The Xayaburi Dam, if built, will block critical fish migration routes for dozens of fish species, as well as sediment flows in the Mekong River, affecting the agriculture and fisheries as far downstream as the Mekong Delta in Vietnam. Photo: International Rivers

Assessing Climate Risks to Communities

While large dams and diversion projects are often touted as appropriate adaptation projects to deal with flooding, water shortages or storage, not only can these projects be highly vulnerable to climate change themselves, but they can also compound the impacts of climate change and threaten the climate resilience of vulnerable populations. Many of these projects will likely have severe impacts on water quality and quantity, which will in turn have negative consequences for communities' adaptive capacity. Large dams may also lead to serious regional security issues, especially in the case of transboundary rivers.

In order to prevent a particular adaptation project from having harmful impacts (known as "maladaptation"), it is critical that it be assessed for its climate change risks *and* for its impact on the adaptation of local communities. Given the considerable uncertainties around climate change impacts on human and natural systems, many adaptation practitioners recommend taking a risk-based approach to assessing a range of possible scenarios and the ecosystems or populations that will be most vulnerable to change, rather than an impact assessment approach that relies on predictions of what might happen.

These vulnerability and risk assessments can and should be done in a range of planning activities, but urging governments to require them at the Strategic Environmental Assessment (SEA) phase of water and energy planning should be a minimum. (SEAs are not always done, so pushing for this kind of assessment is a good first step.) In addition, they should always be done in consultation with local communities and regional experts in order to ensure that you have the most relevant and accurate data to work with before you begin assessing a development project for its climate risks or developing your own adaptation project (see Chapters 4 and 5).

This chapter discusses the types of assessments that you can conduct with your communities, and the challenges you might encounter along the way.

COMMUNITY-BASED ADAPTATION

Providing people with tools for conducting comprehensive assessments of local vulnerabilities to climate impacts and helping them prioritize responses to those impacts will improve their capacity to adapt. It is important to obtain information from community members about local adaptation and coping strategies that already exist, so that further activities and assessments can be done in a way that meets community goals and preserves community traditions.[17] Working with community representatives and developers to design and implement inclusive processes for soliciting this type of information is critical for ensuring that local needs are well identified and prioritized in assessment processes.

Before pursuing community-based assessments of any type, it is important to first think about what kinds of information you might need, how credible that information is, and if you are likely to have a gap between what the community wants and what you can deliver (especially when it comes to accurate climate data). It is also critical to determine how durable your decisions will likely be and how much they might lock you into one particular pathway. According to John Matthews, Director of Freshwater Climate Change at Conservation International, "This is a fundamentally different way of managing resources and infrastructure compared to what adaptation practitioners have been doing."

Climate change adaptation is a process rather than a single event. Uncertainty, vulnerability and risk should be regularly re-evaluated. Assessments are not carved in stone and will need to be revised. A decision-making process that is transparent, holistic and participatory will more likely lead to accurate assessment and sustainable solutions.

> "The expectation that you can make decisions that will remain useful and relevant for 100, 50, or even 10 years is probably wrong. You need to make vulnerability assessment an integral component to your work. That might mean, for instance, that you build a smaller water treatment facility or one that is capable of operating over a wider range of conditions or that can be expanded over time."
>
> – John Matthews, Director of Freshwater Climate Change, Conservation International

In addition, the high levels of uncertainty inherent in climate change adaptation means that building in flexibility is the best possible response until uncertainty has been reduced. For instance, if water resources appear to be declining relative to demand, reducing demand through increased efficiency may be a more flexible route than constructing a new dam.[18] For more on improving the climate resilience of decision-making process, see recommendations in Chapter 4.

Women demonstrate an improved cooking stove in a Darfur refugee camp. Photo: Potential Energy

KEY RECOMMENDATIONS FOR CIVIL SOCIETY GROUPS

Conduct a Community-level Needs Assessment

Setting the context and understanding the key needs of communities – especially the poorest and most vulnerable members – is critical before assessing particular risks and possible solutions. Some of the key activities during this step include:

- Describing the community's livelihood activities, key actors, gender and diversity aspects, and the ecological context.

- Identifying and mapping out the resources that are important to local livelihoods and who has access and control over them.
- Using a needs assessment to identify the social groups that tend to be more marginalized or lack access and control over key resources, and therefore who could be more vulnerable to climate risks.
- Documenting every step of the assessment process.

Detailed field guides on conducting both a needs assessment and capacity assessments can be found here: www.timmagee.net/field-guide-to-cba.

