Climate Risk Screening and Management Tool

For use in strategy design

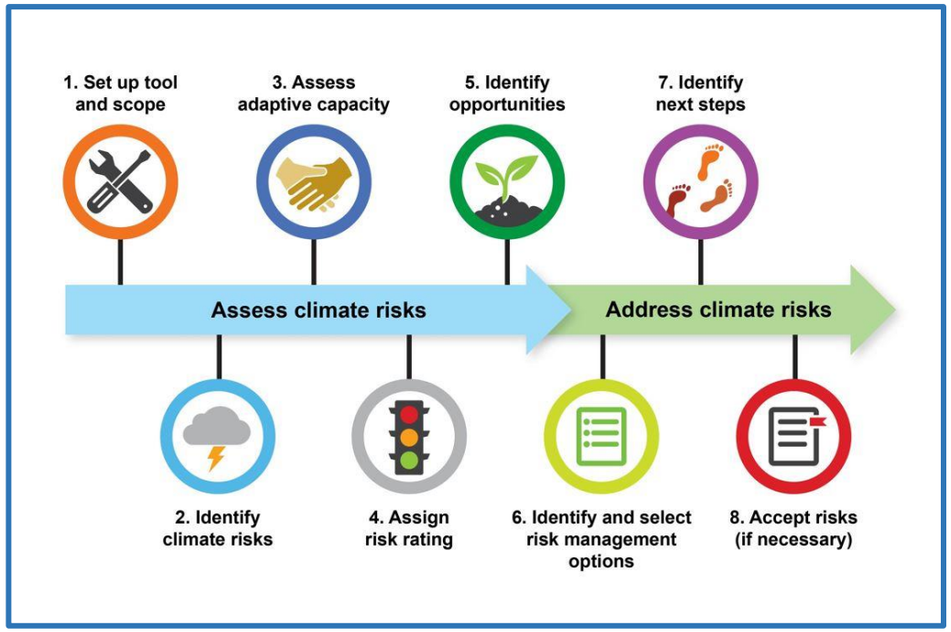
Purpose: This tool guides USAID strategy (e.g., Regional / Country Development Cooperation Strategies, R/CDCS) planners and support staff through the process of assessing and addressing climate-related risks. This process will help to ensure effectiveness and sustainability of strategy objectives in the face of climate variability and change. The output of this tool provides information for the Climate Change Annex required in *Climate Change in USAID Strategies: A Mandatory Reference for ADS Chapter 201.*

Structure: The tool guides you through the steps shown to the right. For additional information, you will find purple pop-ups with definitions and yellow pop-ups with examples throughout the tool.

Additional Resources: This tool should be used in conjunction with climate information, such as these country-specific climate risk profiles, which describe climate stressors and the major types of risks that climate change poses to each country. Additional resources can be found in the annexes of this tool and on Climatelinks.

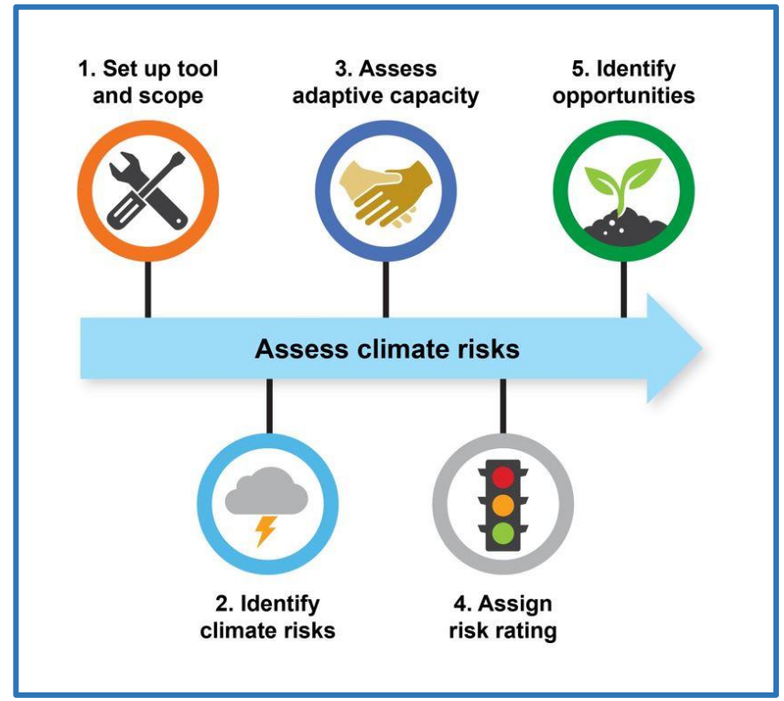
Climate change impacts different groups differently: All analysis using this tool should reflect a commitment to social inclusion that considers the different societal roles, needs, constraints, and opportunities of individuals and groups based on their identities, including gender, age, sexual orientation, disability status, linguistic status, and ethnicity – particularly marginalized populations.

Turn the page to get started!



PART A: ASSESS CLIMATE RISKS

Part A of the tool helps you assess climate risks and should be used early in the strategy design process – before the theory of change is finalized. Click here to see a diagram summarizing the complete climate risk screening and management process for strategies. For more details, see the Mandatory Reference.



1. SET UP TOOL

1.1 Identify What to Screen

- If Development Objectives (DOs) and Intermediate Results (IRs) have already been drafted for the strategy, enter each DO or IR in column 1.1 of the Output Matrix, Part 1 (pg. 13). These are the elements you will be screening. If you refine or modify your DO or IR, simply update that column. Screening at the IR level is recommended. However, screening can also be done at the DO level, especially in low-risk areas.

OR…

- If DOs and IRs have not yet been drafted, you may still proceed with the climate risk screening. In that case, identify the sectors that are expected to be featured prominently in the strategy, and/or in which current activities are implemented. Select from the following F Framework sectors, as appropriate, and **enter each sector on a separate line in column 1.1 of the Output Matrix, Part 1** (pg. 13). An excel version of the Output Matrix can be used to record your results.
  - Agriculture
  - Disaster Readiness
  - Economic Growth (excluding Agriculture, Infrastructure, and Environment)
  - Education, Social Services, and Marginalized Populations
  - Environment and Biodiversity
  - Governance and Peace and Security
  - Health
  - Infrastructure, Construction, and Energy
  - Water Supply and Sanitation

  Note: Once the DOs and IRs have been determined, you will need to revisit the results from this tool to explicitly consider and document climate risks to all DOs and IRs. You will need to revise the Output Matrix accordingly, replacing the sectors in column 1.1 with the DOs or IRs.

1.2 Identify Timeframes

For each DO, IR, or sector, determine the relevant timeframe for this assessment, i.e., the period of time over which you expect the investments to provide service or contribute to development. In most cases, this is longer than the timeframe of the strategy. Also, consider the longevity of decisions stakeholders may make as a result of the investments. See examples.

Record the appropriate timeframe for each DO, IR, or sector in column 1.2 of the Output Matrix, Part 1 (pg. 13)**.**

1.3 Identify Geographies

For each DO, IR, or sector, identify and record the geographies to screen in column 1.3 of the Output Matrix, Part 1 (pg. 13). You may choose to analyze the strategy's geographic scope as a single country or region. See examples.

2. IDENTIFY CLIMATE RISKS

Next, identify the risks that climate change poses to each DO, IR, or strategy sector. See the definition of climate risks.

To begin, **download and review the climate risk profile(s) on Climatelinks** relevant to your country(ies) or region(s). The climate risk profile describes climate stressors and the major types of risks that climate change poses to each country or region. You may complement the climate risk profile with your own knowledge of the geographies you have identified. This will be especially important if the profile does not provide information specific to the selected geographies. Other sources of climate information may be available and helpful, e.g., the World Bank's Climate Change Knowledge Portal. Consult with your operating unit's Climate Integration Lead (CIL) to identify additional information, if needed.

Consider climate risks within the timeframes identified. Take note of uncertainty and consider the full range of future climate scenarios.

Review the following questions for each DO, IR, or sector and **document the climate risks in column 2 of the Output Matrix, Part 1** (pg. 13)**.**

- How has the DO, IR, or sector been impacted by climate change in the past few decades? This may include risks from gradual climate change (e.g., sea level rise) and climate variability or weather-related disasters (e.g., droughts, floods, extreme storms). How severe were those impacts? Were any populations disproportionately impacted?
- Given projections of future climate change, how might the DO, IR, or sector be affected? This may include changes in climate variability. How severe might those impacts be?
- How might climate and non-climate stressors interact to exacerbate climate risks? See example.

Remember to articulate climate risks in terms of their impacts on programming due to the expected climate stressor, e.g., *reduced crop productivity due to higher temperatures*.

Optional: Sector-specific examples of climate risks are available in the annexes listed below, which can be found on Climatelinks. It may be helpful to consult multiple sector examples for multi-sectoral DOs or IRs. Note, if new construction or rehabilitation is anticipated, consulting the Infrastructure, Construction, and Energy Annex is **highly recommended**.

- Agriculture
- Disaster Readiness
- Economic Growth (excluding Agriculture, Infrastructure, and Environment)
- Education, Social Services, and Marginalized Populations
- Environment and Biodiversity
- Governance and Peace and Security
- Health
- Infrastructure, Construction, and Energy
- Water Supply and Sanitation

3. ASSESS ADAPTIVE CAPACITY

Next, consider the extent to which there is the capacity to prepare for and undertake actions to address climate risks, including demonstrated capacity to respond to climate impacts in the past few decades. Consider the adaptive capacity of all relevant stakeholders potentially affected by climate change, as well as others that can contribute to adaptive capacity (e.g., civil society organizations, government agencies).

Review the following questions in order to describe adaptive capacity in each of the following areas. **Record your responses in column 3 of the Output Matrix, Part 1** (pg. 13).

- Information Capacity: What is the capacity of relevant stakeholders to collect and use information related to climate risks in this sector/geography?
- Social and Institutional Capacity: What institutions and social networks exist and what is their capacity to support this sector/geography in preparing for and responding to climate impacts?
- Human Capacity: What resources, including technical and other know-how, exist amongst individuals and organizations to support this sector/geography in preparing for and responding to climate impacts?
- Financial Capacity: What types of financial resources might support this sector/geography in preparing for and responding to climate impacts?

Optional: Sector-specific questions that can help you further explore adaptive capacity are available in the annexes listed below, which can be found on Climatelinks.

- Agriculture
- Disaster Readiness
- Economic Growth (excluding Agriculture, Infrastructure, and Environment)
- Education, Social Services, and Marginalized Populations
- Environment and Biodiversity
- Governance and Peace and Security
- Health
- Infrastructure, Construction, and Energy
- Water Supply and Sanitation

4. ASSIGN RISK RATING

Based on your characterization of climate risks and adaptive capacity, assign a qualitative risk rating for each DO, IR, or sector: low, moderate, or high. The level of risk increases both as the severity of negative impact increases and as the probability of negative impact increases (see Table 1).

Table 1: Risk ratings (see examples of low, moderate, and high risk)

	PROBABILITY OF NEGATIVE IMPACT (increases from left to right)		
SEVERITY OF NEGATIVE IMPACT (increases from top to bottom)	Low probability Low impact **LOW RISK**	Moderate probability Low impact **LOW RISK**	High probability Low impact **LOW RISK**
	Low probability Moderate impact **LOW RISK**	Moderate probability Moderate impact **MODERATE RISK**	High probability Moderate impact **MODERATE RISK**
	Low probability High impact **MODERATE RISK**	Moderate probability High impact **HIGH RISK**	High probability High impact **HIGH RISK**

Record climate risk ratings for each DO, IR, or sector in column 4 of the Output Matrix, Part 1 (pg. 13).

5. IDENTIFY OPPORTUNITIES

Consider opportunities for the strategy, as well as for broader development objectives.

5.1 Opportunities Related to Climate Risk Management

Consider the following questions for each DO, IR, or sector to identify opportunities.

- What opportunities are there to achieve multiple development objectives or realize co-benefits by addressing climate risks? What opportunities are there to incorporate resilience into other development activities? Are there relevant non-climate policies that can contribute to climate risk management? See examples.
- What "windows of opportunity" may exist due to recently adopted policies or changing attitudes? Can political will (e.g., recently adopted policies, changing attitudes, new leadership, or other developments) be leveraged to address identified climate risks and/or enhance either the DO, IR, or sector's direct outcomes or broader development objectives? See examples.
- How may changes in climate create new opportunities to advance development? See example.
- What are the tradeoffs of pursuing these opportunities? (Not all opportunities will be worth pursuing.) See examples.

Note that opportunities can exist irrespective of the climate risk rating.

Record the opportunities that you have identified in your responses in column 5 of the Output Matrix, Part 1 (pg. 13)**.**

Optional: Sector-specific examples of opportunities are available in the annexes listed below, which can be found on Climatelinks.

- Agriculture
- Disaster Readiness
- Economic Growth (excluding Agriculture, Infrastructure, and Environment)
- Education, Social Services, and Marginalized Populations
- Environment and Biodiversity
- Governance and Peace and Security
- Health
- Infrastructure, Construction, and Energy
- Water Supply and Sanitation

5.2 Opportunities Related to Climate Change Mitigation

USAID efforts can help reduce the magnitude of global climate change through climate change mitigation, i.e., reductions in greenhouse gas emissions or removal of greenhouse gases (GHGs) from the atmosphere (e.g., via tree planting). Address the following questions for each DO, IR, or sector to identify opportunities related to climate change mitigation. Consult the country's greenhouse gas emissions fact sheet on Climatelinks.

- **5.2a:** What are the major sources of GHG emissions, how have they changed over time, and how are they expected to change in the future? How are the sources of GHG emissions contributing to the economy and development objectives? What mitigation or low-emission development plans, targets, and priorities have the government (national, state, and local) articulated? Enter your responses in the first row of **Output Matrix, Part 2** (pg. 14).
- **5.2b:** What opportunities exist to reduce emissions in each DO, IR, or sector? What opportunities exist to reduce emissions associated with USAID activities? **Enter your responses in the second row of Output Matrix, Part 2** (pg. 14).
- **5.2c:** Does the strategy incorporate ways to reduce GHGs? Reference the page number in the strategy. Note in particular if the Goal, a DO, or an IR or sub-IR specifically incorporates mitigation. **Enter your responses in the third row of Output Matrix, Part 2** (pg. 14).
- **5.2d:** What are the next steps in project and/or activity design to reduce GHGs? **Enter your responses in the fourth row of Output Matrix, Part 2** (pg. 14).

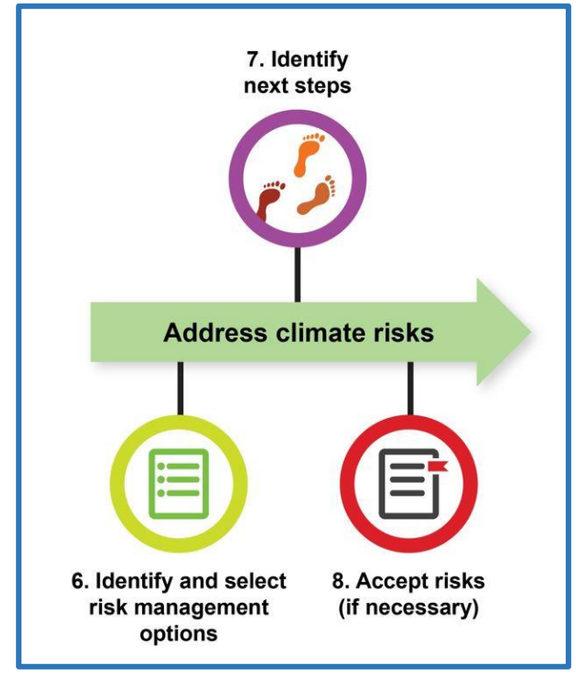
5.3 Additional Requirements for Missions with Global Climate Change Funds

Missions receiving Global Climate Change (GCC) funds must answer additional questions in order to guide them to strategically address climate change and development in their strategy. Refer to the Mandatory Reference for additional requirements.

Congratulations! *You have completed the first part of this tool. The initial brainstorming of climate risk management options in* **Part B** *can be done now or you can wait until you are beginning to design your strategy.*

PART B: ADDRESS CLIMATE RISKS

Part B of the tool helps you address the climate risks you have identified. This should be done alongside the development hypothesis and results framework. For more details, see the Mandatory Reference. You will start by identifying possible climate risk management options. Then you will decide which options you will use to address the climate risks, identify next steps, and note any climate risks that you decide to accept. If you do not yet have DOs or IRs, you can identify climate risk management options for your sector or wait until you have drafted DOs and IRs to proceed.



6. IDENTIFY AND SELECT CLIMATE RISK MANAGEMENT OPTIONS

This step will depend on the climate risk rating:

- Low climate risk: The mission is not required to incorporate specific plans in the strategy to address climate risk for DOs or IRs that have low climate risk. The mission can consider monitoring those DOs and IRs for potential future climate risk throughout the Program Cycle, as appropriate.
- Moderate to high climate risk: Moderate or high climate risk must be addressed by the mission based on its technical judgment and integrated into the development hypothesis and results framework, as appropriate. Consideration of tradeoffs and how USAID can best promote resilient development should inform the mission's decision. The mission may alternatively decide to accept one or more climate risks (i.e., those risks will not be addressed explicitly by risk management options during strategy, project, or activity design and implementation); see Step 8.

6.1 Identify Climate Risk Management Options

Brainstorm options for addressing the moderate and high climate risks. **Record your ideas for climate risk management in column 6.1 of the Output Matrix, Part 1** (pg. 13). While you may not incorporate all of these options, having a record of your ideas may prove useful in the future. You will select options to pursue in the next sub-step.

Optional: Sector-specific examples of climate risk management options are available in the annexes listed below, which can be found on Climatelinks.

- Agriculture
- Disaster Readiness
- Economic Growth (excluding Agriculture, Infrastructure, and Environment)
- Education, Social Services, and Marginalized Populations
- Environment and Biodiversity
- Governance and Peace and Security
- Health
- Infrastructure, Construction, and Energy
- Water Supply and Sanitation

6.2 Describe How Climate Risks Are Addressed in the Strategy

Next, select from column 6.1 the options that you will include in the strategy. It is helpful to have drafted DOs and IRs before undertaking this part. **Record how climate risks are addressed in column 6.2 of the Output Matrix, Part 1** (pg. 13)**. Note in the Output Matrix the relevant strategy page number where this is included.** Some of the criteria to consider are:

- *Effectiveness*. To what extent will the options reduce the climate risk(s) to the strategy's objectives, or increase the ability to cope with the potential impacts?
- *Affordability*. How much will it cost upfront? How much will it cost to operate and maintain the investment? Will there be non-monetary resource demands, e.g., requirements for ongoing support by trained professionals?
- *Feasibility.* Are there barriers to implementation? For example, is there political or stakeholder opposition to the options? Conversely, are there factors that will facilitate implementation of the options? Is there sufficient institutional and human capacity to support implementation?
- *Flexibility.* How effective will the options be in the face of uncertain future conditions, including climate conditions, environmental conditions, socioeconomic conditions, political conditions, etc.? Will a change of course be possible if new information warrants it? Note: options that will be successful under a variety of scenarios and "no regrets" approaches are particularly important in cases of high uncertainty.
- *Co-benefits*. Will the options support other development objectives?
- *Tradeoffs*. Are the downsides and the potential for unintended consequences relatively minor?

The manner in which climate risks are addressed in the strategy should be documented in the following sections:

- Development Context, Challenges, and Opportunities – Missions should incorporate discussion of the extent to which climate change has, in past few decades, already affected sectors and geographies in which the mission is working. Missions should consider describing how the sectors and populations have responded. Missions should also incorporate a discussion of future risks from climate change identified in the screening analysis.
- Development Hypothesis and Strategy – The development hypothesis and strategy should take into account the results of the screening in the results statements and accompanying narrative. Additionally, the narrative should cite evidence (e.g., assessments, stakeholder consultations) that support causal linkages.
- Monitoring, Evaluation, and Learning – Missions should consider opportunities to incorporate climate risk and resilience considerations into the learning plan developed for the R/CDCS. Monitoring and evaluation can also contribute to continuous learning and improvement of climate-resilient strategies.

7. IDENTIFY NEXT STEPS

For each DO, IR, or sector, identify next steps for addressing climate risks and opportunities in project and/or activity design. **Document these next steps in column 7 of the Output Matrix, Part 1** (pg. 13)**.** This is the set of actions to be taken *after* you have finished developing the strategy. Next steps may include further analysis to be conducted prior to project or activity design or incorporation of risk management options that are too detailed to include in the strategy.

8. ACCEPT CLIMATE RISKS

In some cases, the benefits of USAID actions outweigh the potential negative consequences of climate risks. Or, the cost of all available measures to reduce a climate risk may exceed the expected benefit of the action. In those cases**,** you may accept the climate risk(s). **Document the accepted climate risk(s) and explain why you accepted the risk(s) in column 8 of the Output Matrix, Part 1** (pg. 13). See example.

Note, every moderate or high risk needs to either be addressed in the strategy (Step 6.2), have next steps identified (Step 7), or be accepted (Step 8).

Note: If you completed the screening by sector, please be sure to replace the sectors in column 1.1 with the DOs or IRs once they have been drafted. Review to determine if you need to make any adjustments to the responses in the subsequent columns.

Congratulations! *You have completed this tool.*

STRATEGY CRM TOOL OUTPUT MATRIX, PART 1 – CLIMATE RISK

An excel version of the Output Matrix can be used to record your results.

1.1: Defined or Anticipated DOs, IRs, or sectors*	1.2: Time-frame*	1.3: Geo-graphy	2: Climate Risks*	3: Adaptive Capacity*	4: Risk Rating of DO or IR*	5.1: Opportunities	6.1: Climate Risk Management Options	6.2: How Risks are Addressed in the Strategy*	7: Next Steps for Project and/or Activity Design*	8: Accepted Climate Risks*
[List defined or anticipated DO, IR, or sector]# *Example: Morbidity and mortality related to malaria is reduced.*	*[List time-frame]* *Example: 0-5 years*	*[List geog. scope]* *Example: Country-wide*	*[Enter description of climate risks]* *Example: Increases in temperature and changes in precipitation patterns in the past few decades have increased distributions of disease-carrying vectors and led to increases in the prevalence of malaria.*	*[Enter description of Information Capacity, Social and Institutional Capacity, Human Capacity, and Financial Capacity]* *Example: Malaria early warning systems are not in place. Health workers have low awareness of climate impacts to health. The country has moderate access to financing in the health sector, but investments in the sector have focused on maternal and child health.*	*[Enter rating for each DO, IR, or sector: High, Moderate, or Low]* *Example: High*	*[Enter description]* *Example: Increased awareness of ways to address climate impacts on health will also benefit children, who are particularly at risk to climate impacts, and boost the climate resilience of the country's considerable percentage of investment in maternal and child health.*	*[Enter management options for each climate risk]* *Example: Incorporate capacity building for health workers to recognize and address climate change impacts to health. Increase distribution of mosquito nets in regions that may be the most affected based on climate projections. Make improvements to the water sector to minimize breeding grounds for mosquitos.*	*[Enter selected management options for each climate risk, if relevant]* *Example: Incorporate capacity building for health workers to recognize and address climate change impacts to health (Strategy, p. X).*	*[Enter next steps for addressing risks in project and/or activity design, if relevant]* *Example: Further information related to how climate change is expected to impact malaria prevalence in region X will be sought prior to project design. The mission will continue to monitor the impact of changing temperature and precipitation patterns on the prevalence of malaria.*	*[Enter if the risk is accepted and why, if relevant. This is required if 6.2 and 7 do not address this climate risk]* *Example: Populations with weakened immune systems from public health issues besides malaria may have reduced capacity to physically cope with impacts from changing climate conditions.*
Next step: Timeframe	Next step: Geog.	Next step: Climate Risks	Next step: Adaptive Capacity	Next step: Risk Rating	Next step: Opps.	Next step: Risk Mgmt. Options	Next step: Selected Options	Next step: Next Steps	Next step: Accepted Risks	Finished!

* = A required element, according to the Mandatory Reference

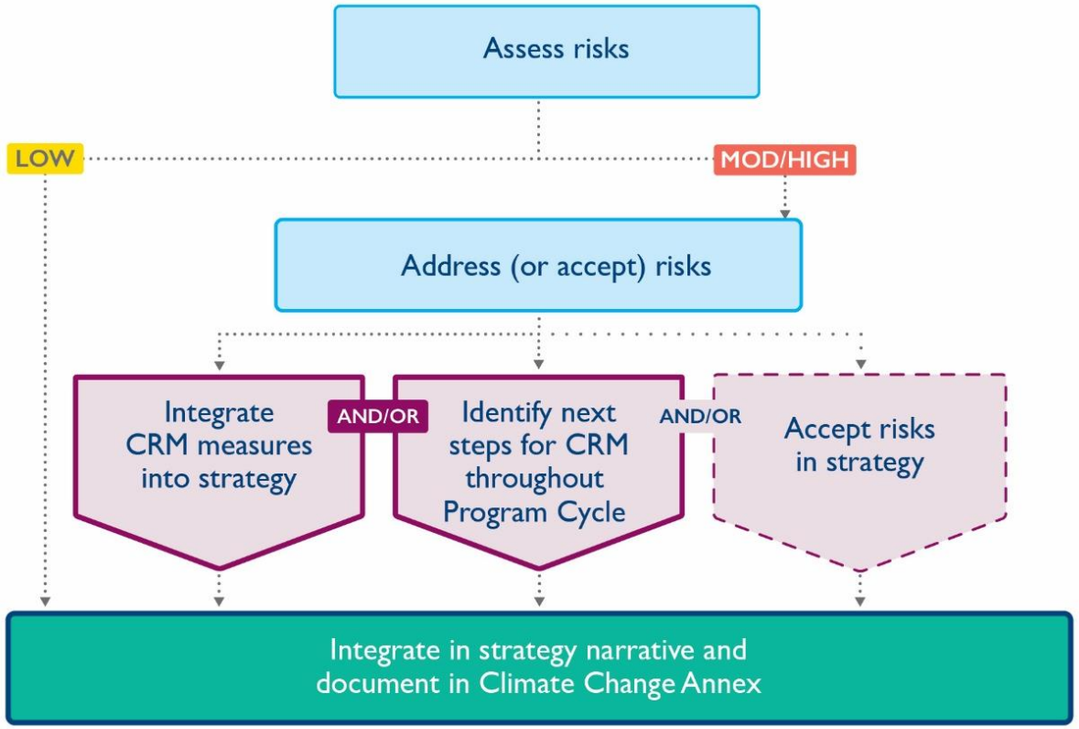
Note, every moderate or high risk needs to either be addressed in the strategy (6.2), have next steps identified (7), or be accepted (8). These columns are not required for low risks.

