNICEF). 2016. *Fast Facts – April 2016, Ethiopia El Nino Emergency.* Available at: https://www.unicef.org/ethiopia/UNICEF_Ethiopia_El_Nino_Emergency_Fast_Facts_1_April_2016.pdf

United Nations Office for the Coordination of Humanitarian Affairs (OCHA). 2016. *El Nino in East Africa.* Available at: http://www.unocha.org/el-nino-east-africa

USAID. 2012a. *USAID Climate Change and Development Strategy*. June. Available at: http://pdf.usaid.gov/pdf_docs/PDACS780.pdf.

USAID. 2014a (reprinted 2015). *USAID Biodiversity Policy*. Available at: https://www.usaid.gov/sites/default/files/documents/1865/USAID%20Biodiversity%20Policy%20-%20June%202015.pdf.

USAID. 2014b. *USAID Climate-Resilient Development: A Framework for Understanding and Addressing Climate Change*. Available at: http://pdf.usaid.gov/pdf_docs/PBAAA245.pdf.

USAID. 2015a. *USAID Biodiversity and Development Handbook*. Available at: http://pdf.usaid.gov/pdf_docs/PA00KKWS.pdf.

USAID. 2015b. *USAID Integrating Biodiversity and Climate Change Adaptation in Activity Design*. Available at: http://pdf.usaid.gov/pdf_docs/PA00KKNX.pdf.

USAID 2015d. *Climate Change in USAID Strategies: A Mandatory Reference to ADS 201*. Available at: http://pdf.usaid.gov/pdf_docs/PBAAD322.pdf.

USAID. 2015e. *Climate Variability and Change in Ethiopia: Summary of Findings*. Available at: https://www.usaid.gov/sites/default/files/documents/1866/12.22.15%20-%20ClimateVariabilityChange_Ethiopia_Dec2015%20(1).pdf

USAID. 2016a. *Climate Change Risk in Ethiopia: Country Fact Sheet*. August. Available at: https://www.climatelinks.org/sites/default/files/asset/document/2016%20CRM%20Factsheet%20-%20Ethiopia_use%20this.pdf

USAID. 2016b. *USAID Climate Risk Screening Tool for Ethiopia*. August. [Note: this is unpublished. The draft from Alex Apotsos was reviewed by the Assessment Team]

USAID. 2016c. *Global Health*. August. Available at: https://www.usaid.gov/ethiopia/global-health

USAID. 2016d. *History*. August. Available at: https://www.usaid.gov/ethiopia/history

UNDP. 2016a. *Multi-Partner Trust Fund Office. Ethiopia Climate Resilient Green Economy Facility*. Available at: http://mptf.undp.org/factsheet/fund/3ET00

Vogl, A.L., Dennedy-Frank, P.J., Wolny, S., Johnson, J.A., Hamel, P., Narain, U., Vaidya, A. 2016. Managing forest ecosystem services for hydropower production. Environmental Science and Policy. 61:221-229.

6.4 SUSTAINABLE DEVELOPMENT GOALS