Help Build Capacity

A key role that civil society groups can play is providing community members with information that improves their understanding of climate impacts and strengthens their understanding of and ability to document local climate change impacts. This will allow them to more easily identify the climate risks that affect them.[19] Information can range from the more technical (for example, training people in citizen science practices so they can document how changing climate patterns are affecting them locally), to the basic (for example, providing affected communities with a greater understanding of what general climate change impacts are projected for their region). If people living in river basins can deepen their understanding of climate change impacts and vulnerabilities, they can better position themselves to provide strong and persuasive input in decision-making processes surrounding development projects.

In 2011, villagers mapped fishing grounds, riverbank farmland, river morphology and sub-ecosystems for the Mekong River. Photo: TERRA

Civil society groups can develop local resources to enhance community understanding of the ways that climate change will impact ecosystems and livelihoods. These activities should include:

- Conducting research using academic journals and other reliable sources to define the local climate change problem.
- Meeting with local experts who have experience in the areas of climate change or in adaptation in your region. This person could be someone from a government weather office or a climate specialist at an NGO or local university.
- Document changes you are already seeing through maps and photos.

HOW IS ADAPTATION DIFFERENT FROM COPING?

The terms "adaptation" and "coping" are somtimes used interchangeably, leading to confusion about the similarities and differences between these two important concepts. The following lists of characteristics are a compilation of brainstorming sessions by groups of development practitioners in Ghana, Niger and Nepal.

COPING	ADAPTATION
Short-term and immediate	Oriented towards longer term livelihoods security
Oriented towards survival	A continuous process
Not continuous	Results are sustained
Motivated by crisis, reactive	Uses resources efficiently and sustainably
Often degrades resource base	Involves planning
Prompted by a lack of alternatives	Combines old and new strategies and knowledge
	Focused on finding alternatives

Figure 4: Coping with climate change vs. adapting to it. Source: "Climate Vulnerability and Capacity Analysis Handbook" © 2009 by CARE International. Used with permission.

Empower Women in the Community

Women in developing countries face disproportionately high risks to their livelihoods and health from climate change. Adaptation projects that address their needs, such as rainwater harvesting structures and clean stoves, can begin to improve women's livelihoods and their ability to support their families.[20] Further efforts to develop and sustain education and income generation opportunities for women can increase community resilience to future climate risks. Engaging and empowering women from the early assessment stage all the way through the adaptation project development phase is critical. Civil society groups should encourage women to actively participate in local development schemes, decision-making, and entrepreneurship, particularly through women's mentoring groups. As noted by UNEP Executive Director Achim Steiner, "Women often play a stronger role than men in the management of ecosystem services and food security. Hence, sustainable adaptation must focus on gender and the role of women if it is to become successful."

Women have long taken action to protect rivers. These women were speaking out against the Sardar Sarovar Dam in India. Photo: Karen Robinson

Identify the Risks and Vulnerabilities

Once a local community and supporting NGOs have gathered both local knowledge and scientific information on climate change impacts, combine them to develop a picture of the climate risks and vulnerabilities of the local community. One approach to this is conducting a vulnerability and risk assessment, which is the process of evaluating the risks associated with a particular hazard on a certain group of people, and their level of vulnerability. As part of the process, it is important to also identify the gaps in information and provide support to community members to document immediate climate change impacts in order to fill in these gaps (see "Climate Modeling for Adaptation and Freshwater Management" on page 27 for how to deal with uncertainty). In particular, if the riverine community is already being negatively impacted by water and energy infrastructure projects such as large dams, support them in documenting the impacts of dam operation on their livelihoods and in identifying projects that can meet their needs in a resilient way. See *Appendix 1: Key Resources* for adaptation NGOs with experience in this area that you can contact.

Risk-based approaches typically involve (1) defining objectives and identifying the components of interest/ concern, (2) establishing the impact and likelihood of events that could compromise those objectives, (3) identifying the options that reduce the risk of the identified events, and (4) assessing adaptation options to determine suitability and timing of intervention.[21] Identification of where ecosystems are likely to be most sensitive to changes in climate should be an integral part of a vulnerability and risk assessment. Some examples of how to do this are:

- Mark on a calendar when key seasonal events (wet and dry season), hazards (flooding, diseases), and special events (such as planting and harvesting) occur;
- Assess if the region falls in a high-risk zone (for example, from glacial melting, upstream GLOF risk, landslide and flash flood risks);
- Make this information available to all community members; and
- Begin designing specific strategies to address specific climate-related problems revealed by the vulnerability assessment (for more, see Chapter 4).

