

# 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<sup>1</sup> 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<sup>2</sup> 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.<sup>3</sup> See the [Infrastructure, Construction, and Energy Annex](#) for solicitation language.

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<sup>1</sup> 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*).

<sup>2</sup> 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).

<sup>3</sup> An appropriately qualified engineering firm under contract or subcontract with USAID for the purpose of completing the engineering design.

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### 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
<ul style="list-style-type: none"> <li>● Increased tree mortality and reduced extent and condition of forest habitats due to pest outbreaks and fires from changes in temperature and precipitation.</li> <li>● Ecosystem function damage due to desertification caused by higher temperatures and drought.</li> <li>● Impaired water quality and fish habitat due to increased flooding carrying nutrients, sediments, and contaminants over the landscape to downstream waters.</li> <li>● Reduced abundance and diversity of coral reefs due to more frequent bleaching and coral die-offs caused by higher ocean temperatures and ocean acidity.</li> <li>● Exacerbated pressures on coastal ecosystems from land development, pollution, and other non-climate stressors due to sea level rise, saltwater intrusion, and coastal flooding.</li> <li>● Impaired ecosystem services such as fish production from coastal wetlands due to sea level rise and storm surge.<sup>4</sup></li> </ul>	<ul style="list-style-type: none"> <li>● 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.</li> <li>● 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.</li> <li>● Changes in growth and survival of migrating species due to climate change-induced mismatches in the timing of migration, breeding, and food availability.</li> <li>● Destruction of habitat for fish and other aquatic species due to prolonged drought.</li> <li>● Destruction of habitat and forced relocation or death of some species due to salt water intrusion into freshwater ecosystems caused by sea level rise.</li> </ul>	<ul style="list-style-type: none"> <li>● Local fisheries may be affected by changes in the range and abundance of many economically-important marine fishes due to higher ocean temperatures.</li> <li>● Agricultural production and human health may be affected by the spread pathogens, parasites, and diseases due to higher temperatures.</li> <li>● 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.</li> <li>● Interrupted beach recreation and related livelihoods due to coastal erosion from sea level rise and storm surge.</li> </ul>

<sup>4</sup> A temporary sea level rise associated with a storm.

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### 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?

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### *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?<sup>5</sup>
- 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?

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<sup>5</sup>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](https://www.usaid.gov/sites/default/files/documents/1874/LGBT_Vision.pdf).)

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### 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?

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### 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,<sup>6</sup> 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+<sup>7</sup> to help achieve climate change mitigation goals while also providing conservation-based, income-generating opportunities.

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<sup>6</sup> In this document “climate change mitigation” refers to efforts to reduce greenhouse gas emissions.

<sup>7</sup> 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>

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- 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.

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

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#### 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.

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### 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
<a href="#">Integrating Biodiversity and Climate Change Adaptation In Activity Design</a>	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.
<a href="#">Impacts of 1.5°C Global Warming on Natural and Human Systems</a>	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.
<a href="#">IPCC Special Report on the Ocean and Cryosphere in a Changing Climate</a>	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.

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<a href="#"><i>Integrating Climate Change Adaptation into Biodiversity and Forestry Programming</i></a>	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.
<a href="#"><i>USAID Ecosystem-based Adaptation Series Synthesis</i></a>	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.
<a href="#"><i>Ecosystem-Based Adaptation Case Studies, Evidence Summaries, and Lessons Learned</i></a>	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 <a href="#">helpful portal</a> provides a good overview of the series.
<a href="#"><i>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</i></a>	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.
<a href="#"><i>Ecosystems, Ecosystem Services, and Biodiversity. In Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II</i></a>	D. Lipton, et al.	U.S. Global Change Research Program	2018	54 pp.	Development practitioners, environmental scientists, and policymakers	Provides more detail on impacts of climate change on ecological resources.

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<a href="#">Species Susceptibility to Climate Change Impacts</a>	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.
<a href="#">Climate Change Vulnerability Assessment of Species</a>	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.
<a href="#">Impacts of climate change on future air quality and human health in China</a>	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.