STRATEGY CRM TOOL OUTPUT MATRIX, PART 2 – GREENHOUSE GAS MITIGATION

5.2a	• **What are the major sources of greenhouse gas (GHG) emissions?** • **How has the distribution and composition of the GHG emissions profile changed over time historically, and how is the profile expected to change in the future considering the major emitting sectors and/or sources?** • **How are the sectors and sources that contribute to GHG emissions contributing to the growth and development of the economy and to meeting development objectives?** • **What climate change mitigation or low-emission development plans, targets, commitments, and priorities has the government (national, state, and local) articulated?"**	*Example: According to FAOSTAT (2015), the major sources of greenhouse gas emissions in the country are land use change and forestry (LUCF) sector, followed by the energy and agriculture sectors. The country's Second National Communication (SNC) however lists the major sources for greenhouse gases as fuel combustion, agriculture, waste handling, and industrial purposes.* *LUCF emissions originate from forest land use changes and the burning of biomass. The SNC states that 70 percent of the population depends directly on forests for firewood, construction timber, food, and fodder. Energy, as of 2012, is primarily supplied by biofuels and waste (66 percent), followed by coal, oil, and hydropower.* *The country's emissions decreased by 10 percent from 1990 to 2011. Emissions from industrial processes decreased possibly due to a sharp decline in manufacturing and industrial activity. The decline in manufacturing and industry is linked to the country's economic and political crises.* *With the worsening electricity supply situation, firewood will continue to be the main source of energy with increased use in urban settlements. The importance of coal for electricity production could also increase as frequent droughts reduce the country's hydro- electric generation capacity.* *The government has prioritized the following actions as part of its intended Nationally Determined Contributions (INDC) under mitigation:* • *Increasing hydro power in the energy mix* • *Energy efficiency improvement* • *Refurbishment and electrification of the rail system* • *Ethanol blending* • *Solar water heaters*

5.2b	• **Which of these sectors in USAID planning to program in?** • **What opportunities exist to reduce emissions in each DO, IR, or sector?** • **What opportunities exist to reduce emissions associated with USAID activities?**	*Example: USAID is not working in the broader energy, waste disposal, manufacturing, transport, and forestry sectors. Although USAID is not working directly in these sectors, it works in rural areas where firewood is one of the main natural resources used for energy. Under DO 1, USAID works to improve the resilience of communities. One way communities improve resilience is by improving management of natural resources like trees. Work on better management of these natural resources could to some extent reduce the use or improve the efficiency of firewood energy. In the agriculture sector, USAID will be promoting climate smart agricultural practices as a mitigation measure.*
5.2c	• **Does the strategy incorporate ways to reduce GHGs? Reference the page number in the strategy. Note in particular if the Goal, a DO, an IR, or sub-IR specifically incorporates mitigation.**	*Example: The strategy focuses more on climate adaptation than mitigation. However, mitigation will include a focus on climate smart agricultural practices and improved natural resources management as part of DO 1.*
5.2d	• **What are the next steps in project and/or activity design to reduce GHGs?**	*Example: Subsequent projects and any new designs in DO 1 will take into consideration results of the climate screening and ways in which natural resources management and agriculture activities can mitigate climate change.*

CLIMATE RISK SCREENING AND MANAGEMENT IN STRATEGY DESIGN



This diagram summarizes the process of climate risk screening and management for strategy design, as described in the Mandatory Reference. The first step is to assess climate risks at a level of detail sufficient to develop approaches to adequately address moderate and high climate risks. The subsequent steps involve identifying climate risk management options; identifying next steps; accepting climate risks, if necessary; and documenting the results.

Agriculture

Introduction

Purpose: This annex to the Climate Risk Screening and Management Tools is designed to provide you with more information on climate change[1] implications for agriculture (including terrestrial agriculture, pastoralism, and fisheries). The information is grouped into the following sub-sections, with the corresponding step from the Tool shown in parentheses:

- Climate Risks to Agriculture (Step 2)
- Adaptive Capacity Related to Agriculture (Step 3)
- Opportunities Related to Climate Risk Management of Agriculture (Step 5)
- Climate Risk Management Options for Agriculture (Step 6)
- Additional Key Resources Related to Agriculture

The questions and examples provided in this annex are illustrative and designed to stimulate thinking about climate risks, adaptive capacity, opportunities, and climate risk management options. Actual climate risks will depend on the context and anticipated climate changes for particular geographies.

Sectoral focus: The material in this annex aligns with EG.3 Agriculture in the Standardized Program Structure. Note, to the extent your design involves multiple sectors, you may want to consult other relevant annexes. In particular, if any new construction or rehabilitation[2] is anticipated, referring to the Infrastructure, Construction, and Energy Annex is highly recommended. Please note, *activity*-level climate risk management (CRM) for engineering design **must** be conducted by the Engineer of Record.[3] See the Infrastructure, Construction, and Energy Annex for solicitation language.

[1] In this document, the term "climate change" refers to both climate variability and climate change. "Climate variability" refers to variations in climate (including the normal highs and lows, wet and dry periods, hot and cool periods and extremes) and can refer to month-to-month variability, year-to-year variability, and even decadal scale variability. In this document, "climate change" refers to those variations as well as persistent change in climate over decades or longer (USAID, 2014. Climate-Resilient Development: A Framework for Understanding and Addressing Climate Change).
[2] USAID Implementation of Construction Activities, A Mandatory Reference for ADS Chapter 303, defines "construction" as: "construction, alteration, or repair (including dredging and excavation) of buildings, structures, or other real property and includes, without limitation, improvements, renovation, alteration, and refurbishment. The term includes, without limitation, roads, power plants, buildings, bridges, water treatment facilities, and vertical structures." Construction at USAID almost always occurs within another primary programming area (e.g., school building for education, hospital/clinic construction for health).
[3] An appropriately qualified engineering firm under contract or subcontract with USAID for the purpose of completing the engineering design.

Tool Step 2: Climate Risks to Agriculture – Illustrative Examples and Questions

Once you have reviewed this section, you can navigate back to the Tool by clicking on the relevant hyperlink in the header.

Productivity	Food Security	Nutrient Quality, Dietary Diversity, and Food Safety
• Damage to crops and reduced productivity due to heat stress and changes in rainfall. • Damage to crops, reduced productivity, and increased economic losses due to increased flooding in river basins. • Earlier greening, leaf emergence, and fruit set in temperate and boreal climates due to changes in seasonality. • Increased prevalence of parasites and diseases that affect livestock due to changing climate conditions. • Reduced animal feeding and decreased growth rates due to higher temperatures. • Reduced fertility and reduced milk production due to prolonged heat stress. • Reduced water availability for crops and livestock due to increased evaporative demand from higher temperatures. • Reduced water availability for crops and livestock due to reduced snow cover and receding glaciers in mountainous areas that feed rivers. • Reduced yields due to crop damage and field waterlogging from floods. • Reduced crop yields in the near term from drought and lost topsoil and reduced soil fertility in the future from prolonged drought and extreme events. • Reduced amount of quality forage for grazing livestock due to drought. • Dramatic decreases in productivity of coastal agricultural	• Reduced yields of staple cereal crops (wheat, rice, and maize) due to higher temperatures. • Reduced food availability due to increased climate variability and the changed frequency and intensity of extreme weather events. • Increased food price fluctuations due to variation in temperature and precipitation. • Price volatility and price spikes due to increasing climate variability and extremes including floods and droughts. • Disproportionately negative effects of price volatility on poor consumers, who spend most of their income on food. • Reduced willingness of farmers to invest in productivity-enhancing assets such as fertilizer due to price volatility and greater uncertainty about future prices.	• Lower protein content in grains due to elevated temperature and CO_2. • Long term loss of health, productivity, and incomes of poor consumers due to prioritization of calorie-rich but nutrient-poor foods. This decrease in dietary quality and quantity is due to reduced food consumption caused by reduced food supplies from climate extremes.

Productivity	Food Security	Nutrient Quality, Dietary Diversity, and Food Safety
areas due to increased salinization from sea level rise, greater storm surge, and ocean acidification. ● Reduced harvests and lower incomes from nearshore fisheries and aquaculture due to sea level rise and greater storm surge.[4] ● Increased catches of warm water aquatic species at higher latitudes and decreased catches of subtropical species in the tropics due to higher ocean temperatures. ● Reduced availability of fish and shellfish important for many tropical coastal fisheries due to damage to coral reef habitat caused by higher temperatures and ocean acidification. ● Reduced labor productivity due to impacts to health and wellbeing of the workforce caused by extreme heat events.		

Illustrative questions by climate stressor:

Temperature:

- How will higher temperatures affect crop yields? Will some crops be favored more than others in certain regions and locations?
- How will higher ocean temperatures and ocean acidification affect fisheries and aquaculture operations?
- How will increases in temperature extremes affect agricultural productivity?
- How will increases in temperature extremes affect water availability?
- How may very high or very low temperatures affect workforce productivity?

Flooding:

- What are some of the direct and indirect effects of floods on crops? Are some effects likely to persist over the medium- to long-term?

[4] A temporary sea level rise associated with a storm.

- Are there locations where livestock are vulnerable to flooding? Are some types of livestock more vulnerable (e.g., pigs compared to cattle)? How significant is mortality during flooding?
- How may coastal flooding due to sea level rise increase liability costs for the insurance/reinsurance sectors?

Drought:

- How will drought affect livestock? How will drought affect the quantity and quality of pasture?
- How will drought affect the productivity of croplands?
- Does drought disrupt supply, transport, and distribution chains, increasing costs of trade?

Sea Level Rise and Storm Surge:

- Where are coastal areas vulnerable to sea level rise and storm surge? What agricultural activities are vulnerable to flooding and saltwater intrusion?
- How vulnerable are nearshore fisheries and aquaculture operations to sea level rise and/or storm surge?

Illustrative questions by programming or system element:

Productivity:

- How will changing temperature ranges, extremes, and/or shifts in seasonal onsets affect drivers of agricultural productivity? Those drivers may include soil quality and fertility, vegetative cover, fodder quality, water availability, temperature regulation, aquatic thermoclines, etc. Do these changes differ by agro-ecological zone? For instance:
  - Are changes in precipitation patterns expected to change crop suitability or reduce the number of harvests?
  - Are changes in seawater temperatures expected to change fish distributions and migration patterns along the coast?
- Is climate change expected to result in significant changes to the timing of key seasonal events such as pollination or fish spawning?
- Is it possible that because of climate changes some crops or targeted fish species are no longer economically viable?
- Is climate change likely to interact with non-climate threats to agricultural production, such as loss of soil nutrients or salinization of crop lands?
- How are the impacts of climate change on human systems expected to affect agricultural productivity? For instance:
  - Are sea level rise and coastal flooding likely to increase conversion of uplands to cropland?
  - How is climate change expected to affect the productivity of the workforce (due to reduced water availability, heat stress, changes in disease incidence, etc.)?

Food Security

- How will climate change affect food prices and price volatility? How will climate change interact with economic policies such as food subsidies?
- How are staple crops likely to be affected?

- Is the commercial[5] sector equipped to respond to changes in the supply and demand for goods and services?
- To what extent do banks take into consideration climate risk? How might climate change cause banks to become more risk averse in their lending decisions?
- How might changes in climate stressors affect equitable access to financial markets? Would women, the elderly, at-risk youth, LGBTI individuals[6] and other marginalized populations[7] be disproportionately affected regarding access to financial markets?
- How might climate change affect the value of land or otherwise put pressure on property rights?

Nutrient Quality, Dietary Diversity, and Food Safety

- How will climate change affect food quality?
- How might impacts of climate change alter the dietary diversity available to populations?
- How might extreme climatic events (heat waves, floods, etc.) or climatic considerations during storage and transport impact food safety?

Tool Step 3: Adaptive Capacity Related to Agriculture – Illustrative Questions

Once you have reviewed this section, you can navigate back to the Tool by clicking on the relevant hyperlink in the header.

Information Capacity

- What is the level of capacity for research and development for climate-resilient seeds, livestock or fishes and for research and development about sustainable land and aquatic management practices?
- What is the level of capacity to collect and use information about climate impacts to agriculture?
  - Are early warning systems in place to provide farmers and markets with information about severe weather events? How effective are they?
  - Is accurate and timely weather/seasonal forecasting available to community members? How accessible and usable is it for agricultural decision-making?
  - Are there monitoring systems in place that will provide place-based information on changes to agricultural systems (e.g., reporting on trends in yields or food access in each locality)? How well is monitoring information used to adjust agricultural practices?

[5] Commercial sector is defined as non-manufacturing business establishments, including hotels, restaurants, wholesale businesses, retail stores, warehouses, storage facilities, and health, social and educational institutions.
[6] LGBTI individuals refers to lesbian, gay, bisexual, transgender, or intersex individuals. Further information can be found in the LGBT Vision for Action, https://www.usaid.gov/sites/default/files/documents/1874/LGBT%20Vision.pdf.
[7] Marginalized populations are groups of people who are excluded, based on their identity, from political, social, and economic power and participation. Often they include women and girls, at-risk youth, the elderly, LGBTI individuals, persons with disabilities, people in linguistic minorities, indigenous people, and/or a combination of any of these identities.

Social and Institutional Capacity

- What is the level of capacity of institutions and civil society to rapidly deploy new means of coping with more rapidly changing ecological and other stresses?
- Are there national and community-level policies that can enable more gradual adaptation?
  - How effective are institutions and leadership at supporting the planning and implementation of actions to address potential climate impacts and opportunities regarding agriculture?
  - To what extent are systems and policies in place that support effective adaptation, such as secure land tenure and effective land use planning?
  - To what extent are government agencies able to respond to changes in climate that affect agricultural productivity?
  - How effective are civil society organizations and/or government actors in promoting effective responses to impacts from both severe weather events and incremental climate change on agriculture and food security?
  - To what extent do linkages between national and sub-national governments exist and work to promote responses around climate change impacts on the agriculture sector?
  - What is the current state of awareness/knowledge within government fiscal and monetary policy systems about risks and/or opportunities of climate change to agriculture?
  - How is the capacity to carry out commercial activities (trade and investment, financial services, GDP, and employment) expected to be affected by climate change?
  - Are the general public and marginalized populations sufficiently protected by inclusive economic laws and property rights?
  - What risk reduction strategies have been implemented by the private sector?
  - To what extent are economic planning systems able to take into account both gradual changes (e.g., droughts) and rapid onset events (e.g., floods)?

Human Capacity

- What is the level of capacity of individuals to respond to climate impacts on agriculture and to adopt climate-smart practices?
- Are there established pathways to build human capacity (of individuals and groups) through extension and training?
  - To what extent do those within the agriculture sector recognize the potential impacts and/or opportunities from climate stressors? This includes stakeholders all along the value chain, from farmers to buyers to processors to financiers.
  - Are technical and research organizations in place to train and support those along the agriculture value chain on responding to impacts? How effective are they?
  - Is there evidence that farmers are incorporating new information and techniques into their agricultural management practices to reduce climate risk, such as integrated pest management, control of soil erosion, and soil health management? Are other stakeholders incorporating new information and techniques into their agricultural activities to reduce climate risks relevant to their sector?
  - Are agriculturalists enabled or able to adjust farming/livestock/fisheries practices *in anticipation* of climate changes where current production and marketing patterns are likely to become unprofitable or unsustainable due to climate change? Why or why not?
  - To what extent have traders and investors considered climate risks and opportunities?
  - Are technical and research organizations in place to train and support workforce development?

- To what extent are key economic actors able to incorporate new information and techniques into production and distribution of goods and services, procurement practices, workforce training, or business operations to reduce climate risks to productivity?
- To what extent will marginalized populations that are most likely to be disproportionately affected by climate change be included in workforce training or other efforts to build adaptive human capacity?

Financial Capacity

- Are there adequate financial resources to support the agricultural sector in preparing for climate impacts?
  - To what extent are investments being made in research and technical development to reduce climate risks to agriculture? How effective are they?
  - How sufficient are funding sources to address heightened risk management needs to maintain preparedness for agriculture losses and new investments?
  - How sufficient are financial or in-kind resources to re-capitalize losses of farmers/pastoralists/aquaculturalists after a climate-related disaster?
  - What financial products and services are currently available to address increasing risk (e.g., insurance, credit and savings)?

Tool Step 4: Opportunities Related to Climate Risk Management for Agriculture – Illustrative Examples[8]

The need to address climate risks to agriculture may provide a range of additional opportunities. For strategic elements, projects, and activities with moderate/high climate risks, the important types of opportunities to discuss are climate change mitigation,[9] potential co-benefits for non-climate development objectives, and leveraging political will. For strategic elements, projects, and activities with low climate risks, and those based in Washington opportunities should focus more on how to support resilience more broadly.

Once you have reviewed this section, you can navigate back to the Tool by clicking on the relevant hyperlink in the header.

Enhance Food Production and Food Security

- Encourage farmers to take advantage of changes in temperature or precipitation that will extend the growing season and allow for additional harvests.
- Increase training and investment in more sustainable agricultural practices.
- Promote new public-private partnerships that will strengthen agriculture value chains.
- Promote programs to improve the security of property rights and land tenure in order to incentivize agricultural investment, including climate-smart agriculture (CSA).
- Train farmers to optimize irrigation through enhanced storage and access to irrigation water; more efficient water delivery systems; improved irrigation technologies such as deficit irrigation; more effective water harvesting; and agronomy that increases soil water retention through practices, such as minimum tillage and canopy management.
- Encourage adoption of innovations in food processing, packaging, transport, and storage.

[8] We also recommend that you refer to "Tool Step 5 for Economic Growth" for additional illustrative opportunities of direct relevance to agriculture.
[9] In this document "climate change mitigation" refers to efforts to reduce greenhouse gas emissions.

Improve the Nutrient Quality, Dietary Diversity, and Safety of Food Supply

- Promote markets for foods that are particularly important for nutrition and that smallholder farmers' produce.
- Discourage monoculture planting to reduce susceptibility to catastrophic losses from pests and disease. Polyculture can diversify farm income and can reduce the need for inputs such as nitrogen fertilizers that result in nitrous oxide emissions, a greenhouse gas.
- Increase soil organic carbon to improve soil fertility and release nutrients for plant growth. Storing more organic carbon in the soil sequesters carbon from the atmosphere and helps to mitigate climate change. Many management practices that increase soil organic carbon also improve crop and pasture yields.

Take Advantage of Synergies with Other Development Objectives

- Provide timely weather information to farmers using results of monitoring from early warning systems.
- Construct/retrofit agricultural infrastructure for changing climate conditions when it is necessary to rebuild following extreme events.
- Promote management approaches and policies that maximize resilience of exploited fish species (e.g., no-take zones).
- Support municipal composting of organic waste to improve waste management and public health, and to reduce greenhouse gas emissions from the decomposition of organic matter in landfills, which produces methane, a greenhouse gas.

Use Public Finance Mechanisms to Mobilize and Leverage Private Capital for Promising Technologies for Adaptation and Climate Change Mitigation

- Carbon finance can be used to monetize future cash flows from the advanced sale of carbon credits to finance investment costs for climate resilience investment (e.g., resilient infrastructure) or renewable energy and energy efficiency projects.
- Develop financial services for underserved and marginalized populations.
- Mobile banking, Village Savings and Loan Associations (VSLAs), and microfinance can help build the adaptive capacity of smallholders who otherwise lack access to financial services.
- Community supported agriculture provides up front financing for farmers at the start of or prior to a growing season, and can distribute farm income more evenly throughout the year, which can help smaller growers and cooperatives. With more predictable revenue, growers may be better positioned to implement climate-smart agricultural practices.

Achieve Climate Change Mitigation Co-Benefits While Increasing Agricultural Productivity

- Adopt agroforestry techniques or other methods of climate-smart or regenerative agriculture to increase production while also enhancing carbon sequestration.
- Sequester soil carbon and nitrogen through conservation agriculture (e.g., low till rotations).
- Introduce nitrogen-fixing crops and trees.
- Generate clean energy from biodigesters of agriculture byproducts, including animal manure and crop residues.
- Plant sustainable palm plantations on degraded lands that do not displace food crops or force relocation of inhabitants.

- Increase fertilizer efficiency through mulching, soil fertility improvements, microfertilizer placement, etc.
- Use low-methane-producing feeds for livestock.

Tool Step 5: Climate Risk Management Options for Agriculture – Illustrative Examples

Once you have reviewed this section, you can navigate back to the Tool by clicking on the relevant hyperlink in the header. Some **illustrative options** for reducing climate risks to agriculture are outlined below.

Increase Efficiency and Cost-Effectiveness of Agricultural Production

- Train farmers in basic techniques of sustainable agriculture, such as improving soil health, integrated pest management (IPM), and crop rotation.
- Train farmers in use of drip and micro-irrigation techniques for more efficient irrigation.
- Provide farmers with new cultivars that are drought and heat-tolerant.
  - Ensure equal opportunity access to such technologies for all farmers, especially marginalized populations.
- Encourage mixed crop-livestock systems and water, feed, and animal management to increase livestock productivity.
- Promote adoption of breeds better adapted to the prevailing climate.
  - Promote analysis of climate risks and assessment of climate impacts taking into account crop–weather interactions.
  - Integrate economic models, linear and non-linear optimization methods, and risk perception by farmers.
  - Develop and provide advice to farmers and access to modern information and communication technologies.
  - Support optimization of farm management practices conditioned by climate (for early and late onset of rainfall, good, average, and bad seasons).
  - Provide farmers with information on crops for which climate change has favorable effects.
    Earlier flowering and maturity have been observed worldwide in grapes, apples, and other perennial horticultural crops.
    Cassava (manioc) is likely to benefit from an elevated optimum temperature, for photosynthesis and growth, and a positive response to CO^2 increases.
- Implement activities to enhance the natural resource base.
  - Address point and non-point pollution of agricultural landscapes and freshwater and marine systems.
  - Implement laws and policies to prevent overexploitation.
  - Promote land tenure and property rights reform to strengthen local natural resource management.
  - Restrict harmful agricultural practices such as slash and burn agriculture, which increases erosion and reduces soil fertility.
  - Encourage farmers, pastoralists, and fishers to manage natural regeneration of trees, grasslands, and fish stocks.

Strengthen Food Security

- Build awareness of climate change implications for food security.
- Help farmers adapt cropping practices to help ensure food production, food security, and sustainable livelihoods (e.g., altering cultivation and sowing times and crop cultivars).
- Support improvements in processing, marketing, and distribution of agricultural products.
- Help develop value chains for new agricultural products.
- Support investments in new technologies and management practices that will increase returns to land, labor, and capital.
- Provide extension services and training in climate-smart agriculture and sustainable fishing practices.
- Expand access to markets and credit to encourage farmers to adopt new, climate-resilient crops and agricultural practices.

Improve Nutrient Quality, Dietary Diversity, and Food Safety

- Encourage planting of crops with high nutrient value that are suitable for changing climatic conditions.
- Help smallholders to diversify crops to increase resilience to variable climate conditions and to promote dietary diversity.
- Develop storage practices to protect food supplies under conditions of heat stress or excess moisture.

Improve Risk Management

- Develop new insurance instruments to address climate risks.
- Make financial markets more inclusive to help build the adaptive capacity of marginalized populations.
- Encourage new development away from high-risk locations (e.g., the coastal zone, river floodplains).

Additional Key Resources Related to Agriculture

The following **resources** provide additional information related to climate risks to agriculture and corresponding climate risk management options.

Title	Author(s)	Organization	Date	Length	Intended Audience	Unique Value
Climate Smart Agriculture Sourcebook (2nd edition--online platform)	FAO	FAO	launched 2017; continually updated	Online platform	Policy makers, program managers, sectoral experts, academics, extension workers, as well as practitioners in the agriculture sector	The Climate-Smart Agriculture Sourcebook comprises a wide range of knowledge and expertise on the concept of CSA to make the agricultural sectors (crops, livestock, fisheries and forestry) more sustainable and productive, while responding to the challenges of climate change and food security.
Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems *Summary for Policy Makers and Full Report* *Ch 5: Food Security*	IPCC	IPCC	Aug 2019	Summary for Policy-Makers is 41 pp. Ch 5 Executive Summary is 3 pp and full chapter is 120 pp.	Development practitioners, food security experts, policymakers	An IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems. Includes risks and management options.
Ecosystem-based Adaptation and Food Security	USAID Forestry & Biodiversity Office and USAID BRIDGE	USAID	2017	8 pp.	Development experts, food security experts, policymakers	Provides an overview of ecosystem-based adaptation approaches to address food security.
Conserving Ecosystems to Support Climate Resilience in Bangladesh	USAID Forestry & Biodiversity Office and USAID BRIDGE	USAID	2018	4 pp.	Development experts, food security experts, policymakers	Highlights a project supported by the USAID/Bangladesh mission that uses ecosystem-based adaptation approaches to address food security.

Title	Author(s)	Organization	Date	Length	Intended Audience	Unique Value
Climate-Smart Agriculture (CSA) country profiles	International Center for Tropical Agriculture (CIAT) and World Bank	CIAT and CCAFS, in partnership with the World Bank, Costa Rica's CATIE, and USAID's Bureau for Food Security	2014 to present	Varies, about 20 pp.	Development practitioners, food security experts, policymakers	Overview of the agricultural challenges in countries around the world, and how CSA can help them adapt to and mitigate climate change
Food security and food production systems. *(In: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change)*	J.R. Porter et al.	IPCC	2014	49 pp.	Development practitioners, food security experts, policymakers	Provides more detailed information on food security than the tools and includes numerous examples of effects of climate change on food security.

Disaster Readiness

Introduction

Purpose: This annex to the Climate Risk Screening and Management Tools is designed to provide you with more information on climate change[1] implications for disaster readiness. The information is grouped into the following sub-sections, with the corresponding step from the Tools shown in parentheses:

- Climate Risks to Disaster Readiness (Step 2)
- Adaptive Capacity Related to Disaster Readiness (Step 3)
- Opportunities Related to Disaster Readiness (Step 5)
- Climate Risk Management Options for Disaster Readiness (Step 6)
- Additional Key Resources Related to Disaster Readiness

The questions and examples provided in this annex are illustrative and designed to stimulate thinking about climate risks, adaptive capacity, opportunities, and climate risk management options. Actual climate risks will depend on the context and anticipated climate changes for particular geographies. The majority of capacity building activities to improve timely and adequate response of emergency managers also improve climate resilience by addressing many of the risks associated with climate variability or weather-related hazards. Note, however, that most emergency management efforts focus on a short timescale (i.e., one year) and may not incorporate longer times scales that are more relevant when considering potential climate change impacts. The need to be prepared for climate-related disasters may increase in the future.

