# Monitoring & Evaluation in Climate Change Adaptation Projects: Highlights for Conservation Practitioners

Monitoring on-the-ground implementation projects in the face of climate change shares much in common with monitoring and evaluation best practices that have been advocated for in conservation in recent years. However, climate change presents some additional challenges that warrant consideration. Here we provide a brief summary of current thinking on the monitoring and evaluation of climate adaptation projects, and point readers towards additional resources.

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Within conservation projects, monitoring is the collection of repeated observations or measurements, typically linked to determining whether an action, or series of actions, achieves an intended conservation outcome. Evaluation is a key part of the monitoring equation: using the monitoring data to compare the anticipated responses of the system to particular conservation actions, to those responses that are actually observed. The "best practices" for monitoring and evaluation (M&E) of conservation projects, as developed by non-governmental organizations (e.g., Conservation Measures Partnership) and agencies (e.g., National Park Service Inventory and Monitoring Program), provide standards that are equally applicable for climate adaptation projects (Box 1).

**Box 1.The inputs, steps, and outputs for developing a monitoring program**


While overall M&E standards continue to apply, the dynamic nature of climate change requires that conservation practitioners design their M&E programs in a way that explicitly considers the trajectory of climate change and system responses. A few "curveballs" that climate change throws into recommended M&E practices include:

- Continuous and often directional change overlain by natural variability, resulting in;
- Shifting baseline conditions against which effectiveness is measured, complicated by;
- Long time frames over which some climate change effects will be felt, and over which we will be able to see whether our actions are contributing to conservation outcomes in the face of those changes.

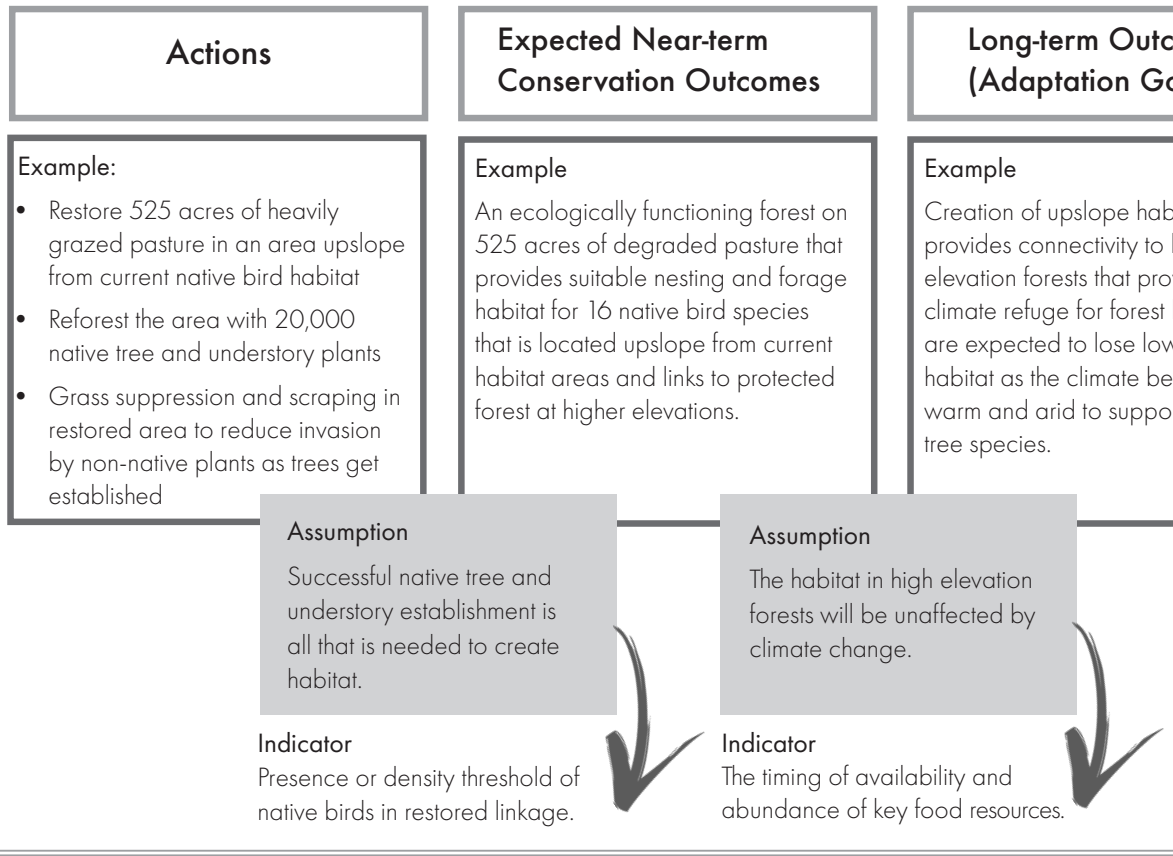
We discuss several implications of these challenges for designing an M&E program related to characterizing intended outcomes, measuring project effectiveness, and assessing the success of adaptation projects. We conclude with a few suggestions on making monitoring happen, and point readers towards additional resources on M&E for adaptation projects.

