Rapid assessment to facilitate climate-informed conservation and nature-based solutions

Lauren E. Oakes1,2 | Molly S. Cross1 | Erika S. Zavaleta3

1Wildlife Conservation Society, Bronx, New York
2Department of Earth System Science, Stanford University, Stanford, California
3Department of Ecology and Evolutionary Biology, University of California-Santa Cruz, Santa Cruz, California

Abstract
The need to ensure that rising investment in nature-based climate solutions delivers expected outcomes hinges on incorporating current and future climate into design and implementation. Technical guidelines and formal planning processes serve a purpose in ensuring the quality of climate-informed strategies for local projects. The inherent complexity, cost, and time required to use these tools, however, can make them inaccessible or daunting. Taking lessons learned from a decade of funding over 100 adaptation initiatives in conservation—some of which also provide mitigation benefits—we describe a simple rapid assessment framework for use by practitioners and funders. This framework, which we refer to as the 5Ws (what, when, where, why, and who) of climate-informed action, serves as a guide to make projects more robust to future climate.

KEYWORDS
adaptation, assessment, climate change, conservation, nature-based solutions, planning, resilience

1 | INTRODUCTION

Nature has a critical role to play in protecting people and communities from the impacts of climate change, but climate change is already affecting nature and its ability to provide many services (Global Commission on Adaptation, 2019; Stein, 2020). Climate change also poses risks to conservation efforts, if practitioners assume a future climate similar to the past or present. For example, conservation easements in low-lying coastal areas could become inundated by rising seas, effectively drowning investments designed to protect habitat and buffer human communities from storm surges. More frequent and intense disturbances, such as wildfire and drought-induced tree mortality, threaten projects designed to enhance habitat for forest-dependent species and sequester carbon. Yet policies and economic incentives targeted at protecting and enhancing terrestrial carbon sinks do not always account for climate-related risks and other limits to forest stability (Anderegg et al., 2020). Overlooking climate-related risks could result in maladaptation, carbon-sink reversal, and failed investments.

Nature-based solutions (NbS) to climate change—such as forest protection, reforestation, and conservation agriculture (Griscom et al., 2017)—are rapidly gaining in popularity as actions that could address the twin crises of climate change and biodiversity loss (Seddon et al., 2020) and support a wide-range of sustainable development goals (Gómez Martín et al., 2020), including human health and well-being (Kabisch, van den Bosch, & Laforteza, 2017; Keeler et al., 2019). Much of the recent limelight has been on tree planting for carbon sequestration, but NbS
involve a diversity of ecosystems and incorporate a breadth of conservation strategies. To provide sustainable benefits to society, they should be implemented with the engagement and consent of Indigenous Peoples and local communities, and designed to protect biodiversity (Seddon et al., 2021). Such action, however, can also require a shift in conservation practices that have traditionally focused on preserving or maintaining historical ecological conditions (Stein & Shaw, 2013) toward more forward-looking approaches (Hagerman, Dowlatabadi, Satterfield, & McDaniels, 2010).

We offer a simple framework that enables users to rapidly assess how—and by what means—climate change will require innovation beyond business-as-usual conservation practice. As such, it can help practitioners and funders without specific expertise in adaptation understand what adaptation means in a given context, and how to do it—in particular, what should be done differently from the status quo? This framework, which we refer to as the 5Ws (what, when, where, why, and who) of climate-informed action, serves as a rapid assessment tool to make projects more robust to future climate.

2 | ORIENTING TO THE FUTURE

As practitioners increasingly consider current and future climate conditions, an orientation to the future may replace past ecosystem structure and function as criteria for success (Carroll & Noss, 2020). Such “renovation” in conservation practice, which actively allows for change, includes actions such as managing shifting fire regimes, ameliorating sea levels through living shorelines that can migrate inland, assisting dispersion of species, or selecting drought-tolerant species to avoid losses of desired ecological functions (Prober, Doerr, Broadhurst, Williams, & Dickson, 2019). Endeavoring to repair or improve upon the current state given site-specific consideration of future conditions may offer the best opportunities for building resilience to climate change when traditional approaches are likely to fail. For example, the tree-planting cycle—from seed sourcing and collection to cultivation and planting—often takes years. To deliver the benefits expected in the coming decades, decisions on what to plant, where to plant, and when to plant need to be climate-informed at the onset to increase chances for longer-term survival and to maintain healthy ecosystems.

Climate-informed conservation differs from business-as-usual conservation by considering climate science when setting goals and choosing actions. Climate-informed approaches help users design goals and actions based on the best available science and reassess decisions as knowledge and understanding of climate change advance. Taking climate change impacts into account may reinforce the appropriateness of current goals and actions in some situations, or within a certain time frame. In many situations, however, a climate-informed planning process can reveal that conservation approaches need to shift in targeted ways to reach the desired outcomes as climate changes into the future (Cross et al., 2018).

3 | A TRACTABLE RAPID-ASSESSMENT FRAMEWORK

Growing acceptance of the importance of designing initiatives that explicitly consider a changing climate has led to a proliferation of tools and resources to support climate-informed conservation planning. Tools used in the U.S. conservation community include, for example, the Northern Institute of Applied Climate Science (NIACS) Adaptation Workbook (Swanston et al., 2016), the Climate-Smart Conservation Cycle (Stein et al., 2014), and the Adaptation for Conservation Targets framework (Cross et al., 2012). These tools, along with other approaches such as scenario-based planning (Rowland, Cross, & Hartmann, 2014; Runyon et al., 2020) and the design of ecosystem-based adaptation initiatives (Donatti et al., 2019), require extensive resources, scientific information and expertise, and time to assess climate risks and vulnerabilities at a local scale. These planning approaches generally rely on a cycle of steps to define purpose and scope, assess climate impacts and vulnerabilities, review/revise goals, identify and evaluate possible actions, implement priority actions, assess effectiveness, and then iterate to incorporate emerging information. Such technical guidelines and formal planning processes serve an important purpose in ensuring the quality of climate-informed conservation. However, their inherent complexity, cost, and time required can make them inaccessible or daunting, especially to small or local conservation organizations and agencies.