Sectoral focus of the annex: The material in this annex aligns with HA.2 Disaster Readiness in the Standardized Program Structure. Note, to the extent your design involves multiple sectors, you may want to consult other relevant annexes. In particular, if any new construction or rehabilitation[2] is anticipated, referring to the Infrastructure, Construction, and Energy Annex is highly recommended. Please note, *activity*-level climate risk management (CRM) for engineering design **must** be conducted by the Engineer of Record.[3] See the Infrastructure, Construction, and Energy Annex for solicitation language.

[1] In this document, the term "climate change" refers to both climate variability and climate change. "Climate variability" refers to variations in climate (including the normal highs and lows, wet and dry periods, hot and cool periods and extremes) and can refer to month-to-month variability, year-to-year variability, and even decadal scale variability. In this document, "climate change" refers to those variations as well as persistent change in climate over decades or longer (USAID, 2014. Climate-Resilient Development: A Framework for Understanding and Addressing Climate Change).

[2] USAID Implementation of Construction Activities, A Mandatory Reference for ADS Chapter 303, defines "construction" as: "construction, alteration, or repair (including dredging and excavation) of buildings, structures, or other real property and includes, without limitation, improvements, renovation, alteration, and refurbishment. The term includes, without limitation, roads, power plants, buildings, bridges, water treatment facilities, and vertical structures." Construction at USAID almost always occurs within another primary programming area (e.g., school building for education, hospital/clinic construction for health).

[3] An appropriately qualified engineering firm under contract or subcontract with USAID for the purpose of completing the engineering design.

Tool Step 2: Climate Risks to Disaster Readiness – Illustrative Examples and Questions

Once you have reviewed this section, you can navigate back to the Tool by clicking on the relevant hyperlink in the header.

Capacity Building, Preparedness and Planning
• Need for a greater number of trained responders due to increasing frequency and intensity of extreme weather events. • Increased need for early warnings and early action due to increasing frequency and intensity of extreme events. • More rapid depletion of emergency relief stockpiles due to increasing frequency and intensity of floods and droughts. • Existing codes and standards, or poor implementation might not enable buildings to withstand increasing intensity of cyclones or increased frequency of flooding. • Increased need to improve resilience planning due to the combination of increasing intensity of storms and rapid urbanization. • Increased need for community-level response training due to increasing incidence of vector-borne diseases caused by higher temperatures. • Exacerbated gender inequality due to increasing occurrence of disasters, because women and girls are more likely to face death or injury during extreme events. • Extreme weather events and climate change may affect people's settlements, basic services, health, and livelihoods (e.g., loss of homes, critical infrastructure and services, disruption of markets and value chains) and may contribute to increased temporary displacement or permanent migration under certain local contexts. • Increasing displacement associated with extreme weather events may increase the need for establishment and maintenance of continued assistance to host communities and addressing the needs of the displaced. • Prolonged displacement may lead to social issues related to conflict with host communities, domestic violence, psychosocial impacts of displaced persons, and other issues.

The consideration of risk may be approached in two different but related ways: by climate stressor and by programming or system element. It can be useful to consider both if time permits. Note that while climate risk screening is not relevant for much of the humanitarian assistance sector, given the short-term nature of emergency response, preparedness, planning, and programming in disaster readiness may be affected by climate change and, thus, merits further consideration.

Illustrative questions by climate stressor:

Temperature:

- How may higher temperatures contribute to increased frequency of heat waves that lead to or contribute to public health-related disasters? Consider multiple stressors due to both direct temperature effects and indirect effects of heatwaves on the reliability of electricity supply (and other infrastructure services), and how those stressors may affect marginalized populations[4] differently?

[4] Marginalized populations are groups of people who are excluded, based on their identity, from political, social, and economic power and participation. Often they include women and girls, at-risk youth, the elderly, LGBTI individuals, persons with disabilities, people in linguistic minorities, indigenous people, and/or a combination of any of these identities. (LGBTI individuals refers to lesbian, gay, bisexual, transgender,

- Does the nationally authorized entity (National Meteorological and Hydrological Services-NMHSs) have the capacity to forecast and send warnings on extreme temperatures for action by relevant sectors? Do relevant sectors utilize the early warnings to plan and take action?

Flooding:

- How may changes in flooding directly affect communities and the infrastructure, agricultural, and other services upon which they depend?
- How may changes in flooding affect displacement of people and the need for corresponding planning and response? How may marginalized populations be impacted differently? Are marginalized populations that are frequently neglected in disaster assistance considered in planning and response?
- How may changes in flooding affect the need for disaster risk planning, disaster risk mitigation,[5] capacity building, disaster response training, and early warning systems, and displacement of trained responders?
- Does the nationally authorized government entity (NMHSs) have the capacity to forecast and warn different segments of the population, especially those that are hard to reach and most at risk? Does the disaster management entity use early warnings to take early action? Do other relevant sectors utilize the warnings to take early action to reduce impacts?

Drought:

- How may the increasing frequency and duration of drought affect water and food availability, the potential for corresponding disasters, and the level of preparedness required?
- Does the nationally authorized government entity (NMHSs) have the capacity to forecast and warn different segments of the population, especially those that are hard to reach and most at risk? Do relevant sectors use forecasts and warnings to take action? Is there a coordination mechanism of government entities to take action?

Sea level rise and storm surge:[6]

- How may coastal flooding due to sea level rise affect populations living along the coast? How will marginalized populations be impacted?
- How may storm surge damage coastal resources and infrastructure and affect the magnitude of response needed?

Illustrative questions by programming or system element:

Capacity Building, Preparedness, and Planning

- Are current disaster readiness plans, systems, and operations informed by weather/climate information, forecasts, and warnings?
- What is known regarding potential longer term trends in the frequency and/or intensity of hydro-meteorological hazards (e.g., storms, floods, droughts, heat and cold waves) for your region? Could these trends affect the likelihood of other natural hazards (e.g., wildfires, landslides)?

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or intersex individuals. Further information can be found in the LGBT Vision for Action, https://www.usaid.gov/what-we-do/democracy-human-rights-and-governance/protecting-human-rights/lgbti-inclusive-policies.)

[5] In this document "climate change mitigation" refers to efforts to reduce greenhouse gas emissions.

[6] A temporary sea level rise associated with a storm.

- Are current disaster preparedness plans adaptable or robust enough to respond to changing stressors in the future?
- Do local plans (e.g., land use, zoning) use weather, climate, and hazard (e.g., flood maps) information?
- Do authorized entities have adequate capability to monitor climate and develop relevant products, and the ability to disseminate information in a timely and understandable manner? Do authorized entities have an established operational early warning systems (EWS) to warn the public and stakeholders in advance and provide guidance on response options? Will women, girls, and other marginalized populations be reached by these early warning systems?
- Do training and other capacity building programs incorporate climate-related information?
- Are building / infrastructure design standards sufficient to withstand extreme weather events? Are there the capability and data to develop design codes and standards that are updated to include climate change scenarios?
- What is the potential for short-term disaster risk reduction and coping strategies (e.g., small scale protective infrastructure) to be maladaptive in the future? What alternative options could be implemented to reduce risk from climate impacts while still meeting shorter-term needs?
- Do disaster risk reduction and coping strategies address issues for marginalized populations, such as women, girls, and the elderly, whose response may be impacted by cultural norms, such as mobility restrictions?

Tool Step 3: Adaptive Capacity Related to Disaster Readiness

This step in the Tool is less relevant to the sector, since disaster readiness is a form of adaptive capacity.

Tool Step 4: Opportunities Related to Climate Risk Management for Disaster Readiness – Illustrative Examples

The need to address climate risks related to disaster readiness may provide a range of additional opportunities. For moderate/high risk strategic elements, projects, and activities, the important types of opportunities to discuss are climate change mitigation, potential co-benefits for non-climate development objectives, leveraging political will, opportunities to increase gender equality and female empowerment, and other development issues. For Washington-based and low-risk strategic elements, projects, and activities, opportunities should focus more on how to support resilience more broadly.

Once you have reviewed this section, you can navigate back to the Tool by clicking on the relevant hyperlink in the header.

Enhance disaster preparedness and planning

- Climate change provides an expanded opportunity to promote training for disaster readiness and expand/strengthen existing early warning systems.
- Potential impacts from climate change provide opportunities to develop plans for more resilient response options and post-disaster recovery.

Increase resilience across multiple development sectors

- The need to rebuild after extreme events provides an opportunity to construct improved, more resilient infrastructure.
- The need to rebuild after extreme events also provides an opportunity to try innovative approaches such as “incremental housing”, which enables quick reconstruction while helping residents to invest in high quality long-term housing. More durable housing may reduce the need to rebuild after future disasters and thereby reduce the energy and greenhouse gas emissions associated with the production and transport of construction materials.
- Capacity building across other development sectors, to screen plans and projects for climate and disaster risks, may increase resilience to disasters and ensure effectiveness and sustainability of development objectives.
- Disaster surveillance equipment used for early warning and emergency response can be used to provide information to those in other sectors (e.g., farmers).
- Capacity building across other development sectors for emergency management and response (e.g., transport, public health).

Incorporate resilience into other development activities

- New challenges caused by climate change may provide opportunities to establish new coalitions or partnerships to enhance resilience.
- Incorporating information about disaster preparedness into education initiatives may increase public awareness.
- Improved infrastructure, such as electricity and communication networks, may enhance dissemination of early warnings.

Tool Step 5: Climate Risk Management Options for Disaster Readiness – Illustrative Examples

Many interventions that are used to make communities more resilient to climate variability in the short term have the potential to contribute to longer term adaptation strategies. Some of the options for reducing climate risks to disaster readiness are outlined below.

Once you have reviewed this section, you can navigate back to the Tool by clicking on the relevant hyperlink in the header.

Incorporate climate change into capacity building, preparedness, and planning

- Build capacity to incorporate and update disaster readiness plans with information on extreme weather and climate.
- Enhance capacity to monitor, forecast, interpret, and communicate weather and climate information required to plan adaptive responses and ensure that responses are gender-informed and reach the most vulnerable.
- Strengthen available risk information through community mapping and open-source platforms.
- Incorporate climate-related information into trainings and other capacity building programs to increase and strengthen capacity on DRR and potential response options.
- Incorporate climate related risks in DRR strategies and plans. Post-disaster recovery may present a unique opportunity for transformative adaptation that fundamentally reduces vulnerability or increases resilience to future events.

Strengthen disaster risk mitigation

- Enhance early warning systems.
- Enhance support for information-sharing systems and services, which may involve strengthening networks and promoting dialogue and cooperation among scientific communities and practitioners.
- Further incorporate resilience measures into recovery to mitigate negative impacts of future disasters. For example, planting appropriate vegetation on coastlines that would protect from storm surges or integrating disaster awareness into education projects.

Additional Key Resources Related to Disaster Readiness

The following **resources** provide additional information related to climate risks to disaster readiness and corresponding climate risk management options.

Title	Author(s)	Organization	Date	Length	Intended Audience	Unique Value
Climate Change Adaptation and Disaster Risk Reduction in the Education Sector	Anonymous	UNICEF	2012	228 pp.	Development practitioners, educators, government officials	Resource manual with modules providing more in-depth information than the Tools on climate risks and adaptation in the education sector. Modules cover risks; legal instruments policy framework for reducing risks; approaches for scaling up and mainstreaming adaptation and disaster risk reduction; child and youth participation; M&E; cross-sector planning; implementation; and case studies.
Assessing Drought Hazard and Risk: Principles and Implementation Guidance	World Bank	World Bank	2019	69 pp.	Those who may set up and run a drought risk assessment and at which moments to involve experts.	Provides direction to effective drought hazard and risk assessments. It is based on a new extensive inventory of drought models and tools, made available through www.droughtcatalogue.com, and a technical evaluation of these models on a set of case studies.
Ecosystem-based Adaptation and Extreme Events	USAID Forestry & Biodiversity Office and USAID BRIDGE	USAID	2017	8 pp.	Development experts, policymakers	Provides an overview of ecosystem-based adaptation approaches to help communities adapt to extreme weather and other climate events

Title	Author(s)	Organization	Date	Length	Intended Audience	Unique Value
Ecosystem-based Adaptation and Coastal Populations	USAID Forestry & Biodiversity Office and USAID BRIDGE	USAID	2018	8 pp.	Development experts, policymakers	Provides an overview of ecosystem-based adaptation approaches to help coastal communities build resilience to climate change.
Improving Ecosystem Management to Strengthen Resilience to Extreme Weather in the Philippines	USAID Forestry & Biodiversity Office and USAID BRIDGE	USAID	2018	4 pp.	Development experts, policymakers	Highlights a projected supported by the USAID/Philippines mission that used ecosystem-based adaptation approaches to strengthen community resilience to extreme weather events.
Restoring Coral Reefs in the Face of Climate Change in the Seychelles	USAID Forestry & Biodiversity Office and USAID BRIDGE	USAID	2018	4 pp.	Development experts, policymakers	Highlights a project supported by the USAID/Southern Africa Regional Mission that used ecosystem-based adaptation approaches to strengthen community resilience to sea level rise and extreme weather events in the Seychelles.

Title	Author(s)	Organization	Date	Length	Intended Audience	Unique Value
Words into Action Guidelines: Implementation Guide for Local Disaster Risk Reduction and Resilience Strategies	J. Hardoy, M. Filippi, C. Johnson, E. Gencer , B. Eduardo, Morera, and D.Satterthwaite	United Nations Office for Disaster Risk Reduction (UNDRR)	2019	113pp	Local government (authorities, planners and managers at city or other subnational levels)	Advise on developing and implementing a holistic and integrated local DRR (disaster risk reduction) strategy that contributes to building resilience at the local scale and that accommodates to a national strategy whenever one is in place.
Introductory Capstone Enhancing Disaster Preparedness for Effective Response	Masayo Kondo Rossier, and Sarah Wade-Apicella	United Nations Office for Disaster Risk Reduction (UNDRR)	2017	75pp	National Disaster Management Offices (NDMOs), Emergency Managers and relevant government officials, civil society and international organizations, within and across all sectors at national/local and global/regional Levels	Highlights the key principles and required actions outlined in the Sendai Framework to enhance disaster preparedness for effective response, points to existing resources that provide more detailed explanations and guidance, and illustrates implementation with examples.

Title	Author(s)	Organization	Date	Length	Intended Audience	Unique Value
A better climate for disaster risk management	Many	International Research Institute for Climate and Society (IRI) with funding from CCAFS, OCHA, RCCC, and NOAA	2011	133pp	Disaster risk managers, Humanitarian community, Climate information providers	Describes opportunities for building trust and the sharing of knowledge between the providers of climate services and those who can use those services to enhance disaster risk management.

Economic Growth

Introduction

Purpose: This annex to the Climate Risk Screening and Management Tools is designed to provide you with more information on climate change[1] implications for economic growth. The information is grouped into the following sub-sections, with the corresponding step from the Tools shown in parentheses:

- Climate Risks to Economic Growth (Step 2)
- Adaptive Capacity Related to Economic Growth (Step 3)
- Opportunities Related to Economic Growth (Step 4)
- Climate Risk Management Options for Economic Growth (Step 5)
- Additional Key Resources Related to Economic Growth

The questions and examples provided in this annex are illustrative and designed to stimulate thinking about climate risks, adaptive capacity, opportunities, and climate risk management options. Actual climate risks will depend on the context and anticipated climate changes for particular geographies.

Sectoral focus of this annex: The material in this annex focuses on economic growth, and aligns with the following Program Areas of the Standardized Program Structure: EG.1 Macroeconomic Foundation for Growth, EG.2 Trade and Investment, EG.4 Financial Sector, EG.5 Private Sector Productivity, and EG.6 Workforce Development. Note, you may want to consult annexes related to key sectors of the economy such as Agriculture. If any new construction or rehabilitation[2] is anticipated, referring to the Infrastructure, Construction, and Energy Annex is highly recommended. Please note, *activity*-level climate risk management (CRM) for engineering design **must** be conducted by the Engineer of Record.[3] See the Infrastructure, Construction, and Energy Annex for solicitation language.

[1] In this document, the term "climate change" refers to both climate variability and climate change. "Climate variability" refers to variations in climate (including the normal highs and lows, wet and dry periods, hot and cool periods and extremes) and can refer to month-to-month variability, year-to-year variability, and even decadal scale variability. In this document, "climate change" refers to those variations as well as persistent change in climate over decades or longer (USAID, 2014. *Climate-Resilient Development: A Framework for Understanding and Addressing Climate Change*).

[2] USAID Implementation of Construction Activities, A Mandatory Reference for ADS Chapter 303, defines "construction" as: "construction, alteration, or repair (including dredging and excavation) of buildings, structures, or other real property and includes, without limitation, improvements, renovation, alteration, and refurbishment. The term includes, without limitation, roads, power plants, buildings, bridges, water treatment facilities, and vertical structures." Construction at USAID almost always occurs within another primary programming area (e.g., school building for education, hospital/clinic construction for health).

[3] An appropriately qualified engineering firm under contract or subcontract with USAID for the purpose of completing the engineering design.

Tool Step 2: Climate Risks to Economic Growth – Illustrative Examples and Questions

Once you have reviewed this section, you can navigate back to the Tool by clicking on the relevant hyperlink in the header.

Macroeconomic Foundation	Trade and Investment	Financial Sector	Private Sector Productivity	Workforce Development
• Strained public health budgets and access to health services due to increasing incidence of vector-borne and waterborne diseases from higher temperatures. • Reduced tourism revenues due to extreme temperatures and increased frequency and intensity of storms. • Increased expenditures for coastal infrastructure due to sea level rise, saltwater intrusion, and more frequent and/or intense coastal storms. • Reduced environmental and public use of coastal wetlands due to sea level rise. • Reduced national tax base, increased deficit spending or inflation, increased unemployment, and other important macroeconomic	• Changes in foreign exchange earnings at both summer and winter tourist destinations due to higher temperatures. • Stressed roads and rail lines used for commerce and trade due to higher temperatures. • Reduced trade and investment in coastal goods and services due to damaged ports, coastal infrastructure, and natural resources, caused by sea level rise and coastal storm surge.[4] • Closed or damaged ports and transport routes critical to trade due to extreme weather events in coastal areas, such as hurricanes. • Disrupted trading patterns and international investment flows due to floods and droughts. • Reduced trade and investment in agriculture to due prolonged	• Increased vector-borne diseases and liability costs of insurers due to increased morbidity and mortality caused by rising temperatures. • Increased risks to bank lending portfolios with coastal infrastructure vulnerable to sea level rise and coastal storm surge. • Increased costs for property and infrastructure insurers due to increased frequency or magnitude of extreme events. • Increased loan default rates due to floods. • Increased financial market losses due to economic disruption and damage caused by extreme weather events. • Disrupted financial markets due to floods and droughts.	• Power outages, decreased worker productivity, and reduced industrial output due to increased heat. • Reduced production, increased costs, and reduced availability of natural resources, other inputs, and labor due to increases in flooding and droughts. • Reduced competitive advantage of affected businesses due to a range of possible climate stressors affecting certain locations or economic sectors more than others.	• Decreased worker health and productivity due to heat stress. • Changes to workforce from migration of people related to severe flooding or prolonged drought. • Unsafe building conditions for workers due to extreme weather events. • Workforce required to learn new skills and technologies to achieve employment in other sectors due to reduced productivity of sectors such as agriculture caused by climate stressors. • Gender inequalities exacerbated due to livelihood impacts that affect women's livelihoods more severely.

[4] A temporary sea level rise associated with a storm.

effects due to extreme weather events and more gradual climate changes.	drought. ● Increased investment uncertainty due to increased market volatility from climate variability.			

The consideration of risk may be approached in two different but related ways: by climate stressor and by programming or system element. It can be useful to consider both if time permits.

Illustrative questions by climate stressor:

Temperature:

- How may temperature extremes affect work scheduling and workforce productivity for women and men? How might this be different for marginalized populations?
- How may increasing health risks due to higher temperatures or heavy rainfall affect public financing?
- Would higher temperatures increase business costs related to cooling work areas, materials, or products?

Flooding:

- How may flooding due to sea level rise increase liability costs for the insurance/reinsurance sectors?
- How may flooding affect movement of labor, materials, services, and access to markets?
- How might floods disproportionately affect marginalized populations,[5] requiring greater public financing to support recovery?
- How may flooding and other extreme events decrease the attractiveness of the region for tourism?

Drought:

- How will prolonged drought reduce production?
- How may drought affect the availability of natural resources that support economic activity?
- Might drought disrupt supply, transport, and distribution chains, increasing costs of trade?

Sea level rise and storm surge:

- How might losses of coastal resources due to sea level rise and storm surge affect economic growth?

[5] Marginalized populations are groups of people who are excluded, based on their identity, from political, social, and economic power and participation. Often they include women and girls, at-risk youth, the elderly, LGBTI individuals, persons with disabilities, people in linguistic minorities, indigenous people, and/or a combination of any of these identities. (LGBTI individuals refers to lesbian, gay, bisexual, transgender, or intersex individuals. Further information can be found in the LGBT Vision for Action, https://www.usaid.gov/sites/default/files/documents/1874/LGBT_Vision.pdf.)

- To what extent could climate-related internal displacement or migration away from coastal zones affect worker availability, political stability, and economic growth?
- How might sea level rise and/or coastal storms affect international and domestic trade?

Illustrative questions by programming or system element:

Macroeconomic Foundation for Growth:

- How might climate change affect key sectors of the economy?
- How might climate change affect long-term public spending needs for infrastructure construction, relocation or adaptation of industrial facilities, utilities, or human settlements?
- How might climate change affect national and subnational domestic revenue mobilization?
- How might changes in government revenues and spending in response to climate change affect the macroeconomy, including fiscal deficits, unemployment, and inflation rates?
- How might climate change affect political stability?
- How might extreme weather events affect government priorities for spending and/or development assistance?

Trade and Investment:

- How might climate change affect trade and investment in the specific sectors and locations that are expected to be most relevant for USAID programs?
- Are the commercial[6] and industrial sectors equipped to respond to changes in the supply and demand for goods and services?

Financial Sector:

- How might climate change cause banks to become more risk averse in lending?
- How might climate change affect equitable access to financial markets? Would women, the elderly, at-risk youth, LGBTI,[7] and other marginalized populations be disproportionately affected regarding access to financial markets? Would small and medium enterprises (SMEs) and women-led companies be disproportionately affected?

Private Sector Productivity:

- How might climate change affect the competitiveness of the private sector or its ability to produce and deliver goods and services, including financial services? Are micro, small and/or women-led enterprises, especially those operated by marginalized peoples, expected to be more affected by changes in economic opportunities as a result of climate change than medium and large enterprises?

[6] Commercial sector is defined as non-manufacturing business establishments, including hotels, restaurants, wholesale businesses, retail stores, warehouses, storage facilities, and health, social and educational institutions.
[7] LGBTI refers to lesbian, gay, bisexual, transgender, intersex individuals. Further information can be found in the LGBT Vision for Action, https://www.usaid.gov/sites/default/files/documents/1874/LGBT_Vision.pdf.

- How may climate change affect the viability of economic activities based on natural resources, including tourism and agriculture? How might this impact women and other marginalized populations considering they often rely heavily on natural resources for livelihoods?
- How might climate change impacts on one sector affect other sectors (e.g., impact of storms on electricity distribution, thereby affecting tourism)?
- How might climate change affect the value of land or otherwise put pressure on property rights? What are the gender implications of this impact?

Workforce Development:

- How is climate change expected to affect the productivity of the workforce (temperature limits, changes in disease incidence, etc.)?
- How might training needs change as a result of climate impacts, in terms of skills within sectors and potential need to emphasize new sectors? What are the implications of climate change for public and private workforce development efforts?

Tool Step 3: Adaptive Capacity Related to Economic Growth – Illustrative Questions

Once you have reviewed this section, you can navigate back to the Tool by clicking on the relevant hyperlink in the header.

Information Capacity

- What is the capacity to collect, analyze, and disseminate information on climate change and economic growth?
  - What is the country's ability to identify and address projected climate-related effects on economic growth? What critical information gaps exist? To what extent is planning based on historical averages, and to what extent are planning systems dynamic and able to adjust to new information?
  - To what extent is climate information incorporated into economic planning?
  - How well are surveillance information and economic indicators (e.g., the cost of resources in key economic sectors, the time it takes to move goods to market) used?
  - Are women and other marginalized populations adequately represented in and participating in decision-making around solutions developed to address climate risks?

Social and Institutional Capacity

- What is the capacity of institutions and civil society to take action and to adjust to climate impacts on economic growth?
  - What is the current state of awareness/knowledge within government fiscal and monetary policy systems about risks and/or opportunities of climate change?
  - How is the capacity to carry out commercial activities (tourism, trade and investment, financial services, GDP, and employment) expected to be affected by climate change?
  - Are institutions and leadership in place to support the planning and implementation of economic growth policies and programs that consider climate change? To what extent do governments and the private sector have the capacity to address climate change impacts and opportunities?
  - Are government policies in place that support increased adaptive capacity as an aspect of economic growth, such as tax incentives for relocation/protection of factories or businesses?
  - Are the general public and marginalized populations sufficiently protected by inclusive economic laws and property rights?

- What risk reduction strategies have been implemented by the private sector?
- To what extent are economic planning systems able to take into account both gradual changes (e.g., droughts) and rapid onset events (e.g., floods)?
- Are civil society organizations (CSOs) that represent marginalized populations sufficiently empowered to be able to insulate the local communities that they represent from the impacts of climate change on economic opportunities?

Human Capacity

- Do individuals and organizations have the capacity to respond to climate impacts on economic growth?
  - To what extent have traders and investors considered climate risks and opportunities?
  - To what extent is the work force's capacity, resilience, and access to resources sufficient to support the changing demand for labor? How might this be different for women and men?
  - To what extent are technical and research organizations in place to train and support workforce development, especially for individuals from marginalized populations that are likely to be disproportionately affected?

Financial Capacity

- Are there adequate financial resources to support key economic sectors in preparing for and responding to climate change impacts?
  - To what extent are investments being made to reduce climate risks to economic growth?
  - To what extent are public-private partnerships being fostered that can help to finance climate resilience?
  - How sufficient are existing or planned mechanisms to channel financial resources to economic actors in the event of severe disruptions from climate change?
  - How sufficient are financial products and services to address increasing risk (e.g., insurance, credit and savings)? Will responding to climate change require new financial products or policies to protect vulnerable resources (e.g., payment for ecosystem services, pricing strategies)?