## Characterizing Intended Conservation Outcomes

While some climate change effects are already being observed (e.g., more frequent and severe extreme events such as floods, droughts and coastal storm surges), climate change is likely to result in increasingly dramatic shifts in conditions in the future. Because adaptation projects can be designed to address current and/or projected changes, it is especially important to try to anticipate the links between more immediate results of actions and how these will influence conditions into the future. This includes considering different sources of uncertainty and assumptions linked to practitioners' mental models about how the climate and ecological context will shift in the near- and long-term, and how conservation actions will lead to desired results under those changing conditions.

One way to address these issues is to consider the expected sequence of near-term outcomes that feed into longer-term adaptation goals. Determining what near-term outcomes (e.g., in the next 3-10 years) are necessary to ensure that long-term adaptation goals (e.g., in the next 10-50 years) can be met allows for tracking progress at different points in time. The use of "logic models" (Box 2) and similar tools are recommended for climate adaptation project planning to capture assumed relationships between actions and outcomes at multiple time-scales (Pringle 2011). These logic models can then be used to target monitoring and evaluation efforts, by suggesting key uncertainties and assumptions that can form the basis for monitoring indicators that can be used to test those assumptions.

**Box 2 . Near-term and long-term outcomes, and the assumptions that underlie your ability to achieve them (i.e., a "logic model"), can point to relevant indicators for monitoring**



## Measuring Effectiveness

Determining whether outcomes are achieved and how well they meet conservation goals and objectives is the crux of evaluating project effectiveness and a key reason for engaging in monitoring. Effectiveness monitoring differs from monitoring changes in climate and its ecological effects, although both may be of interest to conservation practitioners. Effectiveness monitoring indicators are typically tied to project outcomes--what the implemented actions are trying to achieve, and what indicators will let us know that we have been successful (Box 3). Logic-models (Box 2) can also help practitioners allocate M&E resources to different indicators through time. For example, it may be important to track particular indicators related to near-term outcomes at the start of the project; over time, as those near-term outcomes are met, M&E resources can shift to tracking different indicators linked to longer-term outcomes. For the hypothetical adaptation project described in Box 2, it may not be necessary to monitor the successful use of high elevation habitat by bird species at the outset of the project, but rather to focus initially on determining the success of forest restoration in the linkage zone, as a prerequisite for the long-term outcome.

### Box 3. Monitoring indicators, metrics, and evaluation criteria

An indicator is a measurable entity related to a specific information need (e.g., conifer seedling density). The metric describes what about the indicator you are measuring (e.g., seedling density/ha). Related to the metric is the threshold or evaluation criteria (e.g., 1500 seedlings per ha) for determining success. Characteristically strong indicators:

- Accurately reflect underlying processes
- Are sensitive to change
- Are cost-effective to measure
- Have clear relevance to decision making

Selecting indicators linked to near- and long-term outcomes is not a new practice, and the types of indicators and metrics traditionally used in conservation may very well continue to suffice, even if project goals and objectives shift to address the effects of climate change. What may need to be considered are new indicators aimed at understanding how climate-driven changes in the baseline conditions recorded prior to implementation are potentially affecting project outcomes (Box 4). While documenting a baseline is standard practice within conservation, in the context of climate change it is important to select indicators that can capture trajectories of change in those baseline conditions and address assumptions underlying the connections between outcomes at different temporal scales (Box 2). In the example included in Box 2, it is assumed that warming and drought will not impact the habitat in the higher elevation forests in the future, which may or may not be the case. At some point it may be of interest to add an indicator, perhaps related to fores health or tree growth, to understand whether climate change is affecting the high elevation forests. This goes beyond effectiveness monitoring strictly aimed at determining whether or not actions are achieving goals and objectives, but can provide understanding of underlying mechanisms if food resources for bird species are not sufficient and help assess whether long-term goals are ultimately viable.