Maps are a very useful tool for sharing and documenting all kinds of information that can be used for creating needs assessments, showing patterns of climate change on a local community, mapping key resources and their role in livelihoods, and much more. A guide on making community maps for advocacy work can be found here: www.internationalrivers.org/node/4000

Combine Top-down with Bottom-up Approaches

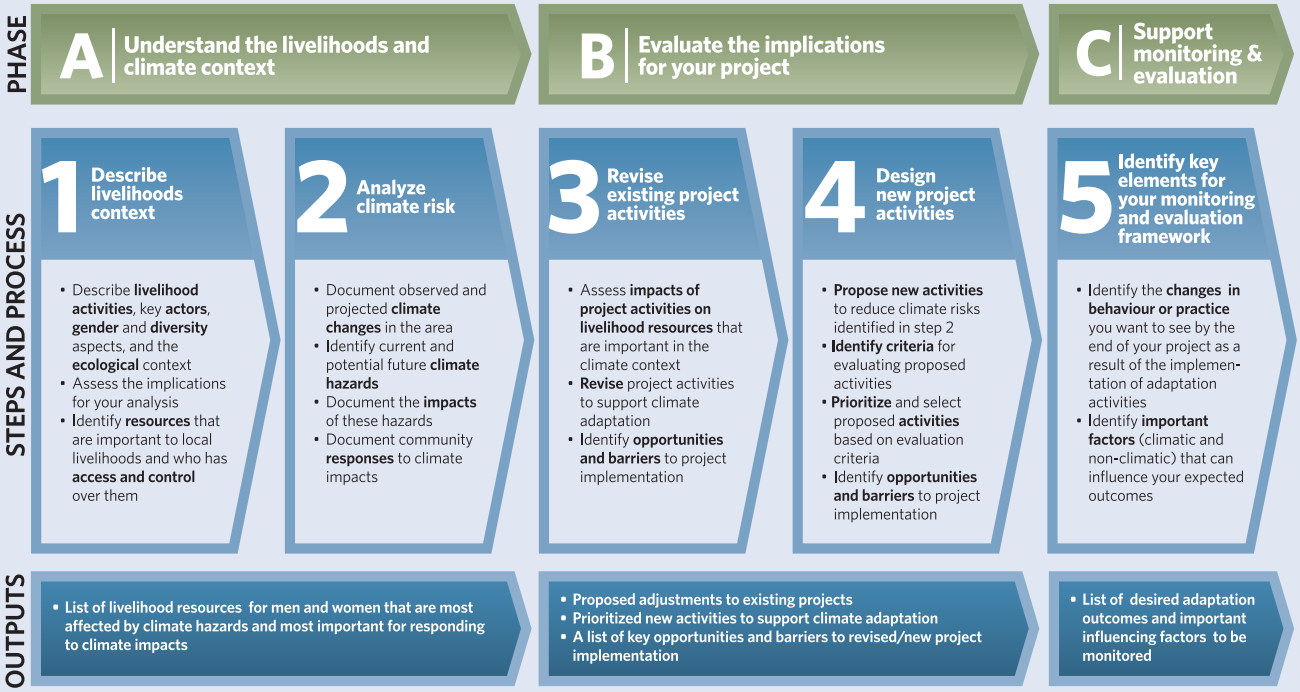
Top-down approaches to risk assessment attempt to characterize the broad likelihood of harmful impacts through the generation of models that analyze future climatic change on a large area (say, at the scale of a country or entire watershed). Bottom-up approaches involve investigating the exposure, sensitivity, and adaptive capacity of a particular system or community. Both can be useful – especially when their findings are used to inform each other. Civil society groups can partner with academic institutions or government agencies that have access to climate modeling tools. However, there are certain limitations to top-down approaches that make them a lower priority when resources are limited (see "Climate Modeling for Adaptation and Freshwater Management" on page 27).

Tools for Climate Adaptation and Risk Management in the Water Sector

While tools are not in themselves the solution, they can support the decision-making process if they are used to answer specific and well-formulated questions. A number of tools exist for conducting community-level assessments and developing adaptation projects. Below are some key things to keep in mind, as recommended by Julian Doczi, Research Officer at the Overseas Development Institute's Water Policy Programme:

- Think carefully about your specific needs. In the 'tool industry,' each developer wants to 'sell' you their tool, like any other product.
- Do your research, and don't rush to select the first tool you discover – it might not be best suited for your needs and could even increase your risk of maladaptation.
- When choosing, consider:
  - Relevance for your context, language, audience, etc.
  - What type of tool(s) do you need?
  - Complexity (will you need training?)
  - Price?
  - User support available? (Is it kept updated?)
  - Do you need a tool at all?
- No tool is perfect – you might need to use several.