Tool Step 5: Opportunities Related to Climate Risk Management for Economic Growth – Illustrative Examples

The need to address climate risks to economic growth may provide a number of additional opportunities. For moderate/high risk strategic elements, projects, and activities, the important types of opportunities to consider are climate change mitigation,[8] potential co-benefits for non-climate development objectives, leveraging political will, opportunities to enhance gender equality and female empowerment, and other development issues. For Washington-based and low-risk strategic elements, projects, and activities, opportunities should focus more on how to support resilience more broadly.

Once you have reviewed this section, you can navigate back to the Tool by clicking on the relevant hyperlink in the header.

Develop low-emission development strategies (including green industries to provide benefits for climate change mitigation/adaptation and sustainable economic development)

- Incentives provided by financial institutions and governments can encourage the private sector to develop and deploy technologies in renewable energy and energy efficiency; waste, water and sanitation; and transport. There are opportunities across the entire value chain to reach a wide variety of beneficiaries – in design, manufacturing, operations and maintenance (O&M), installation, retail and distribution, and research and development (R&D).
- Emphasize the potential of O&M to improve equipment and system performance without the need to invest in new capital. O&M training is less expensive than capital investment, can be implemented promptly, can include simple protocols, such as regular filter cleaning that workers of all skill levels can implement, and which may extend the life of current equipment. Improved performance means the same output is achieved with fewer inputs. To the extent that energy inputs are reduced, greenhouse gas emissions will be reduced.

Use public finance mechanisms to mobilize and leverage private capital for promising adaptation and climate change mitigation technologies

- Carbon finance can be used to monetize future cash flows from the advanced sale of carbon credits to finance investment costs for climate resilience investment (e.g., resilient infrastructure) or renewable energy and energy efficiency projects.
- Ensuring that public infrastructure projects consider climate information and/or can contribute to climate resilience of the economy.
- Encourage investment in cost effective “smart” technologies, such as meters, light sensors, and motion detectors that reduce energy and greenhouse gas emissions in residential, commercial, and industrial facilities.
- Explore new sources of financing, such as green bonds, to raise capital for climate-resilient infrastructure that will improve services while strengthening resilience and directly or indirectly enhance economic growth by making a municipality or other jurisdiction a more attractive place to invest. If used to support infrastructure such as public transit, green bonds can reduce emissions growth in the transportation sector.

[8] In this document “climate change mitigation” refers to efforts to reduce greenhouse gas emissions.

Develop financial services for underserved populations

- Mobile banking, Village Savings and Loan Associations (VSLAs), and microfinance can help build the adaptive capacity of smallholders, entrepreneurs, women-owned businesses, economically disadvantaged persons, or other groups that otherwise lack access to financial services.

Create synergies with existing or planned reforms

- Reforms to public utility pricing and management can increase efficiency and reduce the vulnerability of climate-sensitive resources. For example, subsidies for electricity and water use can distort price signals that would otherwise encourage investment in conservation (e.g., drip irrigation in agriculture, alternative sources of energy, and energy-saving technologies). Increased rate collection can help to ensure wise use of resources.

Develop public-private partnerships to achieve multiple economic objectives when addressing climate impacts

- For example, challenges caused by climate change, such as disruptions in power supply, may provide opportunities to diversify the supply of services to be more inclusive of the private sector (e.g., distributed energy and energy service companies). Distributed energy systems often use renewable energy sources and energy service companies typically provide energy-saving services or equipment that are paid for by the energy cost savings. Both help mitigate climate change.

Encourage governments to place a higher priority on related development objectives and realize co-benefits

- Climate-proofing infrastructure and infrastructure services can support economic growth in a changing climate.
- Government policies that support increased adaptive capacity as an aspect of economic growth, such as tax incentive for relocation or protection of factories or businesses, can support economic growth while increasing resilience.
- Strengthening civil society and engaging broader sectors of the population—including marginalized populations— in development can increase democratic participation and government accountability while simultaneously bolstering economic capacity and resilience of those groups to the impacts of climate change.

Tool Step 6: Climate Risk Management Options for Economic Growth – Illustrative Examples

Once you have reviewed this section, you can navigate back to the Tool by clicking on the relevant hyperlink in the header.

Consider climate information relevant to economic growth

- Analyze climate information to determine vulnerabilities and risks to key economic sectors for this stage of the program cycle. Consider the climate risk management options for the sectors described in the other annexes.
- Increase awareness of various stakeholders about implications of climate change for economic growth and increase understanding of how these implications may impact women and men differently, as well as how marginalized populations may suffer disproportionately.

Strengthen economic policies and planning systems

- Improve coordination of government economic policies and green growth opportunities.
- Determine adaptation needs and opportunities to sustain private sector productivity.
- Increase availability and access to finance to reduce climate risks.

Improve risk management

- Develop new insurance instruments to address climate risks.
- Make financial markets more inclusive to help build the adaptive capacity of marginalized populations.
- Encourage new development away from high-risk locations.

Additional Key Resources Related to Economic Growth

The following **resources** provide additional information related to climate risks to economic growth and corresponding climate risk management options.

Title	Author(s)	Organization	Date	Length	Intended Audience	Unique Value
ADAPTING FROM THE GROUND UP: Enabling Small Businesses in Developing Countries to Adapt to Climate Change	L. Dougherty-Choux et al.	World Resources Institute	2015	88 pp.	Development practitioners, small businesses, and policymakers	Can be used as a next step after the Tools to enable small businesses to adapt to climate change, while also taking advantage of new markets for climate-resilient technologies, products, and services. Also discusses policy actions and regulations that can stimulate new markets. Includes framework for engaging small businesses in adaptation.
Innovative Insurance Solutions for Climate Change: How to Integrate Climate Risk Insurance into a Comprehensive Climate Risk Management Approach	K. Warner et al.	UN University Institute For Environment And Human Security	2013	52 pp.	Development practitioners, climate-sensitive businesses	Provides practical guidance for developing risk transfer instruments that can be used to address climate-related financial risks faced by poor communities that are vulnerable to extreme events, such as floods that can destroy harvests and other sources of income.
Climate Resilience and *Financial Services*	A. Haworth et al.	Braced Knowledge Managers	2016	110 pp.	Development practitioners	Provides information on “best practices” for developing alternative financial services to build the adaptive capacity of smallholders. Options discussed include mobile banking, Village Savings and Loan Associations (VSLAs), and microfinance. Includes detailed case studies of stakeholder experiences in Ethiopia, Mali, and Myanmar.
The Economics of Ecosystem-based Adaptation	USAID Forestry & Biodiversity	USAID	2017	4 pp.	Development experts, policymakers,	Provides an overview of the economics of ecosystem-based adaptation approaches.

Title	Author(s)	Organization	Date	Length	Intended Audience	Unique Value
	Office and USAID BRIDGE				climate-sensitive businesses	
Building Competitive Green Industries: The Climate and Clean Technology Opportunity for Developing Countries	infoDev	*info*Dev/World Bank	2014	128 pp.	Development practitioners, entrepreneurs, and investors in SMEs	Provides more in-depth information than the Tool on clean technologies, with a focus on opportunities for SMEs that have co-benefits for climate change mitigation and economic development. Discusses region-specific challenges and opportunities. Provides numerous examples along with in-depth case studies of bioenergy, solar energy, and climate smart agriculture projects.
Private Sector Engagement in Adaptation to Climate Change: Approaches to Managing Climate Risks	S. Agrawala et al.	OECD	2011	56 pp.	Development practitioners and private companies	Provides more detailed examples than the tool on private sector responses to climate risks and opportunities.
Climate Finance Assessment: Opportunities for Scaling Up Financing for Clean Energy, Adaptation, and Sustainable Landscapes	G. Anderson, et al.	USAID	2019	106 pp.	Development practitioners.	Discusses how development assistance agencies can accelerate financing for investments in clean energy, sustainable landscapes, and climate adaptation.
CEADIR - Climate Economic Analysis for Development, Investment and Resilience		USAID	2019	Multiple web links	Development practitioners and private companies	Knowledge management portal containing many relevant analyses, webinars, and case studies.
Integrating ecosystem values into cost-benefit analysis: recommendations for USAID and practitioners.	B. Kashi et al.	USAID	2018	76 pp.	Development practitioners	Provides recommendations for incorporation of ecosystem service valuations into cost-benefit analyses.

Education, Social Services, and Marginalized Populations[1]

Introduction

Purpose: This annex to the Climate Risk Screening and Management Tools is designed to provide you with more information on climate change[2] implications for education, social services, and marginalized populations. The information is grouped into the following sub-sections, with the corresponding step from the Tool shown in parentheses:

- Climate Risks to Education, Social Services, and Marginalized Populations (Step 2)
- Adaptive Capacity Related to Education, Social Services, and Marginalized Populations (Step 3)
- Opportunities Related to Education, Social Services, and Marginalized Populations (Step 5)
- Climate Risk Management Options for Education, Social Services, and Marginalized Populations (Step 6)
- Additional Key Resources Related to Education, Social Services, and Marginalized Populations

The questions and examples provided in this annex are illustrative and designed to stimulate thinking about climate risks, adaptive capacity, opportunities, and climate risk management options. Actual climate risks will depend on the context and anticipated climate changes for particular geographies.

Sectoral focus of this annex: The material in this annex aligns with the following program areas of the Standardized Program Structure: ES.1 Basic Education and ES.5 Social Assistance. Note, to the extent your design involves multiple sectors, you may want to consult other relevant annexes. In particular, if any new construction or rehabilitation[3] is anticipated, referring to the Infrastructure, Construction, and Energy Annex is highly recommended. Please note, *activity*-level climate risk management (CRM) for engineering design **must** be conducted by the Engineer of Record.[4] See the Infrastructure, Construction, and Energy Annex for solicitation language.

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[1] Marginalized populations are groups of people who are excluded, based on their identity, from political, social, and economic power and participation. Often they include women and girls, at-risk youth, the elderly, LGBTI individuals, persons with disabilities, people in linguistic minorities, indigenous people, and/or a combination of any of these identities. (LGBTI individuals refers to lesbian, gay, bisexual, transgender, or intersex individuals. Further information can be found in the LGBT Vision for Action, https://www.usaid.gov/what-we-do/democracy-human-rights-and-governance/protecting-human-rights/lgbti-inclusive-policies.)

[2] In this document, the term "climate change" refers to both climate variability and climate change. "Climate variability" refers to variations in climate (including the normal highs and lows, wet and dry periods, hot and cool periods and extremes) and can refer to month-to-month variability, year-to-year variability, and even decadal scale variability. In this document, "climate change" refers to those variations as well as persistent change in climate over decades or longer (USAID, 2014. Climate-Resilient Development: A Framework for Understanding and Addressing Climate Change).

[3] USAID Implementation of Construction Activities, A Mandatory Reference for ADS Chapter 303, defines "construction" as: "construction, alteration, or repair (including dredging and excavation) of buildings, structures, or other real property and includes, without limitation, improvements, renovation, alteration, and refurbishment. The term includes, without limitation, roads, power plants, buildings, bridges, water treatment facilities, and vertical structures." Construction at USAID almost always occurs within another primary programming area (e.g., school building for education, hospital/clinic construction for health).

[4] An appropriately qualified engineering firm under contract or subcontract with USAID for the purpose of completing the engineering design.

Tool Step 2: Climate Risks to Education, Social Services, and Marginalized Populations – Illustrative Examples and Questions

Once you have reviewed this section, you can navigate back to the Tool by clicking on the relevant hyperlink in the header.

Physical Structures	Attendance and Ability to Learn	Instruction and Training	Social and Economic Services	Marginalized Populations
• Classroom closures due to overheating school buildings caused by high temperatures. • Unsafe schools due to structural damage of school facilities caused by storms with heavy winds such as hurricanes. • Interrupted delivery of infrastructure services (e.g., supply of drinking water) due to damage to water supply and sanitation infrastructure caused by flooding. • Flooded school facilities and damaged salt-sensitive equipment due to sea level rise and storm surge.[5]	• Reduced school attendance and learning success due to increasing vector-borne diseases caused by higher temperatures. • Reduced ability of students to learn effectively due to extreme heat. • Limited school attendance, especially by girls, due to reduced ability to pay schools fees or temporary relocation of families caused by severe flooding or prolonged drought that affects livelihoods and incomes. • Reduced school attendance due to increasing time spent by girls and boys collecting food and water resources as a result of scarcity due to drought or other climate stressors. • Reduced attendance due to wastewater overflows and spread of waterborne diseases from sea level rise and storm surge.	• Reduced teaching effectiveness and learning success due to interference with course schedules and instruction by climate impacts. • Need for schools to develop new curricula and instructional materials to train students for jobs in other sectors due to reduced employment opportunities in climate-sensitive sectors, such as agriculture.	• Required financial or other support to help children from displaced families attend school due to damaged homes and temporary displacement caused by extreme events. • Increased need to provide vulnerable households with cash, food, or other assistance to help keep children in school due to a variety of climate-related impacts such as prolonged drought. • Adjustments in social assistance for school-aged children due to the relocation or migration[6] of marginalized populations caused by sea level rise.	• Marginalized populations may be disproportionately affected by climate change if they live in areas exposed to weather extremes (e.g., flood plains), don't have access to health care, and don't have access to resources and amenities that can alleviate impacts from climate change. • Increased risk of climate-related disasters will tend to exacerbate existing inequalities experienced by marginalized populations (e.g., increased vulnerability of women and children to sexual violence and abuse during and after disasters).

[5] A temporary sea level rise associated with a storm.
[6] In this document, the term "migration" is used to indicate the movement of people in general, and not necessarily movement across borders.

Illustrative questions by climate stressor:

Consider both current conditions and the future conditions described in the Climate Risk Profile(s).

Temperature:

- Are higher temperatures likely to affect classroom conditions and learning success?
- Are higher temperatures and more humid conditions likely to affect the incidence of disease and school attendance?
- Are higher temperatures and more humid conditions likely to disproportionately impact elderly populations whose physiology is more prone to heat stress?

Flooding:

- Is flooding likely to damage school facilities during heavy precipitation events or rapid snowmelt?
- Is flooding likely to reduce access to schools?
- Is flooding likely to disproportionately affect economically disadvantaged populations living in flood plains or other areas that are not protected from flooding?

Drought:

- Is drought likely to affect family incomes and the ability to pay student fees, reducing attendance and equitable access to education?
- Is drought likely to reduce the availability food and water, reducing the health of school children and leading to poor attendance or school performance?
- Is drought likely to disproportionately affect economically disadvantaged populations or other groups that do not have access to abundant water supply?

Sea level rise and storm surge:

- Is sea level rise and/or storm surge likely to flood school facilities or contaminate drinking water?
- Is sea level rise likely to displace families and require financial or other support to keep children in school?
- Is sea level rise likely to disproportionately affect populations living in coastal slums?

Illustrative questions by programming or system element:

Physical Structures:

- Are high temperatures likely to overheat school buildings?
- Is flooding likely to produce school outfall overflows and waste contamination?
- Are storms such as hurricanes likely to tear off school roofs or otherwise damage school facilities?
- Is sea level rise and/or storm surge likely to contaminate a school's drinking water supply with salt water?

Attendance and Learning Ability:

- Are higher temperatures likely to increase the incidence of vector-borne diseases and reduce school attendance?
- Are higher temperatures likely to reduce school performance?
- Are extreme events, such as heat waves or hurricanes, likely to require students to stay home to care for ill or injured family members?
- Are floods and droughts likely to reduce food supplies, leading to under-nutrition and under-nourishment, impaired cognitive functioning, and poor school performance?
- Is drought likely to lead to crop failures and loss of income, affecting the ability to pay school fees, especially for girls?

Instruction and Training:

- How is projected climate change likely to affect the skills needed for workforce development? What are the implications for school curricula and instructional materials?
- How is projected climate change likely to increase the need for instruction in climate change vulnerability, impacts, and adaptation and climate change mitigation[7] options?

Social and Economic Services:

- How might climate change impacts increase the need to provide vulnerable households with cash, food, or other assistance to help keep children in school?
- Are climate change impacts such as sea level rise likely to displace families, requiring adjustments in social assistance for school-aged children?
- Will climate change impacts such as sea level rise or flooding disproportionately affect marginalized peoples, such as LGBTI individuals, that are discriminated against and have reduced access to social services?

Marginalized Populations:

- What populations may be more exposed to drought, higher temperatures, and storms due to location, adequacy of shelter, etc.?
- How might marginalized populations be impacted by climate change, compared to populations with more wealth and the ability to mobilize services that could reduce their suffering?
- Do marginalized populations have the same access to social services that may be provided to mitigate effects of climate change?

[7] In this document "climate change mitigation" refers to efforts to reduce greenhouse gas emissions.

Tool Step 3: Adaptive Capacity Related to Education, Social Services, and Marginalized Populations – Illustrative Questions

Once you have reviewed this section, you can navigate back to the Tool by clicking on the relevant hyperlink in the header.

Information Capacity

- Is information about climate change impacts on education, social services, and marginalized populations incorporated into planning of educational systems, social services, and emergency preparedness?
  - To what extent is climate change information incorporated into the design of school facilities, including buildings and supporting infrastructure?
  - To what extent is climate change information incorporated into planning to support marginalized populations (e.g., location of government-funded housing outside of flood plains)?
  - To what extent is climate change information included in emergency planning?

Social and Institutional Capacity

- What is the capacity of institutions and civil society to take action and to adjust to climate impacts on education, social services, and marginalized populations?
  - What institutions and leadership are in place to support actions to address potential impacts and opportunities related to education, social services, and marginalized populations?
  - Are civil society organizations (CSOs) that represent marginalized populations sufficiently empowered to take action on climate impacts?
  - Are marginalized populations represented in institutions and leadership that are in place to support actions to address potential climate impacts?
  - Are community shelters and other community institutions that are in place to support adaptation to and/or relief from climate impacts inclusive of all people or will marginalized populations be denied or restricted access?

Human Capacity

- To what extent do policymakers, educators, social service providers, and local communities have the capacity to consider and address climate impacts to education, social services, and marginalized populations?
  - What is the level of awareness and appreciation of potential impacts on school facilities and educational services, social services, and marginalized populations?
  - What technical resources and organizations are in place to train and support educators, social service providers, and communities to manage climate impacts on education, social services, and marginalized populations?
  - Will local communities and marginalized populations be consulted and considered in plans to address climate impacts?

Financial Capacity

- Are there adequate financial resources to support schools, community shelters, and other community institutions in preparing for and responding to climate impacts?

- How sufficient are existing investments to retrofit school facilities, storm shelters, and other facilities that are preferentially used by disadvantaged populations to reduce risks (e.g., replacing tin roofs that blow off in heavy winds)?
- Is sufficient funding available to train teachers and students, social workers, and health care workers in emergency preparedness?

Tool Step 4: Opportunities Related to Education, Social Services, and Marginalized Populations – Illustrative Examples

The need to address climate risks to education, social services, and marginalized populations may provide a number of additional opportunities. For moderate/high risk strategic elements, projects, and activities, the important types of opportunities to consider are climate change mitigation, potential co-benefits for non-climate development objectives, leveraging political will, and other development issues. For Washington-based and low-risk strategic elements, projects, and activities, opportunities should focus more on how to support resilience more broadly.

Once you have reviewed this section, you can navigate back to the Tool by clicking on the relevant hyperlink in the header.

Reduce Gender Inequalities in Education and Social Services

- Projects to ensure access to schools and social services during extreme events will increase support for girls, who may otherwise be required to stay at home to care for sick or injured family members and to help collect food and water.
- Projects to ensure access to schools and social services during extreme events will increase support for LGBTI individuals, who are likely to be discriminated against.
- Making schools “climate safe” can help replace or improve inadequate or degraded school infrastructure.
- Paving roads to prevent wash-outs during floods will provide access for other needs (e.g., food, access to markets) in addition to social services and school access.

Encourage Governments to Place a Higher Priority on Related Development Objectives

- Ensuring a safe water supply for students, educators, and marginalized populations during storms can help prioritize needed improvements in water and sanitation.
- Ensuring school access will encourage government officials to prioritize needed road improvements.

Develop Synergies with Other Development Objectives

- The need to rebuild schools after extreme events could provide an opportunity to relocate schools away from high-risk locations.
- Making schools “climate safe” will provide opportunities to develop new partnerships among educators, community leaders, emergency relief organizations, and government disaster risk management authorities.

Advance Education

- Curricula incorporating climate change will help advance scientific knowledge and skills.
- Knowledge and skills needed for climate change adaptation/mitigation will encourage curriculum development in new areas and increase educational opportunities.

Prevent Backsliding

- Being prepared to provide social services, and layering them with other development efforts, such as supporting the rights of marginalized populations, such as LGBTI individuals, can help avoid cycles of crisis.

Increase Community Awareness of Climate Risks and Adaptation

- Incorporating climate change lessons into the curriculum will help increase knowledge and understanding of students, educators, and parents.
- Addressing climate change issues in schools can provide a platform for engaging students in developing and implementing climate change adaptation in their communities.

Contribute to Climate Change Mitigation

- Clean energy provided by solar panels can provide power to schools that are off-the-grid.
- School design, building and maintenance practices that are geared toward carbon neutral and environmentally sustainable learning spaces can reduce greenhouse gas emissions.

Tool Step 6: Climate Risk Management Options for Education, Social Services, and Marginalized Populations – Illustrative Examples

Once you have reviewed this section, you can navigate back to the Tool by clicking on the relevant hyperlink in the header.

Help Education and Social Service Systems Use Climate Information to Support Adaptation, Particularly for Marginalized Populations

- Help school district administrators conduct risk screening and develop disaster risk management and climate adaptation plans.
- Ensure climate information informs siting, construction, and renovation efforts.
- Incorporate improved understanding of climate risks, adaptation, and climate change mitigation in both formal and informal education curricula. Educating girls and women is one of the best ways of ensuring that communities are better able to adapt and, thus, be less vulnerable to extreme weather events and climate change.
- Use social service systems to better inform marginalized populations about potential risks.

Help Education Systems and Social Services Improve Climate Risk Management

- Help identify school safety concerns (e.g., ability of physical structures to withstand extreme events) and opportunities to improve safety.
- Help strengthen the capacity of teachers, students, and social service providers to prepare for and respond to flooding and other weather-related emergencies.
- Promote avenues through which knowledge gained by learners can extend climate change mitigation and adaptation measures outside of the school or non-formal learning program and into the wider community.

Focus Efforts on Marginalized Populations

- Identify populations most at risk and target adaptation measures toward them. Populations may be at risk due to location and/or the local climate and/or marginalized due to cultural, historical, social, linguistic, or political reasons.
- Support communities to include specific measures to protect women, girls, and persons with disabilities after disasters and other emergencies.
- Empower marginalized populations with the ability and resources to spearhead adaptation efforts, particularly regarding risks that differentially affect them (e.g., reductions in water supply).

Additional Key Resources Related to Education, Social Services, and Marginalized Populations

The following **resources** provide additional information related to climate risks to education, social services and marginalized populations and corresponding climate risk management options.

Title	Author(s)	Organization	Date	Length	Intended Audience	Unique Value
Topic Guide: Education, Climate and Environment	N. Blum	UK Department for International Development (DFID)	2015	45 pp.	Advisers working in education, environment and climate change, and infrastructure	Provides a structured and detailed approach for understanding the risks and opportunities posed by environmental and climatic factors on educational supply and demand at all levels and the role education and educational infrastructure can play in building the resilience of communities.
Education in Emergencies Toolkit	unknown	Inter-Agency Network for Education in Emergencies	2016	n/a	Educators, humanitarian workers, and government officials working in the field of education	This Toolkit contains a wide variety of practical, field-friendly tools and resources to guide educators, humanitarian workers, and government officials working in the field of education in emergencies through to recovery.
Assessment and Preparedness Toolkit	Ministry of Education and Training (MOET), Republic of Viet Nam	MOET, UNESCO Viet Nam, and International Network for Education in Emergencies (INEE)	2016	168 pp.	Teachers, students, parents, community members, and local authorities	Practical and user-friendly guide that goes beyond the screening level to provide “best practices” for making schools safe and sustainable in the face of climate change, natural hazards, biodiversity loss, safety threats, and other risks.
Guide to Education in Natural Disasters: How USAID Supports Education in Crises	USAID	USAID	2014	24 pp.	USAID education offices	This guide aims to provide USAID Education offices with supporting information to help them respond

Title	Author(s)	Organization	Date	Length	Intended Audience	Unique Value
						effectively to educational needs related to natural disasters. It goes beyond the Tool to discuss principles, practices, and tools for addressing educational need during natural disasters, and includes a comprehensive list of related references.
Working with Marginal Populations: An Annex to the USAID Climate-Resilient Development Framework	E. Carr et al.	USAID	2015	42 pp.	Development planners and practitioners	This document provides detailed information to help development practitioners understand the importance of identifying and addressing the situations that influence marginalized populations. It helps development practitioners understand how to identify and incorporate the perspectives, needs, and capacities of marginalized populations into climate-resilient development.
Gender and Climate Change Capacity Development Series - Africa	Z. Habtezion et al.	Global Gender and Climate Alliance (GGCA) & UNDP	2011	32 pp.	Practitioners and policymakers, including those with experience in gender and development, as well as those with a technical background in climate change, the environment and sustainable development	Provides an introduction to the intersection of gender issues and climate change.

Title	Author(s)	Organization	Date	Length	Intended Audience	Unique Value
The Roadmap for Safer and Resilient Schools (RSRS)	F. Ramirez Cortes et al.	World Bank Group, Global Facility for Disaster Reduction and Recovery	2019	n/a	Governments of developing countries exposed to natural hazards	A step-by-step guide that focuses on the design of intervention strategies and investment plans to make schools safer and resilient at scale. The scope of the guide encompasses the recovery and reconstruction of school facilities affected by disasters.

Environment and Biodiversity

Introduction

Purpose: This annex to the Climate Risk Screening and Management Tools is designed to provide you with more information on climate change[1] implications for environment and biodiversity. The information is grouped into the following sub-sections, with the corresponding step from the Tool shown in parentheses:

- Climate Risks to Environment and Biodiversity (Step 2)
- Adaptive Capacity Related to Environment and Biodiversity (Step 3)
- Opportunities Related to Environment and Biodiversity (Step 5)
- Climate Risk Management Options for Environment and Biodiversity (Step 6)
- Additional Key Resources Related to Environment and Biodiversity

The questions and examples provided in this annex are illustrative and designed to stimulate thinking about climate risks, adaptive capacity, opportunities, and climate risk management options. Actual climate risks will depend on the context and anticipated climate changes for particular geographies.

Sectoral focus of this annex: The material in this annex aligns with the following program areas of the Standardized Program Structure: EG.10 Environment and EG.13: Climate Change: Sustainable Landscapes. Note, to the extent your design involves multiple sectors, you may want to consult other relevant annexes. In particular, if any new construction or rehabilitation[2] is anticipated referring to the Infrastructure, Construction, and Energy Annex is highly recommended. Please note, *activity*-level climate risk management (CRM) for engineering design **must** be conducted by the Engineer of Record.[3] See the Infrastructure, Construction, and Energy Annex for solicitation language.