## Box 4. Considering shifting baseline conditions

There is potential for climate change to lead to a shift in baseline conditions, which may need to be taken into account when judging the success of adaptation projects and determining whether and how actions may need to be adjusted, or overall goals revised. In the mountains of West Virginia, The Nature Conservancy is restoring corridors of red spruce forest between mature forest blocks within and around the Monongahela National Forest through planting red spruce and removing hardwoods from the overstory (to accelerate the dominance of red spruce). The goals of these activities are to enhance connectivity in an area that is expected to be important for plant and wildlife movements in response to climate changes. Baseline climate conditions in the project area (e.g., current temperature and precipitation) represent suitable growing conditions for red spruce at these high elevation sites. Near-term climate projections suggest that conditions should remain suitable for red spruce for some period of time; however, there is uncertainty about how long those favorable climate conditions will persist. The project team is considering this potential shift in baseline climate conditions by monitoring climate and red spruce regeneration success to gauge if and when the local climate moves outside of the range suitable for red spruce. With this information, they can periodically revisit their conservation strategies to determine if a primary focus on red spruce continues to be the best approach, and if their long-term goals remain viable.

## Assessing "Adaptation Success"

Trying to assess if and when a project has achieved "adaptation success" can be difficult, in part due to the longer timeframes and shifting baselines described above, but also because we are not always clear what adaptation success looks like. Defining what we mean by adaptation success includes clarifying whether it is characterized by particular conservation outcomes or is more about building capacity to include climate change in conservation decision-making. It also requires establishing the benchmarks against which you are measuring success, which are usually based on what is sufficient and reasonable given the project and audience for whom the assessment is being conducted. Most commonly, success is determined by comparing changes following implementation to baseline conditions recorded at sites prior to taking action (Box 4). This is a correlation-based approach to evaluating project success, essentially showing that taking actions corresponds with sought after outcomes.

Determining the success of adaptation through attribution—i.e., assessing how taking particular actions resulted in desired outcomes—may be desired to justify investments in new and altered strategies, but is often a greater challenge. Complex interactions within biophysical systems, especially those significantly affected by human activities and behaviors, can make it difficult to determine clear cause-and-effect relationships between actions and outcomes. It can also be difficult or even impossible to find comparable controls, where the selected adaptation actions were not taken in otherwise similar systems. Attribution is always difficult, but arguably more so with climate change adaptation due to the many direct and indirect influences on the system, which may or may not be known. Given the long time frame for outcomes and dynamic nature of climate change, adaptation success in the near-term may be best assessed in terms of the process of identifying and implementing actions, rather than being able to determine tangible outcomes related to reducing vulnerabilities or enhancing the adaptive capacity of ecological systems. Therefore, it may be important to identify indicators linked to the adaptation process (i.e., iterative planning, implementation, and monitoring) and how it supports learning and an increased capacity for agencies and organizations to show flexibility in their management as conditions change. In that way there can be both on-the-ground and process outcomes important to a project's success (Box 5). For this reason, the Wildlife Conservation Society's (WCS) Climate Adaptation Fund supports not only the implementation of site-based conservation actions, but also activities aimed at scaling up the implementation of similar projects across a larger landscape, relying on indicators that demonstrate how well a project is catalyzing broader adoption of those practices.

## Box 5. Measuring outcomes related to building capacity to implement adaptation actions

The Wildlife Conservation Society worked with multiple agencies, non-governmental organizations and landowners to demonstrate adaptation actions aimed at maximizing surface and groundwater storage in the face of climate change-induced drying in southwest Montana. Those activities include the installation of low-tech and cost-effective structures made from willow branches and other riparian vegetation that are designed to replicate the positive effects of beaver on stream functions by slowing stream flows, raising water tables, increasing the recharge of shallow aquifers, and increasing the width and condition of riparian habitat. To communicate the value and effectiveness of these beaver mimicry structures and broaden the adoption of this adaptation strategy, WCS conducted participatory, field-based workshops and trainings involving agencies, conservation groups, restoration consultants and landowners who have expressed interest in implementing similar practices on their public and private lands. WCS also convened a working group to coordinate efforts to translate the beaver mimicry work to larger audiences. Collaborative monitoring efforts for this project not only focus on the hydrological and ecological effects of the beaver mimicry structures (e.g., changes in the near-stream water table, changes in riparian bird populations), but also on tracking the effects of outreach efforts, including the number of people that attend workshops and trainings, and that express interest in implementing similar actions on their properties.