Below is one example of a tool that focuses on community-based risk screening, the CRiSTAL Framework. CRiSTAL is a community-based risk screening tool that focuses on adaptation and livelihoods. Learn more: www.iisd.org/cristaltool.



ASSESSING THE CLIMATE RISKS OF PLANNED AND EXISTING PROJECTS

For communities facing planned or existing large water and energy projects, asking the right questions of development planners and government decision-makers can help guide them in evaluating the potential climate risks and the possible impact a project will have on a community's climate resilience. Asking these questions can also prompt decision-makers to develop a climate risk assessment, and potentially reconsider or revise project plans. These questions should be raised when evaluating a river basin plan, Strategic Environmental Assessment (SEA), feasibility study, or a Social and Environmental

Climate Modeling for Adaptation and Freshwater Management

The same methodologies that created mismatched infrastructure and institutions in the developed world are now being used in the developing world for a second "golden age" of rapid water infrastructure expansion. Poor investments made now in Africa, Asia, and South America are likely to plague if not undermine economies and ecosystems and lay the seeds for conflict, inequity, and environmental degradation for future generations. These issues are urgent and important. Decisions about long-term water management are made every day in every nation, and many of these decisions are not resilient.

Effective expertise has been coalescing in many fields in the past decade. We need a synthesis of best-practice water resources management that can inform resilient and strategic decisions and actions, while also functioning in a reliable manner in the developing world, where data and governance limitations often present barriers. Below are some highlights of recent strategies, and their strengths and limitations for water resource management:

Decision Scaling

General Circulation Models (GCMs), or global climate models, have emerged as a widespread tool for projecting future climate and water resource states. However, these models were not designed for adaptation purposes and their quantitative nature can often hide important uncertainties. Thus, they should only be partially used to inform decisions on climate adaptation. Instead, "decision scaling" approaches are bottom-up approaches that take important local characteristics and capacities into account before adaptation solutions are tested against climate projections. Ideally both top-down approaches that include scaling down climate models to the local level and bottom-up approaches should be used together to guide decision-making.

What Do Climate Models Show?

Climate models can with some accuracy simulate changes in observed air temperature, ocean heat content and some regular events like El Niño. They cannot simulate changes in the water cycle such as precipitation, shifts in extreme events (such as frequency or severity of droughts and floods or tropical cyclones), form of precipitation (rain vs. snow), and evapotranspiration. When applied with other models such as runoff or flow models, uncertainties can increase. Due to these limitations, climate models are better at setting the context rather than informing decisions. They are also useful when used together with other types of data, such as historic records and paleoclimate data. This would mean planning for multiple futures and focusing on having a good process of decision-making, rather than trying to make accurate predictions through different climate and hydrological models.

Understanding Modes of Change

There are broadly three major types of climate change impacts on a system that can be expected. While these changes can be difficult to predict, identifying them as best as possible is important, since they will have severe impacts on natural and human systems.[22] In *linear* change, variables such as air temperature, mean precipitation, or even mean monthly extreme precipitation may shift in a relatively even way in some regions. However, changes in freshwater systems are more likely to exhibit a different kind of change, that of the *degree and frequency* of extreme events and in seasonality. Finally, *state-level* change is the shift of climate from a period of relative stability to a period of rapid shifts (passing a climate tipping point or "threshold"), followed by another period of relative stability but in a new state. An example of this last change is the rapid disappearance of glaciers in Glacier National Park in the US, where glaciers have given way to snowpack, then tundra, then grasslands and forest.

What Are New Approaches to Deal with Uncertainty?

Consideration of future impacts of climate change cannot be based simply on taking global climate models and scaling them down to the local level ("downscaling"); instead it requires an assessment of ecosystem sensitivities and a variety of possible futures. Conducting a vulnerability assessment adopts a broader and more cross-sectoral view, without reliance on the accuracy of these models. For practitioners with limited financial and technical resources, a bottom-up approach to adaptation is to use the "tipping point" concept, which attempts to determine how much a system or community can cope with climate change before impacts become unacceptable. This can include mapping out unwanted, high-risk scenarios, so that actions can be taken now to avoid as much as possible the costly consequences of climate change. Such actions could include implementing measures to deal with identified risks, preparing a response plan to potential future risks, and developing "signposts" in a monitoring plan that can identify emerging changes.

For more information, visit: www.alliance4water.org

Adapted from "Caveat Adaptor: The Best Use of Climate Model Simulations for Climate Adaptation and Freshwater Management," White Paper 1, Alliance for Global Water Adaptation (AGWA), 2013, Washington, DC.