[1] In this document, the term "climate change" refers to both climate variability and climate change. "Climate variability" refers to variations in climate (including the normal highs and lows, wet and dry periods, hot and cool periods and extremes) and can refer to month-to-month variability, year-to-year variability, and even decadal scale variability. In this document, "climate change" refers to those variations as well as persistent change in climate over decades or longer (USAID, 2014. *Climate-Resilient Development: A Framework for Understanding and Addressing Climate Change*).

[2] USAID Implementation of Construction Activities, A Mandatory Reference for ADS Chapter 303, defines "construction" as: "construction, alteration, or repair (including dredging and excavation) of buildings, structures, or other real property and includes, without limitation, improvements, renovation, alteration, and refurbishment. The term includes, without limitation, roads, power plants, buildings, bridges, water treatment facilities, and vertical structures." Construction at USAID almost always occurs within another primary programming area (e.g., school building for education, hospital/clinic construction for health).

[3] An appropriately qualified engineering firm under contract or subcontract with USAID for the purpose of completing the engineering design.

Tool Step 2: Climate Risks to Environment and Biodiversity – Illustrative Examples and Questions

Once you have reviewed this section, you can navigate back to the Tool by clicking on the relevant hyperlink in the header.

Ecosystems and Ecosystem Services	Species	Natural Resource-Dependent Livelihoods
• Increased tree mortality and reduced extent and condition of forest habitats due to pest outbreaks and fires from changes in temperature and precipitation. • Ecosystem function damage due to desertification caused by higher temperatures and drought. • Impaired water quality and fish habitat due to increased flooding carrying nutrients, sediments, and contaminants over the landscape to downstream waters. • Reduced abundance and diversity of coral reefs due to more frequent bleaching and coral die-offs caused by higher ocean temperatures and ocean acidity. • Exacerbated pressures on coastal ecosystems from land development, pollution, and other non-climate stressors due to sea level rise, saltwater intrusion, and coastal flooding. • Impaired ecosystem services such as fish production from coastal wetlands due to sea level rise and storm surge.[4]	• Altered food web productivity due to changes in species distributions and the seasonal timing of species' life history activities caused by changes in temperature and precipitation. • Forced migration of species to higher latitudes or higher elevations to survive due to higher temperatures. When thermal tolerance is exceeded, a species may become locally or globally extinct. • Changes in growth and survival of migrating species due to climate change-induced mismatches in the timing of migration, breeding, and food availability. • Destruction of habitat for fish and other aquatic species due to prolonged drought. • Destruction of habitat and forced relocation or death of some species due to salt water instruction into freshwater ecosystems caused by sea level rise.	• Local fisheries may be affected by changes in the range and abundance of many economically-important marine fishes due to higher ocean temperatures. • Agricultural production and human health may be affected by the spread pathogens, parasites, and diseases due to higher temperatures. • Increased greenhouse gas emissions and changes in agricultural and forest production due to changes in carbon sequestration, decomposition, and carbon export caused by changes in soil freezing, snow cover, and air temperature. • Interrupted beach recreation and related livelihoods due to coastal erosion from sea level rise and storm surge.

[4] A temporary sea level rise associated with a storm.

Illustrative questions by climate stressor:

Temperature:

- Are higher temperatures likely to contribute to changes in pest outbreaks or wildfire?
- Are higher temperatures likely to cause some species to move to higher altitudes or other regions, or affect the condition of ecosystems and habitats?
- Are shifting seasons expected to affect the life cycles of particular species?

Flooding:

- Are ecosystems or key habitat for species likely to be damaged by flooding?
- Are there locations where heavy rainfall is likely to carry contaminants or excess sediments and nutrients downstream, impairing water quality, and freshwater habitat?
- Are unusually heavy rainfalls likely to trigger outbreaks of diseases and pests?

Drought:

- Are droughts likely to reduce food availability for threatened or endangered species?
- Are droughts likely to reduce habitat for aquatic species?
- Are droughts likely to contribute to wildfire outbreaks?

Sea level rise and storm surge:

- Are coastal wetlands able to migrate inland as sea levels rise, or are they likely to become flooded?
- Are sea level rise and increased storm surge likely to erode beaches and interfere with livelihoods based on beach recreation?

Illustrative questions by programming or system element:

Ecosystems and Ecosystem Services:

- Are higher temperatures likely to change the timing of seasonal biological events such as budding, migration, or spawning, altering species' relative abundance, and affecting food web productivity?
- Are higher ocean temperatures likely to reduce the abundance of important fishery species?
- Are critical habitats likely to be damaged by flooding?
- Are drought conditions likely to reduce water availability for species, increase the incidence of wildfires, and/or increase erosion?
- Are there locations where sea level rise and storm surge are likely to impair ecosystem services such as fish production from coastal wetlands?

Species:

- Are higher temperatures likely to affect the abundance, range, phenology, and/or behavior of key species of concern to USAID's programs?
- Are higher temperatures and/or reduced precipitation likely to lead to invasive species?
- Is sea level rise likely to lead to saltwater intrusion into freshwater wetlands?
- Is flooding likely to damage instream habitats for fish species?
- Are droughts likely to reduce populations of aquatic species?
- Are adaptation actions by people likely to affect conservation outcomes?

Livelihoods:

- Are higher temperatures likely to affect natural resource-based livelihoods such as commercial fisheries and nature-based tourism? How will this impact both women and men? How will this impact marginalized populations?[5]
- Is sea level rise and storm surge increasing coastal erosion, interfering with beach recreation and related livelihoods? If so, will it impact women and men differently? How will marginalized populations be impacted?

[5]Marginalized populations are groups of people who are excluded, based on their identity, from political, social, and economic power and participation. Often they include women and girls, at-risk youth, the elderly, LGBTI individuals, persons with disabilities, people in linguistic minorities, indigenous people, and/or a combination of any of these identities. (LGBTI individuals refers to lesbian, gay, bisexual, transgender, or intersex individuals. Further information can be found in the LGBT Vision for Action, https://www.usaid.gov/sites/default/files/documents/1874/LGBT_Vision.pdf.)

Tool Step 3: Adaptive Capacity Related to Environment and Biodiversity – Illustrative Questions

Once you have reviewed this section, you can navigate back to the Tool by clicking on the relevant hyperlink in the header.

Information Capacity

- What is the level of capacity to collect and use information related to climate impacts on the environment and biodiversity? How do these capacities differ between women and men and other relevant groups?
  - To what extent are effective environmental and climate monitoring systems in place?
  - To what extent are climate data and information being used to inform natural resource management and conservation?
  - To what extent is the unique knowledge of women, indigenous peoples, and other marginalized populations about natural resource use and management being collected and used (i.e., knowledge of changes in water supply or forests)?
  - Do stakeholders (government officials, natural resource managers, communities, and women's groups) have access to appropriate and usable information about climate impacts on the environment and biodiversity? Do they understand how women and other marginalized populations will be impacted?
  - What is the level of capacity among these stakeholders to understand and apply these data to decision-making?
  - Is there sufficient information about vulnerable ecosystems and species (ecological processes, life histories, habitat requirements, etc.) to take actions to reduce that vulnerability?

Social and Institutional Capacity

- What is the capacity of institutions and civil society to take action and to adjust to climate impacts on the environment and biodiversity?
  - How flexible and robust are existing institutions, systems, and processes for environmental governance and management? Are they able to accommodate additional stresses from a changing climate?
  - Do other national policies and strategies (such as for food security or water management) and related management approaches enhance climate resilience by taking an ecosystem-based approach to management?
  - Do national policies and strategies take into account gender considerations, such as how to leverage women's unique knowledge and how to prioritize the needs of women in order to prevent further gender inequality from impacts of climate change?
  - To what extent have ecosystem-based approaches to adaptation been tested or adopted? Have they been successful in reducing vulnerability and achieving co-benefits?

Human Capacity

- Do women, men, and communities that depend on natural resource-based livelihoods recognize the potential impacts and/or opportunities due to climate change?
- To what extent have these individuals and communities prepared for potential climate impacts on the environment?

Financial Capacity

- Do government agencies have adequate financial resources available to prepare for climate impacts on the environment?
- Are funding sources available for other stakeholders (e.g. civil society, communities, and women's groups) to address climate impacts on the environment?
- Do stakeholders have the capacity to access available funds (e.g., writing proposals?). Will women and other marginalized populations be able to access these funds?

Tool Step 4: Opportunities Related to Climate Risk Management for Environment and Biodiversity – Illustrative Examples

The need to address climate risks related to environment and biodiversity may provide a range of additional opportunities. For moderate/high risk strategic elements, projects, and activities, the important types of opportunities to discuss are climate change mitigation,[6] potential co-benefits for non-climate development objectives, leveraging political will, preventing increases in gender inequality, and other development issues. For Washington-based and low-risk strategic elements, projects, and activities, opportunities should focus more on how to support resilience more broadly.

Once you have reviewed this section, you can navigate back to the Tool by clicking on the relevant hyperlink in the header.

Support New Livelihood Opportunities

- Develop conservation-based livelihoods where existing livelihoods such as farming are no longer viable.
- Encourage fishing communities to take advantage of fish species that are becoming more abundant due to climate change.
- Ensure new livelihood opportunities are available for women and other marginalized populations, and look out for unintended consequences, such as increasing women's unpaid work burden and/or increasing the length of their work day.

Encourage Governments to Place a Higher Priority on Related Reforms

- Support conservation efforts in related sectors, such as agriculture and water.
- Strengthen institutions that are responsible for conservation and management of ecosystems and natural resources, including their ability to incorporate climate change into their activities.
- Achieve co-benefits for ecosystems and climate change mitigation through sustainable land and forest management.
- Promote zoning restrictions on coastal development to allow coastal wetlands to migrate inland as sea levels rise, protecting the goods and services they provide.
- Support REDD+[7] to help achieve climate change mitigation goals while also providing conservation-based, income-generating opportunities.

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[6] In this document "climate change mitigation" refers to efforts to reduce greenhouse gas emissions.
[7] Reducing Emissions from Deforestation and Forest Degradation (REDD+) is a mechanism developed by Parties to the United Nations Framework Convention on Climate Change (UNFCCC). https://www.unredd.net/about/what-is-redd-plus.html

- Reduce subsidies for electricity and water use that distort price signals that would otherwise encourage investment in conservation (e.g., drip irrigation in agriculture, alternative sources of energy, and energy-saving technologies).
- Work with governments to design gender-informed policies that address climate impacts that affect women and men differently, encourage women's participation and leadership, leverage women's knowledge and perspectives, and reduce risk of further gender inequality caused by climate change.

Promote Ecosystem-Based Approaches to Adaptation that Reduce the Vulnerability of People to Climate Impacts, While Providing Co-Benefits for Ecosystems, Other Ecosystem Services, and Species

- Reduce the vulnerability of related sectors, such as agriculture and water, to climate impacts through support for conservation efforts, which provide co-benefits for ecosystems, other ecosystem services, and species.
- Protect ecosystems that buffer or mitigate climate impacts to stakeholders in related sectors.

Use Finance Mechanisms and Public-Private Partnerships to Mobilize and Leverage Funding for Investments in the Environment

- Explore opportunities for payment for ecosystem services that support the conservation or restoration of areas that provide key services.
- Support the use of carbon finance to monetize future cash flows from the advanced sale of carbon credits, as means to finance conservation costs.
- Encourage partnerships between governments and private business to protect forests and promote climate change mitigation (e.g., manufacture and distribute fuel-efficient cook stoves, which reduce emissions while also providing an alternative to burning fuel wood).
- Ensure that women-led businesses have access to financing opportunities.

Tool Step 5: Climate Risk Management Options for Environment and Biodiversity – Illustrative Examples

Once you have reviewed this section, you can navigate back to the Tool by clicking on the relevant hyperlink in the header.

Prioritize Baseline Biodiversity Needs

- Maintain and expand large intact landscapes and seascapes.
- Protect key, representative habitats within landscapes and seascapes.
- Support research that assesses future potential impacts of climate change on biodiversity.
- Conserve biodiversity and manage natural resources in ways that maintain their long-term viability.

Improve Risk Management

- Incorporate climate information into landscape-level conservation, land-use planning, and protected area management.
- Increase connectivity between protected areas.
- Increase conservation outside of protected areas, and incorporate mixed natural systems (e.g., agroforests).
- Protect areas that are likely to become refugia as temperatures increase and sea levels rise.
- Seek information from women, indigenous peoples, and other marginalized populations who are often the custodians of local knowledge about wild plants, seeds, and other elements of biodiversity.

Reduce Other Human Stressors That Exacerbate Climate Change Impacts

- Reduce the effects of non-climate stressors, such as pollution, overexploitation, land use change, urbanization, and invasive species.
- Account for predicted changes in demand for ecosystem services that may exacerbate climate impacts.
- Consider whether human adaptation to climate risks is going to increase or create new stresses on ecosystems and biodiversity.

Strengthen Ecosystem-Based Adaptation in Other Sectors

- Promote climate-smart agricultural practices, including agro-forestry systems.
- Support the use of green infrastructure for flood management or coastal protection.
- Explore opportunities to increase water security through protecting and restoring watersheds.

Additional Key Resources Related to Environment and Biodiversity

The following **resources** provide additional information related to climate risks to environment and biodiversity and corresponding climate risk management options.

Title	Author(s)	Organization	Date	Length	Intended Audience	Unique Value
Integrating Biodiversity and Climate Change Adaptation In Activity Design	Numerous	USAID	2015	60 pp.	Development practitioners, ecologists, and adaptation specialists	Provides guidance on ways to effectively integrate biodiversity and climate change adaptation into development programming.
Impacts of 1.5°C Global Warming on Natural and Human Systems	O. Hoegh-Guldberg, et al.	Intergovernmental Panel on Climate Change	2018	138 pp.	Policymakers, scientists, and development practitioners	Provides the most recent (as of Jan. 2020) state-of-the-art scientific consensus on climate change impacts on natural and human systems globally. For regional and sub-regional impacts, IPCC's 5th Assessment report (2014) may be more useful (see below). For more specific impacts on oceans and the cryosphere, the special report listed immediately below will be more useful.
IPCC Special Report on the Ocean and Cryosphere in a Changing Climate	H-O. Pörtner, H-O. et al.	Intergovernmental Panel on Climate Change	2019	739 ++ pp.	Policymakers, scientists, and development practitioners	Provides the most recent (as of Jan. 2020) scientific consensus on climate change impacts on marine and high-mountain ecosystems. Chapters 2, 4, 5, and 6 respectively focus on high-mountain areas; sea level rise and low-lying islands and coastal areas; changing marine ecosystems; and extremes, tipping points, and managing risks.

Title	Author(s)	Organization	Date	Length	Intended Audience	Unique Value
Integrating Climate Change Adaptation into Biodiversity and Forestry Programming	I. Deshmukh, et al.	USAID	2015	29 pp.	Development practitioners and forest managers	Provides best practices to improve forest management in response to climate change.
USAID Ecosystem-based Adaptation Series Synthesis	USAID Forestry & Biodiversity Office and USAID BRIDGE	USAID	2019	12 pp.	Development experts, policymakers, conservation experts	Introduces ecosystem-based adaptation approaches; summarizes evidence related to ecosystem-based adaptation and food security, water security, coastal populations and extreme events; and discusses cost-effectiveness, elements of a successful ecosystem-based adaptation approach and enabling conditions.
Ecosystem-Based Adaptation Case Studies, Evidence Summaries, and Lessons Learned	USAID	USAID	2019	Multiple Web Links	Development practitioners, conservation, and adaptation specialists	Provides case studies, evidence summaries, and lessons learned on ecosystem-based adaptation. This helpful portal provides a good overview of the series.
Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the IPCC	C.B. Field, et al.	Intergovernmental Panel on Climate Change	2014	1140 pp.	Policymakers, scientists, and development practitioners	Provides the state-of-the-art scientific consensus on climate change impacts.
Ecosystems, Ecosystem Services, and Biodiversity. In Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II	D. Lipton, et al.	U.S. Global Change Research Program	2018	54 pp.	Development practitioners, scientists, and policymakers	Provides more detail on impacts of climate change on ecological resources.

Title	Author(s)	Organization	Date	Length	Intended Audience	Unique Value
Species Susceptibility to Climate Change Impacts	W. Foden, et al.	IUCN	2008	14 pp.	Development practitioners and reserve managers	Supports the assessment of risk by providing information on individual vulnerable species.
Climate Change Vulnerability Assessment of Species	W. Foden et al.	WIREs Climate Change. 2019;10:e551	2019	36 pp.	Development practitioners, environmental scientists, and policymakers	Supports the assessment of risk by providing information on individual vulnerable species as well as the latest vocabulary used in such assessments.
Impacts of climate change on future air quality and human health in China	C. Hong et al.	Proceedings of the National Academy of Sciences	2019	8 pp (17193-17200)	Policymakers, environmental scientists,air quality and public health officials,	Although this article focuses on health issues related to the impacts of climate change on air quality in China, it provides a good synthesis of the state of science on the subject.

Governance and Peace and Security

Introduction

Purpose: This annex to the Climate Risk Screening and Management Tools is designed to provide you with more information on climate change[1] implications for governance and peace and security. It should be noted that many of the program elements in Democracy Rights and Governance Category (DG) are not represented here. This is due to the inherent low climate risk that these types of programming face. That said DG as a category provides both a unique opportunity to address vulnerability and to address governance concerned in an area that may significantly interest and motivate local citizens and government officials alike, leading to both robust governance and climate gains. The information is grouped into the following sub-sections, with the corresponding step from the Tool shown in parentheses:

- Climate Risks to Governance and Peace and Security (Step 2)
- Adaptive Capacity Related to Governance and Peace and Security (Step 3)
- Opportunities Related to Governance and Peace and Security (Step 5)
- Climate Risk Management Options for Governance and Peace and Security (Step 6)
- Additional Key Resources Related to Governance and Peace and Security

The questions and examples provided in this annex are illustrative and designed to stimulate thinking about climate risks, adaptive capacity, opportunities, and climate risk management options. Actual climate risks will depend on the context and anticipated climate changes for particular geographies.

Sectoral focus of this annex: The material in this section focuses on the following program areas of the Standardized Program Structure: PS.5 Trafficking in Persons, PS.6 Conflict Mitigation and Reconciliation, PS.7 Conventional Weapons Security and Explosive Remnants of War (ERW), DR.2 Good Governance, and DR.6 Human Rights. Note, to the extent your design involves multiple sectors, you may want to consult other relevant annexes. In particular, if any new construction or rehabilitation[2] is anticipated, referring to the Infrastructure, Construction, and Energy Annex is highly recommended. Please note, *activity*-level climate risk management (CRM) for engineering design **must** be conducted by the Engineer of Record.[3] See the Infrastructure, Construction, and Energy Annex for solicitation language.

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[1] In this document, the term "climate change" refers to both climate variability and climate change. "Climate variability" refers to variations in climate (including the normal highs and lows, wet and dry periods, hot and cool periods and extremes) and can refer to month-to-month variability, year-to-year variability, and even decadal scale variability. In this document, "climate change" refers to those variations as well as persistent change in climate over decades or longer (USAID, 2014. Climate-Resilient Development: A Framework for Understanding and Addressing Climate Change).

[2] USAID Implementation of Construction Activities, A Mandatory Reference for ADS Chapter 303, defines "construction" as: "construction, alteration, or repair (including dredging and excavation) of buildings, structures, or other real property and includes, without limitation, improvements, renovation, alteration, and refurbishment. The term includes, without limitation, roads, power plants, buildings, bridges, water treatment facilities, and vertical structures." Construction at USAID almost always occurs within another primary programming area (e.g., school building for education, hospital/clinic construction for health).

[3] An appropriately qualified engineering firm under contract or subcontract with USAID for the purpose of completing the engineering design.

Tool Step 2: Climate Risks to Governance and Peace and Security – Illustrative Examples and Questions

Once you have reviewed this section, you can navigate back to the Tool by clicking on the relevant hyperlink in the header.

Governance	Conflict Mitigation and Stabilization	Human Rights
• Impact to local government function, the delivery of public decentralized services, the delivery of local infrastructure, and natural resource management due to current or predicted climate variability and change. • Creation of economic and political instability due to reduced effectiveness of water management systems and prolonged drought. • Exposed weaknesses in transitional governments and increased political instability due to extreme events.	• Contribution to social unrest through reduced resource availability due to the myriad impacts from climate change. • Decreased perceptions of state legitimacy in post-conflict situations due to reduction in natural resource-based livelihoods and increase reliance on informal or illicit livelihoods caused by higher temperatures and other climate changes. • Exposure of more buried or unexploded ordinance (Explosive Remnants of War, ERW) due to increased flooding and erosion. Explosions of ERW may be triggered by higher temperatures. • Creation of "winners" and "losers," creating social tensions that weaken fragile states, due to flooding damage of croplands in low-lying areas. • Interference with resettlement of ex-combatants due to property and infrastructure damage from flooding. • Exacerbated underlying conflicts and reduced citizen security in post-conflict areas due to food and water shortages from prolonged drought. • Displaced populations and introduced conflicts over property rights and land tenure due to sea level rise. • Increased pressures on fragile states and accelerated urbanization due to forced movement of people from coastal areas caused by sea level rise.	• Altered ecosystems and ecosystem services, upon which indigenous peoples depend, due to higher temperatures. • Displaced marginal populations due to flooding. • Increased risk of trafficking in persons and migrant smuggling due to sudden population migration[4] caused by flooding. • Interference with traditional livelihoods of indigenous peoples due to prolonged drought. • The status and treatment of women and girls, as well as of LGBTI individuals, may be affected by sudden displacement and disruptions of cultural norms, including gender relationships, triggered by extreme events. • Forced abandonment of traditional lands by Indigenous populations due to sea level rise. • Flooding, drought, or sea level rise may disproportionately affect LGBTI people who may be denied the ability to resettle following migration or displacement.

[4] In this document, the term "migration" is used to indicate the movement of people in general, and not necessarily movement across borders.

Many of these risks relate to institutional capacity and barriers, ability to utilize information, and balance "no regrets" development strategies under adverse conditions. A set of questions below can assist in identifying risks that are specific to what you are trying to accomplish.

Illustrative questions by climate stressor:

Temperature:

- Are higher temperatures likely to increase competition and conflict in areas with a narrow resource base?
- Will higher temperatures increase disease risks among displaced populations?

Flooding:

- How might flooding, and its health and infrastructure impacts, give rise to sudden population migration and affect the risk of trafficking in persons or migrant smuggling?
- Is flooding likely to interfere with resettlement of ex-combatants?
- Is flooding likely to expose ERW?

Drought:

- Is drought likely to increase political instability and the risk of state failure in post-conflict areas?
- How might prolonged drought increase reliance on informal or illicit livelihoods and affect perceptions of state legitimacy in post-conflict situations?
- Is drought likely to significantly reduce agricultural production, reducing incomes and causing food insecurity and out-migration or displacement?

Sea level rise and storm surge:[5]

- Is sea level rise likely to force indigenous peoples to migrate away from traditional lands?
- Is sea level rise likely to impact marginalized populations[6] disproportionately? How might they be impacted?
- Is sea level rise likely to create conflicts over land tenure and property rights, including among ex-combatants returning to coastal lands?

[5] A temporary sea level rise associated with a storm.

[6] Marginalized populations are groups of people who are excluded, based on their identity, from political, social, and economic power and participation. Often they include women and girls, at-risk youth, the elderly, LGBTI individuals, persons with disabilities, people in linguistic minorities, indigenous people, and/or a combination of any of these identities. (LGBTI individuals refers to lesbian, gay, bisexual, transgender, or intersex individuals. Further information can be found in the LGBT Vision for Action, https://www.usaid.gov/what-we-do/democracy-human-rights-and-governance/protecting-human-rights/lgbti-inclusive-policies.)

Illustrative questions by programming or system element:

Governance

- How might current or predicted climate variability and change impact local government function, the delivery of decentralized public services and local infrastructure, and natural resource management?
- Is climate change data and information shared across and available to appropriate local government agencies responsible for adaptation, disaster response, and other relevant activities?
- Do trainings and other capacity building activities for local government officials include how to engage national meteorological services and incorporate climate information into local planning?
- Are local government officials incorporating climate vulnerabilities into local government plans and do they have a process in place to do so?

Conflict Mitigation and Stabilization

- Are higher temperatures and heat stress likely to contribute to social unrest?
- Are higher temperatures or flooding likely to trigger explosions of or change the location and risk posed by ERW?
- Is drought likely to increase resource competition?
- Are extreme events likely to reduce security and the rule of law?
- Could climate change impact agricultural production and food markets leading to volatile food prices or provision or changes in national policies that affect food pricing? How would these changes to food security impact marginalized populations? Urban populations? Rural populations?
- Is flooding or other weather and climate extremes likely to disrupt the delivery of essential services in post-conflict areas and erode confidence in transitional governments?
- Is sea level rise interfering with relocation strategies for ex-combatants and the success of conflict-to-peace transitions?
- Is climate change likely to increase reliance on illicit livelihood activities?
- Will combatants be given appropriate adaptive skills in the face of current or predicted changes in precipitation, temperature, or storm surges?
- Are combatants being placed in highly climate-vulnerable communities?

Human Rights

- Are higher temperatures or prolonged drought likely to alter the ecosystems and ecosystem services upon which indigenous peoples depend?
- Is flooding likely to displace indigenous populations into marginal environments?
- Is flooding likely to impact historically marginalized populations disproportionately?
- Are extreme events likely to give rise to sudden population migration and increase the risk of trafficking in persons or migrant smuggling?
- Is sea level rise likely to affect the property rights and land tenure of indigenous peoples?

- Are LGBTI individuals, and other marginalized populations, at risk of being denied social services and/or will their ability to migrate and resettle in response to extreme climate events be restricted?

Tool Step 3: Adaptive Capacity Related to Governance and Peace and Security – Illustrative Questions

Once you have reviewed this section, you can navigate back to the Tool by clicking on the relevant hyperlink in the header.

Information Capacity

- To what extent do existing peace and security monitoring systems have access to and integrate information about near- and long- term climate stressors?
- How effectively is climate change information being communicated to indigenous communities?
- How effectively is climate change information being communicated to involved parties, particularly in situations where resource scarcity is a piece of the conflict?