# Making Monitoring Happen

While conducting monitoring and evaluation is widely acknowledged as an important part of climate change adaptation to allow for flexibility and responsiveness (Stein et al. 2014, Swanston and Janowiak 2012, Cross et al. 2012), resources to cover the effort are often limited. The degree to which a consideration of climate change influences your M&E program design ultimately depends on the nature of the audience for your M&E outputs and the intended users of the information collected (e.g., other managers, supervisors, funders). Considering these audiences at the start of an M&E effort are therefore critical considerations for efficiently allocating resources.

Given the constraints, there are ways to fulfill some information needs for monitoring and evaluation using existing data collection efforts, and to be well positioned to take advantage of monitoring funding opportunities that come along. You can begin by finding out what kind of monitoring may already be going on in your landscape. While some might be focused on the effectiveness of particular projects, the majority will more likely be examining in the effects of changing climate conditions. However some of this information may be applicable to assessing project effectiveness, too. It is a good idea to look beyond the boundaries of the project area, in part because conditions across the broader landscape provide a backdrop for climate change and its effects on your conservation work. For example, if your conservation focus is a cold-water fish species, understanding how climate change will affect that species across its range may help you decide where it is most appropriate to direct your activities, or provide rationale for re-prioritizing conservation investments in your management unit if the fish species is more likely to persist in another part of the landscape over the long term.

It is also important to look outside your unit boundaries because you may be able to benefit from monitoring networks that already exist in your region. The Southeast Global Change Monitoring Portal (https://my.usgs.gov/gcmp/) and other web-based resources offer catalogs of observational networks associated with aquatic and terrestrial ecosystems for this and other regions of the US. Even if you don't have the resources in hand to implement a monitoring program, laying out a monitoring plan can be important to establish baseline conditions and document for others what you have identified as important in thinking through near and long-term outcomes, and what information would be needed to establish their achievement or course-correct in the future.

Climate change stands to exacerbate existing challenges and introduce new hurdles for designing monitoring and evaluation efforts focused on measuring conservation project effectiveness. Our efforts to highlight a few of those concerns are drawn from numerous resources, which can be consulted for additional information and ideas:


Bours, D., McGinn, C. and Pringle, P. 2014. Twelve reasons why climate adaptation M&E is challenging. SEA Change CoP, Phnom Penh and UKCIP, Oxford.

Bours, D., McGinn, C. and Pringle, P. 2013. Monitoring & evaluation for climate change adaptation: A synthesis of tools, frameworks and approaches. SEA Change CoP, Phnom Penh and UKCIP, Oxford.

Cross, M.S., et al. 2012. The Adaptation for Conservation Targets (ACT) framework: A tool for incorporating climate change into natural resource management. Environmental Management 50: 341-351.

Grafakos, S. and V. Olivotto. 2013. Towards an Integrated Evaluation Framework of Climate Change Adaptation Projects. Presentation at the European Climate Change Adaptation Conference, March 18-20. UNCFD.

Gross, J. and E.L. Rowland. 2014. Tracking Action Effectiveness and Ecological Response. Chapter 11 In, Climate-Smart Conservation: Putting Adaptation Principles into Practice, Stein, B.A., Glick, P., Edelson, N., Staudt, A., National Wildlife Federation, Washington, D.C.

Olivier, J., T. Leiter, and J. Linke. 2012. Adaptation made to measure: A guidebook to the design and results-based monitoring of climate change adaptation projects. Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, Eschborn, Germany

Pringle, P. 2011. AdaptME: Adaptation monitoring and evaluation. UKCIP, Oxford, UK.

Spearman, M. and H. McGray. 2011. Making Adaptation Count: Concepts and Options for Monitoring and Evaluation of Climate Change Adaptation. Deutsche Gesellschaft fur Internationale Zusammenarbeit (GIZ) GmbH, Eschborn, Germany. UNFCCC Secretariat.

Stein, B.A., P. Glick, N. Edelson, and A. Staudt (eds.) 2014. Climate-Smart Conservation: Putting Adaptation Principles into Practice. National Wildlife Federation, Washington, D.C.

Swanston, C. and M. Janowiak, eds. 2012. Forest adaptation resources: Climate change tools and approaches for land managers. GTR NRS 87, 121 pp.

UN-HABITAT, 2012. Planning for Climate Change: A strategic, values-based approach for urban planners. Eco-Plan International, Inc. 202 pp.

Villaneuva, P.S. 2011. Learning to APAPT: Monitoring and evaluation approaches.


**The WCS Climate Adaptation Fund** supports on-the-ground conservation projects taking science-based actions to assist species and their habitats adapt to climate change

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