Impact Assessment (SEIA). Below are some key questions that civil society can ask regarding these projects. A full list of questions can be found in Appendix 3.

Social Impacts

Water resource availability:

- How will the project affect the community's access to clean water? What will be the impact on existing sources, including groundwater? Will new sources be provided if existing sources will be compromised?
- Does the project take a "catchment approach" and analyze cumulative impacts of all dams in the basin?
- Are there flood safety measures or drought risk management plans in place?
- Do relocation sites have sufficient access to natural resources?
- Are there adaptive management plans for high and low precipitation scenarios?

Livelihoods:

- How are livelihoods or loss of livelihoods considered in the development of the project, and is the analysis comprehensive – are direct and indirect impacts considered? (These might include impacts caused by large migratory work force, changes to fisheries and forests, a change in access to the river or to neighboring communities, etc.)
- Have the main effects of climate change on the community been assessed and addressed in the project's social impact assessment?

Health:

- Has a health impact study been done? Have local public health agencies been involved? Have the health impacts of a large migratory construction crew (such as sexually transmitted diseases) on the local population been addressed?
- What health services will be provided to deal with any health impacts from the project? How are these services being paid for?
- What types of strategies are being proposed or implement to avoid or mitigate waterborne diseases?

Governance:

- Have strong local paths of engagement been incorporated in government-led assessments and mitigation processes?
- Is there a disaster risk management plan and preventive measures in place to deal with droughts and floods?
- Is there an adaptation plan in place to help mitigate the negative impacts of dams on communities under different scenarios?
- Are accountability mechanisms in place? Is there a means of enforcement to hold developers accountable for meeting projected water and energy needs? Are there accountability mechanisms for developer-led damage to key environmental services?

Environmental Impacts

Soil erosion in watersheds and coastal deltas:

- Does the river basin experience high precipitation and is precipitation expected to increase? Higher precipitation will mean greater erosion. What is the current extent of erosion in the watershed?
- How will sedimentation be managed at the proposed or existing dams?
- What rehabilitation or watershed management projects (such as afforestation or improved farming practices) have been proposed in the watershed? What are their costs and have they been accounted for in project assessments?
- Have the impacts of the loss of sediment transport on downstream ecosystems and floodplain agriculture been analyzed and addressed?

River flows:

- How will climate change affect a river's natural flow? Will it increase or decrease magnitude, duration, timing, and frequency? How have precipitation and flow changes expected from climate change been addressed?

Community researchers were involved in a long citizen science project to in Thailand to assess Pak Mun Dam's impacts. Photo: Living River Siam

- How will the project change the river's natural flow and how will this alter or disrupt surrounding river vegetation, floodplain agriculture, and fisheries?
- What will be the economic impact of these losses as a result of altered flows? Are these costs fully accounted for in the cost-benefit analysis for new river infrastructure?
- What is the plan for calculating and incorporating environmental flows into the design and operation of a project? Are there plans to bring environmental flows into the operation of existing projects?
- What role will local communities be allowed to play in the maintenance and refinement of the environmental flows plan? Are there transparent mechanisms for monitoring that the public can use?
- How will the environmental flows plan be enforced?

Deforestation:

- Does the project account for the greenhouse gas emissions from deforestation?
- In the case of a project constructed as a low-carbon energy option, will deforestation turn the project into a net carbon emitter? Does this disqualify the project from receiving clean energy or mitigation funding?
- What impacts will climate change and deforestation have on local livelihoods and resource availability? What measures are in place to address these impacts?

Greenhouse gas emissions:

- Are emissions being accounted for in the full life cycle of the project, including construction, deforestation, and materials used?
- For dams, are all possible sources of emissions accounted for as part of the GHG measurements?

Economic and Safety Impacts

Economic feasibility:

- Does the project have a disaster risk management plan and is it funded? Which government agency will be responsible for it?

Dam reservoirs, especially in the tropics, are a significant source of global greenhouse gas pollution. Photo: Frédéric Guérin

- Are the costs of climate-change impacts on project operation (such as water shortages during times of drought) incorporated into overall project costs?
- Have the costs of dam decommissioning been incorporated into project cost assessments?
- Before new projects are planned, have existing projects been assessed for reoperation or rehabilitation?

Electrical output:

- Does the project's economic analysis take into account climate change scenarios?
- What alternative back-up energy systems exist in-country if an energy project is not generating power?

Structural integrity and dam safety:

- Are different climate change scenarios considered in project safety assessments and the design of the dam?
- Are there national and community-level evacuation plans and emergency notification systems in place in case of a dam failure due to floods?