Social and Institutional Capacity

- Are there institutions in place to govern shared use of resources and manage instances of conflict that may be exacerbated by climate change?
- Are governing institutions prepared to enforce laws related to illicit livelihood changes? How will those actions affect the ability of affected populations to cope and/or public perceptions of state effectiveness and legitimacy? Will marginalized populations be included in such actions?
- What is the capacity of local institutions and civil society organizations to develop strategies for conflict-to-peace transitions that account for climate change?
- How well prepared are institutions at the points of departure and arrival to manage population migration induced in part by climate variability and change, and are they prepared for the changes in the need for service delivery and governance?
- How sufficient are policies and institutions to help indigenous peoples address climate risks to traditional livelihoods?
- How sufficient are policies and institutions to help marginalized populations, such as women, LGBTI individuals, and persons with disabilities, address climate change?

Human Capacity

- What is the capacity of indigenous communities to respond to climate risks to traditional livelihoods?
- To what extent are technical staff available and capable of training peacekeepers about climate risks and climate risk management options?
- What is the capacity of marginalized populations and local community leaders to respond to climate change risks?

Financial Capacity

- How sufficient are funding sources to support monitoring and research on potential climate risks to conflict resolution and stabilization?
- How sufficient are financial resources for governance and peacebuilding to invest in climate risk management?

Tool Step 4: Opportunities Related to Climate Risk Management for Governance and Peace and Security – Illustrative Examples

The need to address climate risks related to governance and peace and security may provide a range of additional opportunities. For moderate/high risk strategic elements, projects, and activities, the important types of opportunities to discuss are climate change mitigation,[7] potential co-benefits for non-climate development objectives, leveraging political will, and other development issues. For Washington-based and low-risk strategic elements, projects, and activities, opportunities should focus more on how to support resilience more broadly.

Once you have reviewed this section, you can navigate back to the Tool by clicking on the relevant hyperlink in the header.

Governance

- Promote stakeholder engagement in addressing severe weather events as a means of strengthening governance and peacebuilding.
- Consider climate change adaptation planning as an activity in demand-side local governance programming.
- Use public concern about climate change as an opportunity to engage civil society and citizens, including marginalized populations, to increase their involvement in planning and local government.
- Support development of governance mechanisms to help manage competition over natural resources, of which shortages might be exacerbated by climate change.

Conflict Resolution and Stabilization

- Support monitoring, early warning models, and response protocols in conflict areas that take climate change into account.
- Encourage incorporation of climate change information in peacebuilding communication systems.
- Help identify areas where flooding may increase exposure to Explosive Remnants of War (ERW) and the risk of explosions triggered by high temperatures.
- Help identify areas or populations in which climate change is likely to increase reliance on illicit livelihood activities.
- Support the provision of adaptive skills for combatants to address current or predicted changes in precipitation, temperature, and storm surges.
- Identify and support combatants placed in highly climate-vulnerable communities.

Human Rights

- Provide opportunities for indigenous peoples and other marginalized populations to participate in climate-related decision-making related to local governance and participation, and peacebuilding.
- Help identify areas where population migration in response to extreme events may increase the risk trafficking.

Develop Synergies With Other Development Objectives

- Provide information on climate change to support “climate smart” rebuilding in post-conflict areas.

[7] In this document “climate change mitigation” refers to efforts to reduce greenhouse gas emissions.

- Encourage activities that meet both peacebuilding and climate risk management objectives.
- Look for opportunities to bring adversaries together to address climate risks through collaborative, transparent, and participatory implementation processes.

Tool Step 5: Climate Risk Management Options for Governance and Peace and Security – Illustrative Examples

Some options for reducing climate risks to governance and peace and security are outlined below.

Once you have reviewed this section, you can navigate back to the Tool by clicking on the relevant hyperlink in the header.

Integrate Climate Information into Related Program Areas

- Conduct conflict assessments that integrate climate change considerations and seek to identify climate risks and climate risk management actions that could contribute to conflict.
- Consider how climate information and support for adaptation strategies could be integrated into dispute resolution processes and other conflict management interventions to improve climate resilience as well as peacebuilding/conflict prevention outcomes.

Strengthen Relevant Policies, Planning, and Systems

- Help reinforce peacebuilding by encouraging cooperative actions to manage resource scarcity resulting from climate change.
- Look for opportunities to leverage climate change mitigation and adaptation activities to advance post-conflict reconstruction.
- Support changes to policies and laws that contribute to poor resource management and increased scarcity.
- Support more effective enforcement of existing resource protection and management requirements.
- Support participation and inclusion, especially of marginalized populations, in climate change adaptation planning processes at the local, regional, and national level.

Integrate Climate Change Considerations in Decision-Making to Improve Governance and Peace and Security

- Conduct a climate-sensitive conflict analysis that considers how climate change might influence the following three conflict-relevant factors: the context, institutional performance, and key actors' interests, resources, and strategies.
- Conduct a problem diagnosis linked with your project design, identifying a peacebuilding or related development objective in terms of its economic, political, social, and cultural context. Then, determine which inputs and enabling conditions must be supported to achieve that goal.
- Working with stakeholders, assess vulnerabilities to climate stressors. Emphasize engaging decisionmakers and stakeholders, especially local civil society organizations (CSOs) and marginalized communities, throughout the assessment with transparency. This has the co-benefit of reducing tensions through a deeper common understanding of the challenges and the perspectives of all parties involved.
- Assess, monitor, and report on institutional performance of climate-related efforts in this sector. This includes reviewing progress of supported societal mechanisms for managing latent conflict among groups.

Additional Key Resources Related to Governance and Peace and Security

The following **resources** provide additional information related to climate risks to governance and peace and security and corresponding climate risk management options.

Title	Author(s)	Organization	Date	Length	Intended Audience	Unique Value
A New Climate for Peace	N/A	Adelphi	2015 onwards	N/A	Development practitioners, policymakers, and experts	This global knowledge platform aims to generate knowledge and bring together resources to build the evidence base on climate change and fragility. It serves as a resource hub for policy makers, practitioners and experts engaged in foreign affairs, peacebuilding, development, and humanitarian aid to discuss and share emerging thinking and analysis on the links between climate change, vulnerability, fragility, and conflict.
Climate-Related Security Risks: Towards an Integrated Approach	Dr Malin Mobjörk, et al.	SIPRI and Stockholm University	2016	88 pp.	Policymakers	This report provides an overview of climate-related security risks and policy responses for addressing those risks. First, it presents findings on six thematic areas in which climate change can pose security risks. Second, it investigates how policy organizations integrate climate-related security risks into their policies and practical work. The analysis provides a deeper understanding of the opportunities and challenges presented by different integration strategies.
Climate Change and Conflict: An Annex to the USAID Climate-Resilient Development Framework	K. Reiling et al.	USAID	2015	44 pp.	Development practitioners and policymakers	Describes approaches for integrating climate risk into post-conflict and peacebuilding efforts.

Title	Author(s)	Organization	Date	Length	Intended Audience	Unique Value
Governing for Resilience: An Annex to the USAID Climate-Resilient Development Framework	J. Troell et al.	USAID	2015	64 pp.	Development practitioners	Describes approaches for integrating climate risk into governance tailored for USAID.
Adaptation and Governance	J. Schaar and P. Caffrey	USAID	2014	24 pp.	Development practitioners	Describes the challenges faced by decision-makers in addressing climate change adaptation needs and building resilience in communities.
Addressing the Linkages Between Democracy and Governance and Climate Change Management	D. Callihan	USAID	2010	36 pp.	Development practitioners	Describes the democracy and governance linkages related to climate change programming and suggests program approaches that can be used to address the challenges.

Health

Introduction

Purpose: This annex to the Climate Risk Screening and Management Tools is designed to provide you with more information on climate change[1] implications for health. The information is grouped into the following sub-sections, with the corresponding step from the Tool shown in parentheses:

- Climate Risks to Health (Step 2)
- Adaptive Capacity Related to Health (Step 3)
- Opportunities Related to Climate Risk Management of Health (Step 5)
- Climate Risk Management Options for Health (Step 6)
- Additional Key Resources Related to Health

The questions and examples provided in this annex are illustrative and designed to stimulate thinking about climate risks, adaptive capacity, opportunities, and climate risk management options. Actual climate risks will depend on the context and anticipated climate changes for particular geographies.

Sectoral focus: The material in this annex focuses on health and aligns with the following Program Areas of the Standardized Program Structure: HL.1 HIV/AIDS, HL.2 Tuberculosis, HL.3 Malaria, HL.4 Pandemic Influenza and other Emerging Threats, HL.5 Other Public Health Threats, HL.6 Maternal and Child Health, HL.7 Family Planning and Reproductive Health, HL.8 Water and Sanitation, and HL.9 Nutrition.

Note, to the extent your design involves multiple sectors, you may want to consult other relevant annexes such as the Water Supply and Sanitation Annex. In particular, if any new construction or rehabilitation[2] is anticipated, referring to the Infrastructure, Construction, and Energy Annex is highly recommended. Please note, *activity*-level climate risk management (CRM) for engineering design **must** be conducted by the Engineer of Record.[3] See the Infrastructure, Construction, and Energy Annex for solicitation language.

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[1] In this document, the term "climate change" refers to both climate variability and climate change. "Climate variability" refers to variations in climate (including the normal highs and lows, wet and dry periods, hot and cool periods and extremes) and can refer to month-to-month variability, year-to-year variability, and even decadal scale variability. In this document, "climate change" refers to those variations as well as persistent change in climate over decades or longer (USAID, 2014. Climate-Resilient Development: A Framework for Understanding and Addressing Climate Change).

[2] USAID Implementation of Construction Activities, A Mandatory Reference for ADS Chapter 303, defines "construction" as: "construction, alteration, or repair (including dredging and excavation) of buildings, structures, or other real property and includes, without limitation, improvements, renovation, alteration, and refurbishment. The term includes, without limitation, roads, power plants, buildings, bridges, water treatment facilities, and vertical structures." Construction at USAID almost always occurs within another primary programming area (e.g., school building for education, hospital/clinic construction for health).

[3] An appropriately qualified engineering firm under contract or subcontract with USAID for the purpose of completing the engineering design.

Tool Step 2: Climate Risks to Health – Illustrative Examples and Questions

Once you have reviewed this section, you can navigate back to the Tool by clicking on the relevant hyperlink in the header.

Illustrative examples of climate risk are provided in the table below. You are particularly encouraged to consult with specific portions of that table depending on the program area you are working in. Use the list below to determine where you might focus your assessment.

Global Health Program Area/Priority		Climate Risk Category
Avian Influenza and other Emerging Threats	➔	See Health Systems and Infrastructure; Nutrition; Vector-borne Diseases; Other
Maternal and Child Health	➔	See Nutrition; Vector and Water Borne Diseases; Health Systems and Infrastructure; Other
Family Planning and Reproductive Health	➔	See Nutrition; Vector and Water Borne Diseases; Health Systems and Infrastructure; Other
HIV/AIDS	➔	See Health Systems and Infrastructure; Nutrition; Other
Malaria	➔	See Vector-Borne Diseases; Health Systems and Infrastructure; Other
Neglected Tropical Diseases	➔	See Vector Borne Diseases; Health Systems and Infrastructure; Nutrition; Other
Nutrition	➔	See Nutrition; Health Systems and Infrastructure; Water Borne Diseases; Vector Borne Diseases; Other
Tuberculosis	➔	See Health Systems and Infrastructure; Nutrition; Other
Water Supply, Sanitation, and Hygiene (WASH)	➔	See Water Borne Diseases; Health Systems and Infrastructure; Other
Health System Strengthening	➔	See Health Systems and Infrastructure; Other
Programs for Highly Vulnerable Children	➔	See Health Systems and Infrastructure; Nutrition; Other

Vector-Borne Diseases	Waterborne Diseases	Nutrition
• Altered transmission cycles resulting from shifts in the geographic range, seasonal presence, and biting rates of disease vectors due to changes in temperature, precipitation (especially flood/drought cycles), and ecology. • Acceleration of the life cycles of climate-sensitive disease vectors due to higher temperatures and changing precipitation patterns. • Emergence or re-emergence of diseases through shifting migratory paths and species habitat due to a variety of climate changes. • Increased risk of new pathogen emergence due to increased human-animal interaction, as a result of population growth, changing habitats and habitat encroachment, and changing behavior (of humans and animals).	• Increase in incidence of diarrheal diseases due to higher temperatures, especially in dry seasons (mechanisms vary by disease agent and context). • Spread of waterborne diseases due to extreme events (e.g. floods) and the health emergencies that follow. • Changes in waterborne disease patterns due to changes in water flows and resulting changes in pH, nutrient and contaminant levels, and salinity. • Reduced availability or quality of seafood and human illness or death from eating contaminated seafood or from contact with contaminated water, or breathing problems from increases in harmful algal blooms due to higher water temperatures, increased CO^2 concentrations, and other climate stressors.	• Direct impacts on agricultural productivity and availability of locally produced crops, including impacts on livestock and fisheries, due to temperature increases and changes in rainfall. • Reductions in access to and consumption of safe, nutritious foods, and increases in the prevalence of undernutrition (including stunting, acute malnutrition, and micronutrient deficiencies) due to increases in food insecurity, drought incidence, food contamination, post-harvest losses, and transportation challenges related to climate change. • Reductions in food micronutrients due to higher temperatures and CO^2 concentrations. • Increase in the risk of food contamination (e.g., from aflatoxins and mycotoxins) due to higher air temperatures, sea surface temperatures (for seafood), and humidity. • Increased nutritional needs resulting from increased incidence of diarrhea due to higher temperatures and flood-induced spread of waterborne diseases.

Health Systems and Infrastructure	Other
● Destruction or disruption of sanitation and health facilities and access roads due to extreme events, such as floods. ● Disruptions in access to health facilities, community health workers, health information, drug and supply distribution chains, and diagnostic networks due to extreme weather events impacting transportation and infrastructure. ● Disruption in health training, data collection, surveillance, monitoring, and related activities due to extreme events (e.g., floods) and potentially displaced populations from these events. ● Disruption in energy and water sources for medical centers due to extreme weather events. ● Strained public health budgets and access to health services due to increasing incidence of vector-borne and waterborne diseases from higher temperatures and provision of emergency health care in the wake of climate-related disasters. ● Routine health care service provision reduced due to workforce strained by responding to extreme weather events or emerging pathogens.	Risks to Marginalized Populations ● Diminished health and nutrition status of marginalized populations including those with low-incomes, children and pregnant women, elderly, vulnerable occupational groups, persons with disabilities, and persons with preexisting or chronic medical conditions due to disproportionate climate impacts on these populations or diminished ability to serve these populations due to climate change. ● Reduced labor productivity and capacity for work due to health impacts from temperature increases (in already hot climates this impact can accompany relatively small temperature increases). Direct Physiological and Psychological Risks ● Increased risk of preterm birth due to elevated heat exposure during pregnancy. ● Increased risk of cardiac stress (especially for older adults) or other illness (e.g., hyperthermia) due to extremely high temperatures. ● Increased risk of respiratory illnesses due to air quality problems associated with higher temperatures and ozone, as well as from smoke and haze from large-scale forest fires facilitated by warmer, drier conditions. ● Increased psycho-social stress caused by loss of livelihood, malnutrition, disease, seasonal or permanent migration, and social conflict due in part to climate change impacts (e.g., dwindling water supply, inundation, and repeated crop failure). Risks to USAID's M&E Efforts ● Field visits and data collection planning for effective, feasible monitoring, and accuracy and comparability of results affected by changing and increasingly unpredictable climate and seasonal patterns. ● Increased need to account for confounding factors impacting outcomes other than project interventions as a result of changing and increasingly unpredictable climate and seasonal patterns.

Illustrative questions by climate stressor:

Temperature:

- How may higher temperatures directly increase morbidity and mortality, particularly for the elderly?
- How may higher temperatures affect the geographic extent and life cycle of pathogens and disease vectors?

Flooding:

- How may flooding directly harm people (e.g., through drowning or debris impacts)?
- How may flooding affect access to health care or supply chains, or cause physical damage to health facilities?
- How may flooding affect the incidence of waterborne disease through decreases in water quality (e.g., via sewer overflows)?

Drought:

- How may prolonged drought affect agricultural production and therefore nutrition?
- How may drought affect availability of potable water?
- How may drought affect migration?
- How may drought increase wildfire and soil aridity, and thereby decrease air quality?

Sea level rise and storm surge:[4]

- How may increases in storm surge directly cause increases in morbidity and mortality?
- How may sea level rise and storm surge damage health facilities or decrease access to them?
- How may sea level rise and storm surge affect waterborne disease and the quality of potable water?

Illustrative questions by programming or system element:

Vector-Borne Diseases:

- How may changing temperature and precipitation patterns affect epidemiology of critical vector-borne diseases?
- How will current observed trends or patterns of disease vectors be affected by changes in climate patterns? How will the key hotspots of disease shift over time?
- Will any vector-borne diseases become more or less significant over time? Are there emerging vector-borne diseases that may need more attention?

Waterborne Diseases:

- What are the epidemiological linkages between climate variables and critical waterborne diseases?
- How will climate change impact current observed trends or patterns of water and flooding, and therefore disease pathogens?
- Will there be areas that experience increased or more frequent flooding? Will there be areas that receive more and/or less rainy days and with different amounts of rain on rainy days?
- How will the key hotspots for waterborne diseases shift over time? What implications do those have for disaster preparedness and response? For water-related infrastructure

[4] A temporary sea level rise associated with a storm.

planning or health responses?

- Will any waterborne diseases become more or less important over time? Are there emerging waterborne diseases that may need more attention?

Nutrition:

- What are the linkages between climate variables and productivity of key crops, as well as livestock and fisheries, which are important for food security?
- What are the linkages between climate variables and nutritional value of key nutritional crops?
- How will climate change impact the current observed trends or patterns of under-nutrition and/or stunting? How will the key hotspots shift over time?
- How will climate change impact food safety, for example through changes in exposure to aflatoxins?

Health Systems and Infrastructure:

- Are health facilities and their related energy and water supplies planned around increased flooding and/or drought risks?
- Are access roads to health facilities and/or markets likely to be washed out and/or damaged in an emergency?
- What contingency plans do health facilities have in preparation for extreme weather events to avoid shutdown of key services?
- How will health monitoring, surveillance, and data collection activities be affected by extreme weather events?

Other:

- How will health services for marginalized populations be affected by warmer temperatures, changing rainfall patterns, sea level rise, and other climate stressors?
- What are existing patterns of health-related heat stress, and how are these patterns expected to shift over time due to changes in temperature?
- Is the frequency of wildfires increasing? What is the impact on air quality?

Tool Step 3: Adaptive Capacity Related to Health – Illustrative Questions

Once you have reviewed this section, you can navigate back to the Tool by clicking on the relevant hyperlink in the header.

Information Capacity

- What climate and health information is available to prioritize diseases and/or health impacts for increased surveillance and/or predictive systems? How adequate is that information?
- What surveillance systems are in place that provide place-based information on changes? Are they adequate?
- Are there predictive systems for critical diseases and other health outcomes that incorporate climate information?
- How are surveillance and/or predictive information incorporated into strategic planning of resources (financial, infrastructure, medical personnel and training), distribution chains, disaster preparedness, etc.?
- Are surveillance programs designed to generate the information needed under climate change?

Social and Institutional Capacity

- To what extent are national and local planning, budgeting, and emergency response capabilities able to respond to gradual and rapid onset climate changes affecting health?
- What is the percentage of the population with access to health centers or health services, and/or water and sanitation services?
- What kind of surge capacity or other ability to respond exists within health service to respond to crises that may be caused or exacerbated by climate change? How likely are health services to be overwhelmed by a climatic event?
- What proportions of children, elderly, and other populations with special needs, including immune-compromised populations or other populations with significant health issues would need assistance and are disproportionately susceptible to climate-related health risk?
- What planning systems exist for disaster risk and response, urban planning, and/or supply of services, which may include climate resilience? (e.g., are there impoverished populations living in slums, or is there already a strong planning system to reduce health and other risks?)
- Does the Ministry of Health work with related ministries, such as those covering weather- and climate-related services, disaster risk and response, water management issues, etc.?
- What national and/or international research programs and/or climate change vulnerability and adaptation assessments exist to:
  - Understand the climate linkages of diseases with poorly understood causes?
  - Identify hotspots of health impacts under climate change scenarios?
  - Identify new and emerging health threats due to climate change?
  - Develop new and innovative approaches to managing health impacts?

Human Capacity

- What organizations are in place to promote effective community responses to climate risks to public health?
- How are population pressures (e.g., overcrowding in health facilities) affecting adaptive capacity?
- To what extent do training materials for doctors, nurses, and other medical personnel include information around climate change impacts on health?
- Are medical personnel properly trained to address health issues outside of their typical area of expertise and therefore able to address newly-emerging, climate-related health issues?
- What working relationships do Ministry of Health staff have with other ministries around health-related priorities?
- What human capacity exists or is being developed in surveillance and/or predictive systems?

Financial Capacity

- What investments are being made to reduce climate risks to public health, public health infrastructure, and health service delivery?
- How easily can the government move funding to emerging health priorities?
- What research is the government funding related to climate-related health risks?

- What capacity does the government have to apply for international climate finance?
- Does the country have internal mechanisms for funding climate-resilient development (e.g. infrastructure) that would improve the resilience of health facilities or health outcomes?

Tool Step 4: Opportunities Related to Climate Risk Management for Health – Illustrative Examples

The need to address climate risks related to health may provide a range of additional opportunities. For moderate/high risk strategic elements, projects, and activities, the important types of opportunities to discuss are climate change mitigation,[5] potential co-benefits for non-climate development objectives, leveraging political will, opportunities to increase gender equality and female empowerment, and other development issues. For Washington-based and low-risk strategic elements, projects, and activities, opportunities should focus more on how to support resilience more broadly.

Once you have reviewed this section, you can navigate back to the Tool by clicking on the relevant hyperlink in the header.

Improve health care systems

- Leverage investments to reduce health-related climate impacts to also improve the broader health care system.
- Increase the capacity of health care and emergency services to support disaster planning and management.

Engage new or a greater variety of stakeholders in health services

- Develop new public-private partnerships to build climate-resilient health care infrastructure.
- Facilitate interactions among stakeholders and health decisionmakers on climate change impacts.
- Engage the climate, environment, and meteorological ministries as well as local academic institutions to ensure they are capturing the most relevant information for climate-sensitive disease monitoring and early warning systems, and to leverage investments in health and meteorological monitoring to their mutual benefit.
- Broaden engagement to other sectors to design future infrastructure that focuses on maximizing multiple, cross-sectoral benefits, including benefits to health.

Create synergies with other development objectives

- Use surveillance equipment needed for early warning and emergency response to provide information to managers and designers of health programs and services.
- Rebuild “climate smart” after extreme events to improve access to health services over the long run.
- Use demographic and health surveys for the country to provide information to support climate-resilient health services.
- Restrict development in flood-prone areas and use permeable paving materials and other design elements to reduce storm water runoff during heavy rains.

[5] In this document “climate change mitigation” refers to efforts to reduce greenhouse gas emissions.

Contribute to climate change mitigation by reducing greenhouse gas emissions

- Invest in green infrastructure and sustainable urban environments that both benefit public health and reduce greenhouse gas emissions (e.g., tree planting reduces physical heat stress, sequesters carbon, and reduces demand for air conditioning; improvements in building design increase occupants' safety in the case of flooding and increase energy efficiency, thereby reducing greenhouse gas emissions).
- Support policies, regulations, and investments that reduce greenhouse gas emissions, improve air quality, and reduce risks of respiratory illness.
- Design health infrastructure (e.g., hospitals) and health system supply chains to minimize their greenhouse gas footprint, as appropriate. For example, install solar panels where feasible.

Leverage communications about climate and health to address other related development factors

- Leverage formal and informal curricula developed on climate change and health to address broader development issues, including the water-energy-food security nexus, and population, health, and environment linkages.
- Address broader issues associated with marginalized populations in communications related to climate and health (e.g., promoting use of social networks to increase resilience of older populations to heat stress carries non-climate co-benefits).
  - E.g., conduct a risk communication pilot to demonstrate communication practices that address multiple health risks simultaneously, including climate-related risks.

Tool Step 5: Climate Risk Management Options for Health – Illustrative Examples

Some illustrative options for reducing climate risks to health are outline below. Once you have reviewed this section, you can navigate back to the Tool by clicking on the relevant hyperlink in the header.

Strengthen early warning systems

- Monitor relevant climate and heath parameters important in assessing integrated health risk to ensure early warning of changing conditions.
- Increase development of predictive tools around key priority diseases and heat waves.
- Ensure timely communication to decisionmakers, the media, and the public.
- Improve public education and outreach efforts related to climate and health.

Improve risk management systems

- Develop/improve climate-sensitive vector control programs (e.g., distribute bed nets in areas expected to be affected).
- Strengthen preparedness and response to health emergencies (see additional guidance sections specifically for DRR).
  - Create cooling centers to provide relief from heat to the public.
  - Provide cooling stations for vulnerable populations.

- Create contingency plans for loss of water treatment and sanitation systems during extreme events.

Strengthen foundational heath systems

- Improve strategic planning for health services to account for climate change.
- Increase medical training to improve awareness and treatment of climate-related health issues.

Strengthen governance systems around climate change and health issues

- Addressing many climate risks may require integrated work across different technical ministries or institutions. For example, increased cholera risk should be addressed through collaboration of the water resources ministry and the ministry of health. Ensure support for these cross-disciplinary initiatives, working groups, etc.
- Mobilize relevant finance for health systems, surveillance, and research through assessment of resource requirements, available finance, and critical gaps. Consider opportunities to fill them through local health and other relevant finance, development finance, and international climate change finance.
- Consider relevant policies that should be enacted to increase response and encourage cross-sector collaboration around relevant issues.

Expand initiatives to raise public awareness of health and disease

- Leverage school health classes to provide information on heat stress and other health effects of climate change.
- Add information to public health fact sheets with advice on how to respond to the influence of climate stressors on the development and spread of vector-borne and waterborne diseases.
- Raise awareness about linkages between health, agriculture and fisheries production, and environmental impacts resulting from use of pesticides and fertilizers.

Address research gaps

- Prioritize and clarify a research agenda through discussion with critical stakeholders.
- Support research capacity on relevant climate change and health issues.
- Build multidisciplinary networks to improve public health outcomes related to climate.
- Ensure that climate and health research is clearly connected to policy decisions.

Improve the evidence base and use of early warning for potential impacts

- Identify climate-relevant diseases and gaps in information systems that could provide early warning of changes in relevant health patterns.
- Ensure that information is used in decisions around health resources and supply chains, capacity development, and early warning systems.

Invest in climate-resilient and sustainable infrastructure, including water and energy systems

- Ensure that siting choices for health facilities and building codes take into account current and projected climate risks, such as increasing thermal stress, frequency of floods or extreme events.

- Ensure that water and sanitation systems and energy systems are resilient to climate impacts.
- Consider renewable energy technologies for both primary and backup systems, where feasible.
- Consider the sustainability of roads that connect vulnerable populations to health centers or food markets.
- Support planting of trees along streets, protection or creation of green spaces to reduce urban heat island effects.
- Encourage use of green roofs and shade trees to reduce heat exposure.
- Select medical technologies with a lower footprint and to reduce waste, where feasible.

Additional Key Resources Related to Health

The following **resources** provide additional information related to climate risks to health and corresponding climate risk management options.

Title	Author(s)	Organization	Date	Length	Intended Audience	Unique Value
The 2019 report of The Lancet Countdown on health and climate change: ensuring that the health of a child born today is not defined by a changing climate	Watts, N. et al.	Lancet Commission on Health and Climate Change	2019	42 pp	Public health decision-makers and practitioners	Authoritative update of progress toward achieving goals related to climate and health set forth by the Lancet Commission in 2015. The series of reports as well as a helpful infographic is available at The Lancet Countdown: Tracking Progress on Health and Climate Change
Strengthening Health Resilience to Climate Change	Anonymous	World Health Organization (WHO)	2015	24 pp.	Development practitioners, health care providers, policymakers	Provides a detailed summary of health impacts of climate change and actions to improve health systems to address climate risks.
Lessons Learned on Health Adaptation to Climate Variability and Change: Experiences Across Low- and Middle- Income Countries	K.L. Ebi and M. Otmani del Barrio	WHO	2015	72 pp.	Development practitioners, health care providers	Provides more detail than the Tool on adaptation options and lessons learned.
Operational Framework for Building Climate Resilient Health Systems	J. Shumake-Guillemot et al.	WHO	2015	56 pp.	Development practitioners, public health professionals, and health managers	Provides guidance for health systems and programming, at the strategy- and project- level, to protect health in a changing climate and manage risks (Step 6).
WHO Guidance to Protect Health from Climate Change through Health Adaptation Planning	E. Villalobos Prats and K. Ebi	WHO	2014	36 pp.	Health professionals, development practitioners	Provides additional information for integrating health resilience to climate change into National Adaptation Planning and adapting at a country level.

Title	Author(s)	Organization	Date	Length	Intended Audience	Unique Value
WHO UNFCCC Climate and Health Country Profiles	Anonymous	WHO and UNFCCC (United Nations Framework Convention on Climate Change)	2019/2020 And 2015/2016	9 pp.	Ministers of Health, health decision-makers and advocates	Provides country-specific, evidence-based snapshots of the climate hazards and health risks facing countries.
Human Health: Impacts, Adaptation, and Co-benefits. In: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change	K.R. Smith et al.	Intergovernmental Panel on Climate Change	2014	pp. 709-754	Public health decision-makers and practitioners	Provides a comprehensive international overview of health impacts from climate change, as well as adaptation approaches.
WHO Infographics on Health and Climate Change	Unknown	WHO	Accessed Jan 2020	n/a	The general public and public health decisionmakers	Provides helpful infographics on the impacts of climate change on health.
The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment	A. Crimmins, J. Balbus, J.L. Gamble, et al.	United States Global Change Research Program	2016	312 pp.	Development practitioners, health care planners, policymakers	While the report focuses on the United States, it reviews and communicates the best available science on the major health implications from climate change, which are applicable to many (if not all) countries.

Title	Author(s)	Organization	Date	Length	Intended Audience	Unique Value
Chapter 14: Human Health, in *Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II*	Ebi, K.L., et al.	United States Global Change Research Program	2018	Pp 539-571	Development practitioners, health care planners, policymakers	This chapter of the US National Climate Assessment provides a helpful and accessible update of the 2016 report (cited just above).
Climate Change and Human Health Literature Portal	Unknown	NIEHS	Accessed Jan 2020	n/a	Public health researchers, planners, and policymakers	A tool for locating relevant scientific literature on the health implications of climate change. It provides access to a database of studies from around the world, published between 2007 and 2014.
Health System Adaptation to Climate Variability and Change	Ebi, K.L., et al.	Global Commission on Adaptation (GCA)	Accessed Jan 2020	32 pp.	Development practitioners, health care planners, policymakers	This background paper commissioned for the GCA's flagship report (2019) provides an accessible synthesis of the state of knowledge regarding climate impacts on health as well as set of recommendations for enhancing the climate resilience of health systems.
Health and Climate Change: Policy Responses to Protect Public Health	N. Watts, et al.	Lancet Commission	2015. Accessed Jan 2020	54 pp.	Public Health officials, researchers, and policymakers	Provides high-level recommendations for governments related to climate change and public health.
A Physician's Guide to Climate Change, Health and Equity	Unknown	Center for Climate Change and Health	Accessed Jan 2020	Web Resource	Physicians, community health workers, public health officials	Provides a series of printable posters for community clinics as well as a physician's guide to climate change, health, and equity which covers infectious disease, food security, and other relevant issues.

Title	Author(s)	Organization	Date	Length	Intended Audience	Unique Value
Climate Change and Harmful Algal Blooms	U.S. Environmental Protection Agency	U.S. Environmental Protection Agency	Accessed Jan 2020	Web Resource	Public health officials, community health workers	Provides additional information on the scientific consensus for how climate change will influence nutrient pollution.

Infrastructure, Construction, and Energy

Introduction

Purpose: This annex to the Climate Risk Screening and Management Tools is designed to provide you with more information on climate change[1] implications for Infrastructure. The information is grouped into the following sub-sections, with the corresponding step from the Tool shown in parentheses:

- Climate Risks to Infrastructure, Construction, and Energy (Step 2)
- Adaptive Capacity Related to Infrastructure, Construction, and Energy (Step 3)
- Assign Climate Risk Rating (Step 4)
- Opportunities Related to Infrastructure, Construction, and Energy (Step 5)
- Climate Risk Management Options for Infrastructure, Construction, and Energy (Step 6)
- Identify Next Steps (Step 7)
- Additional Key Resources Related to Infrastructure, Construction, and Energy

The questions and examples provided in this annex are illustrative and designed to stimulate thinking about climate risks, adaptive capacity, opportunities, and climate risk management options.

Important note for engineering design: *Activity*-level climate risk management (CRM) for engineering design **must** be conducted by the Engineer of Record.[2] At the strategy and project level, climate risks should be assessed and addressed as part of the overall design, but again the details of managing climate risk will need to be handled by the Engineer of Record once you get to activity design. For this reason, all construction or rehabilitation[3] interventions should be considered high risk until they are addressed by the Engineer of Record.

[1] In this document, the term "climate change" refers to both climate variability and climate change. "Climate variability" refers to variations in climate (including the normal highs and lows, wet and dry periods, hot and cool periods and extremes) and can refer to month-to-month variability, year-to-year variability, and even decadal scale variability. In this document, "climate change" refers to those variations as well as persistent change in climate over decades or longer (USAID, 2014. *Climate-Resilient Development: A Framework for Understanding and Addressing Climate Change*).

[2] An appropriately qualified engineering firm under contract or subcontract with USAID for the purpose of completing the engineering design.

[3] USAID Implementation of Construction Activities, A Mandatory Reference for ADS Chapter 303, defines "construction" as: "construction, alteration, or repair (including dredging and excavation) of buildings, structures, or other real property and includes, without limitation, improvements, renovation, alteration, and refurbishment. The term includes, without limitation, roads, power plants, buildings, bridges, water treatment facilities, and vertical structures." Construction at USAID almost always occurs within another primary programming area (e.g., school building for education, hospital/clinic construction for health).

Sample language for construction design: Contracts/awards that include construction design should include the following language.
Engineering analysis preceding design activities must include consideration of climate change and its potential impacts on the location (siting), functionality, and sustainability of resulting infrastructure and infrastructure services. Such analysis must include identification of relevant data sets and gaps, review of local building standards and codes for adequacy, and determination of safety factors or other measures of uncertainty that will be carried through design. The results of this analysis, including risks identified and how they are addressed, shall be documented.

Sectoral focus of the annex: This annex should be used for any design including construction or infrastructure such as energy systems, transportation, buildings, and information and communication technology. See the Water Supply and Sanitation Annex for infrastructure-related information on that topic. The material in this annex is relevant to the following Program Elements in the Standardized Program Structure: EG.7 Modern Energy Services, EG.8 Information and Communications Technology Services, EG.9 Transport Services, and EG.12: Climate Change - Clean Energy.

Tool Step 2: Climate Risks to Infrastructure, Construction, and Energy – Illustrative Examples and Questions

Once you have reviewed this section, you can navigate back to the Tool by clicking on the relevant hyperlink in the header.

Energy and Power Generation	Transportation	Buildings
• Increased burden on electricity infrastructure due to increasing demand for air conditioning and cooling caused by heat stress. • Decreased amount of water available for hydropower generation due increases in reservoir evaporation and evapotranspiration in watersheds caused by higher temperatures. • Reduced water levels available for hydropower generation due to prolonged drought. • Generation efficiency of thermal power generation may be affected by reduced thermal gradient caused by warmer intake temperatures of cooling water. • Decreased generated wind power due to increases in air temperature. • Decreased solar power cell efficiency and energy output due to temperature increase.	• Premature deterioration of structures/equipment from thermal stress, including pavement materials and rail tracks, due to increased temperatures. • Foundation failure for roads, rail lines, and structures due to permafrost thaw from increased temperatures. • Increased incidence of transportation service disruption, including loss of access to critical destinations and services, and impeded restoration efforts of energy, water supply and sanitation, and communication services due to increases in heavy precipitation and inland flooding. • Higher levels of structural damage due to flooding caused by increases in heavy precipitation and inland flooding. • Long-term material damage due to increased	• Increased demand, and costs, of building cooling due to increased temperatures. • Premature deterioration of structures/equipment from thermal stress, including building materials, due to increased temperatures. • Building systems, including water and waste services, may be disrupted by changes in precipitation rates and levels. • Water damage to buildings and equipment, disruption of businesses and services, evacuation of occupants, and increase in maintenance and repair costs may be caused by increases in heavy precipitation and flooding. • Damage to building foundations and structures due to increased soil cracking and subsidence in areas with clay soils caused by increased drought.

Energy and Power Generation	Transportation	Buildings
• Decreased generation and transmission efficiency, increased stress to substations, and increased difficulty of meeting environmental constraints for cooling water effluent due to heat stress. • Foundation failure for pipelines, transmission lines, and generation facilities due to increased permafrost thaw from heat stress. • Increased generation capacity and replenished reservoirs due to increased precipitation. • Damaged infrastructure, inhibited facility access, and creation of high repair costs due to flooding from increased precipitation. • Scouring of transmission tower bases, water damage to underground substations and lines, and increased corrosion of electrical components due to increased salt water exposure caused by sea level rise and increased storm surge.[4] • Physical damage to generation facilities and transmission lines due to increased intensity of storm surge. • Power outages due to tree falls caused by structural damage to transmission lines from increased velocity and duration of high winds.	moisture levels caused by longer periods of inundation from increased duration or severity of precipitation • Disruption of inland shipping channels due to increased silt deposition from increased heavy precipitation and flooding. • Reduced shipping navigability due to lower water levels in navigable rivers from drought. • Increased risk of wildfire damage to infrastructure due to drought. • Disruption of transport and increased repair and maintenance costs from damage of roads, railroads, airports, and port infrastructure due to sea level rise and increased intensity of storm surge. • Closure and/or diminished access to low-lying coastal transportation routes (roads, rail) due to permanent inundation or temporary flooding caused by sea level rise and increased intensity of storm surge. • Shipping lanes and port services may be affected by sea level rise and increased storm surge.	• Increased incidence of building flooding and damage to building foundations and HVAC systems due to sea level rise. • Increased corrosion and physical damage to coastal buildings due to increased intensity of storm surge. • Reduced durability of buildings and structures due to increased erosion and weathering of exterior surfaces from dust storm and debris, caused by structural damage from increased high winds.

[4] A temporary sea level rise associated with a storm.

Water Supply and Sanitation Infrastructure (see separate annex for further detail)	Information and Communication Technology	Cross-Cutting
• Increased demands for potable water and other uses of water due to higher temperatures, which add stress to existing water storage and distribution systems. • Reduced surface water availability and groundwater recharge due to prolonged drought, which increases pressure on existing water storage and distribution. • Reduced water quality and increased demand on water treatment infrastructure due to increased pathogens and lower dissolved oxygen caused by higher temperatures. • Reduced efficiency of sanitation systems and treatment performance due to prolonged drought. • Borehole failures due to prolonged drought and declining groundwater levels. • Contaminated groundwater through boreholes and unprotected wells due to flooding. • Increased damage to water supply, treatment, and distribution systems due to increased intensity of precipitation and flooding. • Damage to storm water drainage and sanitation infrastructure due to flooding. • High levels of suspended sediments, potentially exceeding water treatment capacity, due to flood waters. • Increased public health risks due to inundation and overflow of latrines and septic systems caused by increased precipitation and storm events. • Accelerated salinization of coastal aquifers due to sea level rise, storm surge, and/or reduced rainfall. • Damaged pumps and inundation of low-lying latrines and	• Decreased range of wireless signal transmission due to heat stress; disruptions in wireless signals from changes in vegetation growth due to shifting ecosystems. • Flooding of low-lying/ underground infrastructure and access points, particularly in coastal areas, flood plains, and cities, may be caused by increased precipitation. • Flooding, structural damage, and salt water corrosion of communications infrastructure in low-lying/coastal areas may be caused by sea level rise and increased intensity of storm surge. • Cell towers or telephone poles may fall or be damaged by fallen trees or debris due to increased wind severity.	• Changes in the timing or length of construction shifts and work seasons or changes in ongoing staff management may be required due to health impacts to construction crews and permanent staff from heat stress. • Failure of flood control structures due to increases in heavy precipitation and flooding. • Damage to infrastructure, including transportation systems, buildings, and sanitation infrastructure can disproportionately impact marginalized populations by reducing access to services for people with disabilities and people who depend on public infrastructure to access basic services (health care, shelter, etc.).

Water Supply and Sanitation Infrastructure (see separate annex for further detail)	Information and Communication Technology	Cross-Cutting
septic systems due to sea level rise and saltwater intrusion. ● Back up of discharge and spread of waterborne-diseases due to flooded coastal outfalls caused by sea level rise and storm surge. ● Disruption to supply chains for construction of water and sanitation infrastructure due to flooding and severe events. ● Initial heavy surface flows, floods, sediment load, damage to infrastructure, and eventual diminished water supply due to melting glaciers and Glacial Lake Outburst Floods (GLOFs).		

Because much of infrastructure is interdependent, these risks should not be considered in isolation. For example, power stations provide energy to help telecommunications systems function, which in turn can be essential to the operation of water management systems. Because of this, a disruption in electrical power can have cascading impacts that ultimately affect multiple services throughout a region. Additionally all risks and impacts in infrastructure should be examined through a gender lens due to the different ways these risks will likely impact men and women, and may disproportionately impact marginalized populations.[5]

Illustrative questions by climate stressor:

Temperature:

- Are higher temperatures likely to contribute to changes in the volume or quality of water needed for the infrastructure services?
- Are higher temperatures likely to cause damage to the structural components of the infrastructure?
- Are higher temperatures likely to affect the labor force on which the infrastructure construction or operation will depend?

[5] Marginalized populations are groups of people who are excluded, based on their identity, from political, social, and economic power and participation. Often they include women and girls, at-risk youth, the elderly, LGBTI individuals, persons with disabilities, people in linguistic minorities, indigenous people, and/or a combination of any of these identities. (LGBTI individuals refers to lesbian, gay, bisexual, transgender, or intersex individuals. Further information can be found in the LGBT Vision for Action, https://www.usaid.gov/sites/default/files/documents/1874/LGBT%20Vision.pdf.)

Flooding:

- Are changes in flooding likely to damage the infrastructure assets or disrupt the services it provides?
- Will changes in the intensity of rainfall events damage the infrastructure assets or disrupt the services it provides?

Drought:

- Are droughts likely to reduce the volume or quality of water required for the infrastructure facility to operate and meet service demand?
- Will drought contribute to increased incidence of fire that may affect the infrastructure assets or service?
- Will drought contribute to changes in landscape that, interacting with precipitation events, may cause greater erosion that will impact the infrastructure assets or service?

Sea level rise and storm surge:

- Will sea level rise damage coastal infrastructure?
- Will increasing intense storm surge damage infrastructure assets or disrupt services?
- Will sea level rise inundate areas in which the infrastructure is sited, or inundate access roads and services on which the infrastructure depends?

Illustrative questions by programming or system element:

Exposure/Siting:

- To what extent is the planned infrastructure likely to be affected by climate change due to its location? For example, is the infrastructure system located in a flood plain, and therefore subject to potential increases in flooding, sea level, or storm surge?

Sensitivity:

- What is the susceptibility of the infrastructure to more frequent or intense weather events (floods, droughts, and tropical cyclones) because of its age, condition, maintenance levels, or operational protocols?
- Are design standards sufficient to withstand extreme weather events?
- Are there the capability and data to develop design codes and standards that are updated to include climate change scenarios?

Redundancy:

- Are there back-up systems or alternative services available to reduce the effects of damages and disruption in service? Are safety margins adequate to address increased frequencies of extreme weather events in the location?

Safety:

- Are there likely to be specific safety hazards associated with locating infrastructure in particular geographies due to expected climate variability and change?
- Will climate change affect worker's health or ability to safely access the infrastructure?

Operational considerations:

- Will climate change affect the functionality or operational efficiency of the infrastructure (e.g., supply of water required, load on critical cooling systems, material transformation/degradation, levels or schedule of maintenance required, availability of labor force, etc.)?

Robustness:

- Is the infrastructure design robust enough to meet increased service demand that may result from a range of plausible climate change and non-climate scenarios (energy/water demand, urbanization/migration, increased peak demand for cooling, etc.)?
- What design standards are being used? Are these standards internationally recognized for their robustness under different climate scenarios?

Tool Step 3: Adaptive Capacity Related to Infrastructure, Construction, and Energy – Illustrative Questions

Once you have reviewed this section, you can navigate back to the Tool by clicking on the relevant hyperlink in the header.

Physical Capacity

- What is the level of capacity of the infrastructure system to retain or restore service?
- To what extent is there redundancy in the infrastructure system?

Information Capacity

- What is the level of capacity to collect and use information related to climate impacts on infrastructure and infrastructure services?
  - To what extent are effective systems in place to monitor and identify damages to infrastructure and disruptions to infrastructure services from extreme weather and climate variability?
  - How well are data used to inform infrastructure design and service management? What is the level of capacity to use and apply these data?
  - To what extent is climate change information incorporated into strategic planning of resources (e.g., maintenance and operations, infrastructure improvements, personnel, and training) for infrastructure services?

Social and Institutional Capacity

- What is the capacity of institutions and civil society to take action and to adjust to climate impacts on infrastructure and infrastructure services?
  - How effective are institutions, systems, and processes for managing infrastructure and infrastructure services?
  - To what extent do national or sub-national infrastructure guidelines and standards take account of climate change?
  - How flexible and robust are national and local planning, budgeting and emergency response capabilities and systems? Are they able to accommodate additional stresses on infrastructure from a changing climate?

Human Capacity

- How well equipped are the technical and research organizations to train and support communities to adjust to climate impacts to infrastructure services?
- How well trained are the staff of infrastructure management organizations to address climate risks?

Financial Capacity

- How adequate are the financial resources to support the infrastructure sector in preparing for and responding to climate impacts?
  - How adequate are the investments that are being made to reduce climate risks to infrastructure assets and services?
  - Are funding sources to address climate risks to infrastructure assets and services available? How sufficient are the systems through which governments can access these resources?

Tool Step 4: Assign Climate Risk Rating

All interventions related to construction should be categorized as high risk and will be assessed and addressed by the Engineer of Record.[6]

Tool Step 5: Opportunities Related to Climate Risk Management for Infrastructure, Construction, and Energy – Illustrative Examples

The need to address climate risks related to infrastructure, construction, and energy may provide a range of additional opportunities. For moderate/high risk strategic elements, projects, and activities, the important types of opportunities to discuss are climate change mitigation,[7] potential co-benefits for non-climate development objectives, leveraging political will, and other development issues. For Washington-based and low-risk strategic elements, projects, and activities, opportunities should focus more on how to support resilience more broadly.

Once you have reviewed this section, you can navigate back to the Tool by clicking on the relevant hyperlink in the header.

Build institutional capacity in local governments

- Training and capacity building for local government staff on conducting climate vulnerability assessments and adaptation planning can be used to build technical skills in applying and accessing climate data, using geospatial platforms, and writing effective proposals.
- Training and capacity building for local government staff can also be used to create new and more effective working relationships among 'stove-piped' offices (e.g., ties between planners, economists, engineers, and civil defense/emergency response) within local government, and between government offices and local experts (e.g., from universities and the private sector).

[6] An appropriately qualified engineering firm under contract or subcontract with USAID for the purpose of completing the engineering design.
[7] In this document "climate change mitigation" refers to efforts to reduce greenhouse gas emissions.

- The need to collect climate projections and observational data for infrastructure planning could also support information and data needs for early warning and emergency response.

Engage national government in development objectives that have not been priorities for them in the past

- The need to protect water supplies for hydropower generation from climate change-driven water deficits through investments in green infrastructure and watershed restoration in rural communities could encourage a national government to direct public funds to rural development and employment projects.
- Addressing risks to public transportation from climate change could open the door to simultaneously addressing broader social justice and governance issues related to under-served and marginalized populations as well as co-benefits associated with climate resilient and low emission transportation infrastructure design.
- Establishing or strengthening building codes to codify more sustainable elements in new or existing buildings will improve building performance. According to the International Energy Agency, buildings account for over one-third of total final energy consumption and are an equally important source of carbon dioxide emissions, indicating the potential of sustainable buildings to mitigate climate change.

Support countries in achieving low emission development or climate change mitigation efforts

- The need to invest in more climate-resilient energy generation networks could encourage national governments to invest in sustainable renewable energy sources and distributed networks (e.g., small-scale solar, wind, small-scale run-of-river hydro). This also creates opportunities to engage the private sector.
- Investments in climate-resilient energy could support a national government in meeting national NDC commitments.
- Meet energy demand while avoiding or minimizing the need to invest in new power generation infrastructure through peak load management and energy conservation, which can be measured in “megawatt-hours” of energy saved. Saving energy reduces greenhouse gas emissions.
- Develop green building codes and provide training to building owners and managers to incorporate energy and water saving in the design of new buildings and the retrofit of existing buildings through measures such as water catchment, grey water recycling, green/living roofs, use of solar water heating, use of less carbon-intensive building materials, open floor plans, passive heating and cooling, anticipation of electric vehicle charging, and other measures. Deployment of measures such as these would reduce energy use and greenhouse gas emissions.

Attract new funding, donor participation, or private sector financing to expand the pot for development investments

- Projects to reduce energy system black-outs during extreme weather events through investments in more resilient generation and transmission systems and back-up generation could attract support from local businesses dependent on electricity supply.
- Investments in infrastructure resilience could also increase the willingness of foreign corporations to invest in the region or community.

Engage stakeholders that have been hard to reach

- Projects to address local flooding “hotspots” can be used to engage women and girls, or at-risk youth, in community-level initiatives regarding solid waste, sanitation and public health, or erosion control.

Create new coalitions or better working relationships between stakeholder groups that have not been aligned or have been in competition

- The risk of increased drought conditions, affecting water supply for small farmers, area industry, and power generation (hydro), could provide a platform for joint problem-solving to reduce water loss, improve water conservation (e.g., improved irrigation, water capture, and recycling), and obtain funding for infrastructure improvements.

Improve infrastructure services for underserved communities and marginalized populations

- The need for investments in new or renovated infrastructure could provide opportunities to expand services to rural communities and provide jobs to women and other under-employed groups.
- When rebuilding, consider adopting the most progressive accessibility standards and rebuild in a way that improves access for marginalized populations, including persons with disabilities and people of low socioeconomic status (e.g., wheelchair accessible buses, buildings with ramps and elevators, affordable and accessible medical services in neighborhoods where many people use public transportation and might be isolated in an emergency).

Invest in infrastructure services that will support other development objectives

- The need to rebuild infrastructure after extreme events could provide an opportunity to relocate communities from high-risk locations and convert those areas to ecosystem/biodiversity restoration zones.

Tool Step 6: Climate Risk Management Options for Infrastructure, Construction, and Energy – Illustrative Examples

For infrastructure, adaptation actions can be categorized under three main approaches: accommodate and manage, protect and harden, and relocate/retreat. While not always the case, the cost of these approaches generally increases as "hard" engineering approaches or site relocation strategies are pursued. Post-disaster recovery may present a unique avenue for transformative changes in the resilience of infrastructure. Capitalizing on this opportunity may require pre-disaster planning to identify ways to proactively address climate change risks during post-disaster reconstruction.

Once you have reviewed this section, you can navigate back to the Tool by clicking on the relevant hyperlink in the header.

Accommodate and Manage

These options are characterized by their focus on changes in management practices and programs. They consist of updating plans, management policies, regulations, and maintenance and operations activities. Appropriate use of these strategies allows decisionmakers to manage the level of risk and monitor conditions while deferring more costly construction or relocation approaches; in some instances no additional actions may be required. By adjusting existing practices, accommodation and management strategies can increase resilience, manage climate effects as part of routine activities, or prepare for emergency management if infrastructure does fail. Examples include:

- Change the frequency of repair schedules and implement changes in maintenance protocols.
- Develop contingency plans in the event of disruption and install redundant systems to back up a primary system.
- Provide education and training for staff to effectively respond to system disruptions or emergency events. These actions often can be readily redesigned, based on an evaluation of progress, changing needs, and new information.
- Establish or expand a contingency budget reserve or insurance plan to address unexpected disruptions and fund investments to restore services and facilities.

Protect and Harden

Options under this approach involve structural changes to how an infrastructure system is designed, built, renovated, or protected. These options can be resource-intensive in terms of the financing, technical, and organizational capacity required. Implementing these actions as part of scheduled plans for upgrades or infrastructure replacement can be most cost-effective. Further, these options tend to be more permanent, making them less able to respond to changing circumstances. In order to avoid maladaptation, long-lasting and expensive infrastructure needs to be particularly well-designed to ensure its resilience under a range of potential climate futures. When possible, designs should allow for flexibility to incorporate future changes or enhancements as warranted by evolving climate conditions (e.g., a seawall that allows for the height to be increased). Examples include:

- Upgrade design standards and codes (e.g., using stronger building materials) and their implementation for both new construction and renovation.
- Fortify existing structures by incorporating extra foundational supports.
- Erect protective barriers, levees or sea walls, or natural areas (i.e., green infrastructure such as wetlands or replenished barrier islands) to buffer infrastructure from climate impacts.

- Elevate roads, bridges and structures, and change the curvature of drains and roads.
- Use more resilient building materials.

Site Selection or Retreat

These strategies seek to reduce the degree of exposure by locating or relocating assets and systems away from exposed locations, such as shorelines, floodplains, and areas at risk of landslides, mudflows, floods, or fire. Examples include:

- Relocate critical public buildings, such as hospitals and schools, to higher or less vulnerable locations.
- Site emergency response infrastructure (fire stations, helipad) in secure locations.
- Locate critical infrastructure systems, such as power plants, water lines, or telephone sub-stations, in more protected areas.

Tool Step 7: Identify Next Steps

Strategies and projects that include potential construction work should identify the following next step—ensure the Engineer of Record[8] conducts climate risk management by including the following language in solicitations, contracts, and subcontracts for engineering design:

Engineering analysis preceding design activities must include consideration of climate change and its potential impacts on the location (siting), functionality, and sustainability of resulting infrastructure and infrastructure services. Such analysis must include identification of relevant data sets and gaps, review of local building standards and codes for adequacy, and determination of safety factors or other measures of uncertainty that will be carried through design. The results of this analysis, including risks identified and how they are addressed, shall be documented.

[8] An appropriately qualified engineering firm under contract or subcontract with USAID for the purpose of completing the engineering design.

Additional Key Resources Related to Infrastructure, Construction, and Energy

The following **resources** provide additional information related to climate risks to infrastructure, construction, and energy and corresponding climate risk management options.

Title	Author(s)	Organization	Date	Length	Intended Audience	Unique Value
Lifelines : The Resilient Infrastructure Opportunity	Hallegatte, Stephane; Rentschler, Jun; Rozenberg, Julie.	World Bank	2019	Overview 33 pp. Full Report 224 pp.	Governments, stakeholders, and the international community	Building on a wide range of case studies, global empirical analyses, and modeling exercises, Lifelines lays out a framework for understanding infrastructure resilience—the ability of infrastructure systems to function and meet users' needs during and after a natural shock—and it makes an economic case for building more resilient infrastructure. Offers concrete recommendations and specific actions that can be taken by to improve the quality and resilience of infrastructure services.
Resilient Energy Platform		USAID and the National Renewable Energy Laboratory (NREL)	Contin-ually up-dated	Multiple resources, publica-tions	Decision-makers in the energy sector	Developed through the USAID-NREL Partnership, the Resilient Energy Platform provides expertly curated resources, training materials, data, tools, and direct technical assistance in planning resilient, sustainable, and secure power systems.
Incorporating Climate Change Adaptation in Infrastructure Planning and Design series • *Overarching Guide* • *Sanitation* • *Roads* • *Bridges*		USAID	2015	~60 pp. each	USAID infrastructure project managers	Describes best practices to incorporate climate adaptation in the planning and engineering design of USAID infrastructure activities. For use at the project- or activity-level, after reviewing the reference *Addressing Climate Change Impacts on Infrastructure*, in order to gain a more detailed understanding of

Title	Author(s)	Organization	Date	Length	Intended Audience	Unique Value
• *Flood Management* • *Potable Water* • *Irrigation* • *Green Infrastructure (forthcoming)* • *Vertical Structures (forthcoming)*						risks and potential adaptation options.
Addressing Climate Change Impacts on Infrastructure		USAID	2013	52 pp.	Development practitioners including country strategy and project teams	Provides more detailed information than the Tool about climate impacts to specific infrastructure categories (e.g., cultural heritage sites, buildings). Lists potential adaptation measures that help illustrate potential ways to reduce risk.
Fast-Track Implementation of Climate Adaptation	Numerous	USAID	2015	81 pp.	Development practitioners including country strategy and project teams	Fast Track approaches can be applied as a next step after screening, to identify near-term infrastructure adaptation options that may achieve rapid incremental improvements in resilience, and incorporate these adaptation options into planning and decision-making.
Paving the Way for Climate-Resilient Infrastructure	United Nations Developmen t Programme	United Nations Development Programme	2011	148 pp.	Development practitioners assisting government authorities in planning infrastructure investments	Provides more detailed information about key considerations for decision-making on climate-proofing infrastructure, including frameworks for detailed understanding of risks and analysis of adaptation options.
Climate Impacts on Energy Systems: Key Issues for Energy Sector Adaptation	J. Ebinger and W. Vergara	World Bank, Energy Sector Management Assistance	2011	224 pp.	USAID energy project managers	Provides an overview of how climate change might affect the energy sector and what options exist to address the impacts.

Title	Author(s)	Organization	Date	Length	Intended Audience	Unique Value
		Program (ESMAP)				
Confronting Climate Uncertainty in Water Resources Planning and Project Design: The Decision Tree Framework	P. Ray and C.M Brown	World Bank	2015	125 pp.	USAID water resource managers	Provides resource-limited project planners and program managers with a cost-effective and effort-efficient, scientifically defensible, repeatable, and clear method for demonstrating the robustness of a project to climate change.
Climate Change and the Electricity Sector: Guide for Assessing Vulnerabilities and Developing Resilience Solutions to Sea Level Rise	U.S. Department of Energy, Office of Energy Policy and Systems Analysis	U.S. DOE	2016	116 pp.	USAID energy project managers	Provides more detailed discussion of SLR and coastal climate change impacts on the power sector, with a domestic focus.
Adapting Infrastructure and Civil Engineering Practice to a Changing Climate	J. R. Olsen et. al.	American Society of Civil Engineers	2015	104 pp.	Infrastructure designers and engineers	Reviews climate science and relationship to infrastructure, and recommends engineering approaches to reduce climate risk.

Water Supply and Sanitation

Introduction

Purpose: This annex to the Climate Risk Screening and Management Tools is designed to provide you with more information on climate change[1] implications for water supply and sanitation. The information is grouped into the following sub-sections, with the corresponding step from the Tool shown in parentheses:

- Climate Risks to Water Supply and Sanitation (Step 2)
- Adaptive Capacity Related to Water Supply and Sanitation (Step 3)
- Opportunities Related to Water Supply and Sanitation (Step 5)
- Climate Risk Management Options for Water Supply and Sanitation (Step 6)
- Additional Key Resources for Water Supply and Sanitation

The questions and examples provided in this annex are illustrative and designed to stimulate thinking about climate risks, adaptive capacity, opportunities, and climate risk management options. Actual climate risks will depend on the context and anticipated climate changes for particular geographies.

Sectoral focus of this annex: The material in this annex aligns with HL.8 Water Supply and Sanitation of the Standardized Program Structure. Note, to the extent your design involves multiple sectors, you may want to consult other relevant annexes. In particular, if any new construction or rehabilitation[2] is anticipated, referring to the Infrastructure, Construction and Energy Annex is highly recommended. Please note, *activity*-level climate risk management (CRM) for engineering design **must** be conducted by the Engineer of Record.[3] See the Infrastructure, Construction, and Energy Annex for solicitation language. In addition, note that the Health Annex addresses waterborne diseases, and the Environment and Biodiversity Annex addresses water-related ecosystems and integrated water resources management.

[1] In this document, the term "climate change" refers to both climate variability and climate change. "Climate variability" refers to variations in climate (including the normal highs and lows, wet and dry periods, hot and cool periods and extremes) and can refer to month-to-month variability, year-to-year variability, and even decadal scale variability. In this document, "climate change" refers to those variations as well as persistent change in climate over decades or longer (USAID, 2014. *Climate-Resilient Development: A Framework for Understanding and Addressing Climate Change*).

[2] USAID Implementation of Construction Activities, A Mandatory Reference for ADS Chapter 303, defines "construction" as: "construction, alteration, or repair (including dredging and excavation) of buildings, structures, or other real property and includes, without limitation, improvements, renovation, alteration, and refurbishment. The term includes, without limitation, roads, power plants, buildings, bridges, water treatment facilities, and vertical structures." Construction at USAID almost always occurs within another primary programming area (e.g., school building for education, hospital/clinic construction for health).

[3] An appropriately qualified engineering firm under contract or subcontract with USAID for the purpose of completing the engineering design.

Tool Step 2: Climate Risks to Water Supply and Sanitation – Illustrative Examples and Questions

Once you have reviewed this section, you can navigate back to the Tool by clicking on the relevant hyperlink in the header.

Water Quantity	Water and Sanitation Infrastructure	Water Quality	Behavioral Change and Enabling Environment
• Increased evaporative water losses due to higher temperatures. • Increased demands for potable water and for other uses of water due to higher temperatures. • Decreased water availability in the dry season due to rapid runoff and reduced infiltration caused by heavy rainfall over sparsely-vegetated watershed. • Reduced supply of freshwater due to inundation of coastal aquifers from sea level rise. • Eventual diminished seasonal water supply due to melting glaciers. • Increased conflicts over water in arid regions due to droughts. • Increased competition for water for rural and urban needs due to drought and water shortages. • Reduced surface water availability and groundwater recharge due to prolonged	• Increased damage to water supply and sanitation systems, including collection, treatment, and distribution systems, due to increased intensity of precipitation. • Reduced efficiency of sanitation systems and treatment performance due to prolonged drought. • Damage to water supply and sanitation infrastructure due to flooding. • Damaged pumps due to sea level rise and saltwater intrusion. • Inundation of low-lying latrines and septic systems caused by sea level rise. • Damage to water and sanitation infrastructure due to heavy surface flows and floods from melting glaciers and Glacial Lake Outburst Floods (GLOFs). • Reduced access of marginalized populations[4] to sanitation infrastructure due to flooding and extreme storm events.	• Harmful algal blooms (HABs) that produce toxins leading to human health impairment may be created by higher temperatures. • Reduced water quality due to increased pathogens and lower dissolved oxygen caused by higher temperatures. • Increased public health risks due to inundation and overflow of latrines and septic systems caused by increased precipitation and storm events. • Increased disease risks due to exposure of downstream residents to human and animal wastes caused by flooding of sanitation facilities. • Increased incidence of waterborne infectious diseases due to higher temperatures and flooding. • Contaminated groundwater through boreholes and unprotected wells due to flooding. • High levels of suspended sediments,	• Reduced number of stakeholders participating in risk-reducing practices as a result of infrastructure damage and community dislocation due to flooding or sea level rise. • Reduced resources available for community education as a result of resources required for emergency response. • Reduced participation in sanitation and hygiene training and awareness- raising due to community disruption and dislocation due to flooding, sea level rise, and extreme events. • Reduced resources for and enforcement of government policies and regulations related to water use and sanitation due to diversion of government staff and resources to address extreme events and other climate impacts.

[4] Marginalized populations are groups of people who are excluded, based on their identity, from political, social, and economic power and participation. Often they include women and girls, at-risk youth, the elderly, LGBTI individuals, persons with disabilities, people in linguistic minorities, indigenous people, and/or a combination of any of these identities. (LGBTI individuals refers to lesbian, gay, bisexual, transgender, or intersex individuals. Further information can be found in the LGBT Vision for Action, https://www.usaid.gov/what-we-do/democracy-human-rights-and-governance/protecting-human-rights/lgbti-inclusive-policies.)

Water Quantity	Water and Sanitation Infrastructure	Water Quality	Behavioral Change and Enabling Environment
drought. ● Increase in wells drying up, extending distances travelled to collect household water, due to declining precipitation. ● Borehole failures due to prolonged drought and declining groundwater levels. ● Increased workload, time burden, and caloric expenditure for women and girls.	● Disruption to supply chains for construction and maintenance of water and sanitation infrastructure due to flooding and/or severe events.	potentially exceeding water treatment capacity, due to flood waters. ● Higher pollutant concentrations in surface waters and reduced efficiency of sanitation systems due to prolonged drought. ● Reduced ability of rivers to dilute and carry away contaminants due to low-flow periods. ● Back up of discharge and spread of waterborne diseases due to flooded coastal outfalls caused by sea level rise and storm surge.[5] ● Accelerated salinization of coastal aquifers due to sea level rise, storm surge, and/or reduced rainfall.	

Illustrative questions by climate stressor:

Temperature:

- Are higher temperatures likely to reduce water quality?
- Are higher temperatures likely to increase demand for drinking water?
- Will higher temperatures impact worker availability or schedules for construction of sanitation or water infrastructure?

Flooding:

- Is flooding likely to damage water supply, wastewater treatment, and/or sanitation infrastructure?
- Is storm damage to other sectors (e.g., electricity supply, transportation) likely to affect water supply and sanitation?

[5] A temporary sea level rise associated with a storm.

Drought:

- Is drought likely to impair water supply infrastructure, including wells and boreholes?
- Is drought likely to increase evaporation of surface waters and reduce groundwater recharge, limiting freshwater supply?

Sea level rise and storm surge:

- Is sea level rise and/or storm surge likely to introduce salt water into drinking water supplies?
- Is sea level rise and/or storm surge likely to damage water and sanitation infrastructure?

Illustrative questions by programming or system element:

Water supply:

- Are higher temperatures likely to increase evaporation of surface waters?
- Is declining precipitation likely to reduce recharge rates and groundwater supplies?
- Is flooding likely to reduce infiltration and water availability in the dry season?
- Is prolonged drought likely to increase competition for freshwater?
- Is sea level rise likely to contaminate coastal aquifers and reduce the supply of freshwater?

Water and sanitation infrastructure:

- Is flooding likely to damage water supply and sanitation infrastructure or interfere with operations and maintenance?
- Is flooding likely to inundate sanitation facilities?
- Is drought likely to reduce groundwater levels and lead to borehole failures?
- Is salt from sea level rise and storm surge likely to damage water pumps?

Water Quality:

- Are higher temperatures likely to increase the risk of hazardous algal blooms?
- Is flooding likely to lead to overflows of latrines and septic systems leading to increased public health risks?
- Is prolonged drought likely to increase water treatment costs?
- Is sea level rise contaminating drinking water supplies?

*Demand Creation/Enabling Environmen*t:

- Will severe events disrupt community-based education efforts to achieve behavior change regarding sanitation?
- Will severe events result in reduced resources for enforcement of government policies and regulations related to water use and sanitation?

Tool Step 3: Adaptive Capacity Related to Water Supply and Sanitation – Illustrative Questions

Once you have reviewed this section, you can navigate back to the Tool by clicking on the relevant hyperlink in the header.

Information Capacity

- What is the capacity to collect and use information related to climate impacts to water resources and Water, Sanitation, and Hygiene (WASH) services?
  - To what extent do strong and effective systems for monitoring of water resources and WASH services exist, including hydro-meteorological monitoring? Are there information gaps? Are information collection/management and strategic planning systems based on historical averages, or are they dynamic and able to adjust to new information?
  - How well is existing monitoring information of water resources and WASH services used? Is it incorporated into strategic planning of resources (financial, infrastructure, personnel, training, disaster preparedness, etc.)?
  - To what extent is climate change information incorporated into design of WASH infrastructure and facilities?
  - To what extent do current or future WASH efforts take into account the indirect impacts of climate change and other socio-economic and demographic trends in local water availability (especially through agricultural, industrial, and urban water uses)?
  - What is the accessibility and appropriateness of data collection and dissemination (language, literacy, etc.)?

Social and Institutional Capacity

- What is the level of capacity of institutions and civil society (e.g., water and sanitation service providers and utilities) to take action and to adjust to climate impacts on water and sanitation services?
  - Are there effective institutions and leadership in place to support the planning and implementation of actions to address potential impacts and opportunities related to water and sanitation services? To what extent do central and local government non-governmental organizations (NGOs), and the private sector have the capacity to consider and address climate impacts to WASH services?
  - Are roles and responsibilities clearly assigned amongst relevant stakeholders (e.g., government institutions, service providers) such that they facilitate planning for and response to climate impacts?
  - To what extent do national or sub-national policies recognize and address the multiple pressures on WASH services, including climate variability and change? To what extent do national or sub-national WASH guidelines and standards exist that take adequate account of climate change?
  - To what extent are national and local planning, budgeting, and emergency response capabilities able to respond to gradual and rapid onset changes?
  - To what extent are institutions equipped to manage potential conflict between competing water users? How well are institutions able to manage conflict under potentially increasing competition and scarcity? How mature are water management institutions within the country?
  - To what extent do institutions reflect the diversity and different needs of the communities they serve?

- How are the multiple needs and roles of users taken into account (i.e., water for people and water for livestock, both managed by women)?

Human Capacity

- To what extent do WASH service providers, managers, and users have the capacity to consider and address climate impacts to water and sanitation services?
  - Are there effective institutions and leadership in place to support the planning and implementation of actions to address potential impacts and opportunities related to water and sanitation services? Is there capacity to prepare proposals to access financial resources?
  - To what extent do central and local government, NGOs, and the private sector have the capacity to consider and address climate impacts to WASH services?
  - What is the level of awareness and appreciation of water users of water conservation and water efficiency? Do users support government or utility-led water conservation programs? Are users currently applying water conservation and protection practices?
  - Are technical and research organizations in place to train and support communities to adjust to climate impacts to water and sanitation services?

Financial Capacity

- Are there adequate financial resources to support the WASH sector in preparing for climate impacts?
  - Are investments being made to reduce climate risks to WASH infrastructure and service delivery? Will investment be able to scale up or down as needed to channel resources to key areas to minimize negative impacts to WASH services as a result of climate change?
  - Are investments being made in technologies that promote efficient use of water and conservation of water?
  - Are investments being made in research and technical development to reduce climate risks to WASH services?
  - Are funding sources available to address heightened risk management needs to maintain preparedness for losses and new investments?
  - Are revenue flows from water services delivery sufficient to allow providers to sustain operations during periods of drought or flood?
  - Is there any danger that interrupted revenue flows (through, for example, imposed water conservation measures or resource allocation due to extreme events) may lead to “stranded assets” that are no longer economically viable?

Tool Step 5: Opportunities Related to Climate Risk Management for Water Supply and Sanitation – Illustrative Examples

Once you have reviewed this section, you can navigate back to the Tool by clicking on the relevant hyperlink in the header.

The need to address climate risks to health may provide opportunities to:

Develop synergies between disaster risk reduction (DRR) and water-related adaptation

- Climate-proofing water supply and sanitation systems can help integrate DRR and CAA and promote emergency preparedness.

Reduce gender inequalities associated with water and sanitation

- Efforts to increase the resilience of water systems can decrease demands on women who must collect water for household uses, which can consume a significant amount of time in the day. These time demands can increase as the availability of water decreases and women are forced to travel further to access water.
- Efforts to increase the resilience of sanitation systems can support women in maintaining sanitary household conditions and reducing disease in themselves and their families.

Improve water and sanitation infrastructure and infrastructure services

- Making water and sanitation systems more resilient to future climate variability and change may also yield immediate results by addressing insufficient water and sanitation infrastructure and an inadequate supply of clean water and access to sustainable sanitation.

Encourage stakeholder engagement and enhance the sustainability of investments

- New or more varied stakeholders may be engaged in WASH services to help develop and implement climate risk management measures, which can increase the overall sustainability and impact of the investments.
- New coalitions and partnerships may provide cost-effective opportunities to address reduced water supplies and other climate-related challenges to water services.

Take advantage of synergies with other development objectives

- Shared concern about water supply and quality may provide opportunities to promote more holistic approaches to water resource management.
- The need to enhance the resilience of water supply and sanitation services may encourage government officials to prioritize needed improvements in energy systems upon which water supply and sanitation rely.
- Changes in water management infrastructure for WASH services may provide opportunities to expand water and sanitation services to rural communities.
- Improved water conservation measures may reduce the need to transport water, which is energy intensive. Saving energy from transporting water will reduce greenhouse gas emissions.
- The need to rebuild after extreme events may provide an opportunity to inventory and construct improved and more resilient water and sanitation infrastructure.
- Climate surveillance equipment for early warning and emergency response may also provide information to managers and designers of water and sanitation services.

- Implementing integrated watershed management may help protect water resources vulnerable to reduced rainfall and increased incidence of drought.

Achieve climate change mitigation co-benefits while achieving sustainable water supply and sanitation services

- Water is a critical input for multiple sectors, including energy and agriculture. The water-energy-food nexus should be considered as an important sustainability factor in the water sector and in country plans to reduce emissions, e.g., in low emissions development strategies (LEDS) and nationally determined contributions (NDCs).

Tool Step 6: Climate Risk Management Options for Water Supply and Sanitation – Illustrative Examples

The need to address climate risks related to water supply and sanitation may provide a range of additional opportunities. For moderate/high risk strategic elements, projects, and activities, the important types of opportunities to discuss are climate change mitigation,[6] potential co-benefits for non-climate development objectives, leveraging political will, and other development issues. For Washington-based and low-risk strategic elements, projects, and activities, opportunities should focus more on how to support resilience more broadly.

Once you have reviewed this section, you can navigate back to the Tool by clicking on the relevant hyperlink in the header.

Invest In Climate-Related Information Collection and Management Systems

- Strengthen climate information systems, building on existing regional and national networks.
- Build capacity of national governments to harmonize data across regions.
- Build relevant national and/or regional research programs on the links between climate and water supply and sanitation (e.g., vulnerability index).
- Improve public education and outreach efforts related to watershed protection, water demand, water sanitation, and other factors relevant to water-related climate impacts and adaptation.

Strengthen WASH Policies, Planning, and Systems

- Integrate climate information into WASH system planning.
- Identify and prioritize technologies for water-related adaptation.
- Improve design and construction of water supply and sanitation infrastructure to account for the potential for climate-related risks.
- Improve water storage, conservation, and water demand management to account for climate-driven changes in supply and demand.
- Improve coordination of policies and programs across government agencies to address the additional pressures imposed by climate change.
- Foster integrated resource management with agriculture and energy.
- Improve finance for WASH systems that are more adaptive and better designed for a changing climate, including through private sector investment and incentives; ensure consideration of climate risk in financing approaches.

[6] In this document "climate change mitigation" refers to efforts to reduce greenhouse gas emissions.

- Improve monitoring and evaluation systems to measure changes in water-related vulnerability and resilience to climate change and to promote adaptive management.

Consider Rural vs Urban Needs

- Identify changes in demographics, urbanization, and land use that could dictate a shift in WASH investments, particularly in the face of the exacerbating influence of climate change.
- Design urban WASH investments to “reach” more individuals potentially affected by climate change.
- Consider water resource constraints when addressing the complexities of urban migration (family planning, economic opportunities, and integrated public services).

Develop Multi-use Systems to Improve Risk Management for Water Systems

- Integrate WASH infrastructure for multiple uses at the household level to improve resilience to decreased rainfall from climate change and variability.
- Implement rainwater harvesting and greywater reuse for agriculture, where appropriate.
- Strengthen disaster planning and response for water infrastructure and water services.

Additional Key Resources for Water Supply and Sanitation

The following **resources** provide additional information related to water supply and sanitation and corresponding climate risk management options.

Title	Author(s)	Organization	Date	Length	Intended Audience	Unique Value
WASH 101: Development Result 4, Water Resources Management Online Training (search for the course title in USAID University)	USAID	USAID	N/A	1 hour	USAID staff	By the end of the online training module, USAID WASH Leads and those managing WASH programs will be able to: 1. Describe the importance of Water Resources Management (WRM) and lanning. 2. Recognize key concepts and key sector terms in WRM. 3. Identify management practices that affect water quality and availability 4. Describe how to manage climate stressors on water resources.
Sustainable Water Partnership Toolkits	USAID and Winrock International, TetraTech, IUCN, WRI, SEI	USAID and Winrock International, TetraTech, IUCN, WRI, SEI	2017	Six (6) toolkits	Decision-makers in the water sector	The toolkits present a process to address water risks, including long-term water stresses that constrain social and economic development and sudden shocks that can quickly ruin the health and livelihoods of vulnerable populations. The toolkits complement the Climate Risk Screening and Management Tool and provide a more in-depth analysis of water security risks that span beyond climate risks.
Ecosystem-based Adaptation and Water Security	USAID Forestry & Biodiversity Office and USAID BRIDGE	USAID	2018	8 pp.	Development experts, water security experts, policymakers	Provides an overview of ecosystem-based adaptation approaches to address water security.

Title	Author(s)	Organization	Date	Length	Intended Audience	Unique Value
Lifelines : The Resilient Infrastructure Opportunity	Hallegatte, S.; Rentschler, J.; Rozenberg, J.	World Bank	2019	Overview 33 pp. Full Report 224 pp.	Governments, stakeholders, and the international community	Building on a wide range of case studies, global empirical analyses, and modeling exercises, Lifelines lays out a framework for understanding infrastructure (including water and sanitation) resilience—the ability of infrastructure systems to function and meet users' needs during and after a natural shock—and it makes an economic case for building more resilient infrastructure. Offers concrete recommendations and specific actions that can be taken by to improve the quality and resilience of infrastructure services.
Incorporating Climate Change Adaptation in Infrastructure Planning and Design series ● *Sanitation* ● *Flood Management* ● *Potable Water*	USAID	USAID	2015	~60 pp. each	USAID infrastructure project managers	Describes best practices to incorporate climate adaptation in the planning and engineering design of USAID infrastructure activities. For use at the project- or activity-level, after reviewing the reference *Addressing Climate Change Impacts on Infrastructure*, in order to gain a more detailed understanding of risks and potential adaptation options.
Maintaining Water Security in Critical Water Catchments in Mongolia	USAID Forestry & Biodiversity Office and USAID BRIDGE	USAID	2017	4 pp.	Development experts, water security experts, policymakers	Highlights a project supported by the Adaptation Fund and the United Nations Development Program that used ecosystem-based adaptation approaches to address water security in Mongolia.
Maintaining Water Security in Peru Through Green Infrastructure	USAID Forestry & Biodiversity Office and USAID BRIDGE	USAID	2018	4 pp.	Development experts, water security experts, policymakers	Highlights three sub-national projects supported by the USAID/Peru mission that used ecosystem-based adaptation approaches to address water security.

Title	Author(s)	Organization	Date	Length	Intended Audience	Unique Value
Climate Change and Water: An Annex to the USAID Climate-Resilient Development Framework	USAID	USAID	2014	152 pp.	Development practitioners, including country strategy and project teams	Provides a comprehensive overview of water-related vulnerabilities and adaptation actions.
Addressing Climate Change Impacts on Infrastructure: Preparing for Change	USAID	USAID	2013	52 pp.	Development practitioners, including country strategy and project teams	Provides more detailed information than the Tool about climate impacts to water-related infrastructure. Lists potential adaptation measures that will help with identifying ways to address the risks.
Fast-Track Implementation of Climate Adaptation	USAID	USAID	2015	81 pp.	Development practitioners including country strategy and project teams	Can be applied as a next step after screening, to brainstorm water-related infrastructure adaptation options that can be implemented quickly and incorporated into planning and decision-making.