Using the “what, when, where, why, and who”—or the “5Ws”—of climate-informed action, our tractable framework emphasizes modifying conservation approaches to make NbS more effective. Modifying “the what” means introducing new actions or modifying existing actions to make them more effective in light of climate variability and projected changes. Considering “where” in a climate-informed approach can lead to strategically targeting places where longer-term maintenance of species, populations, ecosystem services, or other values is more likely. The need for action may become more urgent, or actions may be necessary at different times of the year—thus leading to a shift in the “when.” As climate change affects a place or ecosystem, the shifting conditions may warrant modifying goals
(the “why”) to address new threats or priorities. Our framework also considers “who” across multiple dimensions: by whom, with whom, who benefits and who might bear potential harm or tradeoffs from the actions taken.

This process of considering the 5Ws in NbS emerged from our collective experience in adaptation planning with conservation practitioners around the world and in funding adaptation initiatives led by NGOs across the United States. In reviewing 983 proposals for adaptation funding over a decade, we and a panel of adaptation experts determined the key question for conservation practitioners to consider in a warming world was, “What, if anything, should we be doing differently in our conservation work for it to be most effective in a changing climate?” In response, we expanded on an earlier use of what, when, where and why in crafting climate-informed goals (Stein et al., 2014) to encourage practitioners to consider the what, when, where, and why of both their goals and actions (Cross et al., 2018). As funders of adaptation projects implemented at local scales, asking “Who?” became additionally important in determining appropriate project leads and partners, ensuring community engagement, and considering the values that a forward-looking approach can support.

The 5Ws emerged as a clear, compelling subset of questions for practitioners to ask in order to identify how to incorporate climate futures into project design (Table 1). It is also a useful framework for funders to evaluate the extent to which climate change and future risks to conservation investments have been considered, while promoting engagement of local communities and the incorporation of diverse values of nature into project design and implementation.

Those applying the 5Ws should query the effectiveness of their work along all five dimensions to decide whether and how to adjust to improve longer-term conservation outcomes (Table 2). Some aspects of project design might emerge through consideration of more than one W; for example, a part of revising the “why” of a project may be to consider “who” the actions are intended to benefit. By calling out all 5Ws, we hope to encourage explicit discussion and consideration of each dimension. Not every climate adaptation project requires modifying all dimensions, but we have found that pausing to ask the full range of questions (Table 1) improves the likelihood that projects will account for climate risks, deliver on a suite of benefits that NbS offer, and avoid negative consequences for local communities and Indigenous peoples.

For example, a land purchase for inland migration of coastal habitats could displace vulnerable human communities; or embracing forward-looking goals could negatively impact place-based cultural identity (Tschakert et al., 2017) that has existed across many generations, Indigenous health (Ford et al., 2018), or even food security (Fujimori et al., 2019) that are inextricably linked to an ecosystem in its current state. In some contexts, increasing tree cover can decrease water supply or cause crop damage by wildlife, exacerbating social inequities (Chazdon & Brancalion, 2019). Engaging local people in design and implementation could help ensure actions not only consider the risks climate change poses to business-as-usual but also help determine what values should be sustained moving forward.

### Table 1: Brief guide to a rapid-assessment approach using the 5Ws to help define project goals, consider climate risks, and brainstorm climate-informed actions

| Step | Question |
|------|----------|
| 1 | Gather and examine the best-available information on current and projected climate change and its effects on nature and/or people that are the focus of the local planning effort. |
| 2 | Consider how changes in climate could impact the effectiveness of traditional actions at meeting goals, and any ways in which those actions and goals may need to be modified to be more effective in a changing climate. |
| 3 | Document any changes to project goals and design (see Table 2 for examples). If after asking the above questions you do not feel that modifications to current goals and actions are needed, document the logic on how current actions will be adequate to achieve goals even as the climate changes. |

| Table 2 for examples) If after asking the above questions you do not feel that modifications to current goals and actions are needed, document the logic on how current actions will be adequate to achieve goals even as the climate changes. | \end{tabular} }
Over the past decade, projects funded through the Climate Adaptation Fund have spanned 42 different U.S. states and territories and a breadth of ecosystem types (Figure 1). They address a diversity of challenges as a result of climate change—from rising seas, to hydrological changes, to more intense and frequent fires, to effects on species, for example. The projects primarily target

| Traditional approach | Reforestation | Fire management | Watershed restoration | Protection |
|----------------------|---------------|-----------------|-----------------------|------------|
|                      | Reforest for habitat and carbon sequestration using seeds/seedlings from historically dominant tree species | Gradually restore forests that have become overstocked with species that prefer moist conditions | Protect forest habitat with fire management, using prescribed burning and thinning based on the historic range of variability in fire frequency and intensity | Restore coastal marshes that provide wildlife habitat and buffer human communities from storm surges |
| Climate change risk  | Tree mortality due to unsuitable climate conditions could degrade habitat and reduce carbon sequestration | Increased drought-stress could lead to sudden and widespread impacts on forest health | Altered fire regimes degrade forest habitat | Inundation causes coastal marsh die-off, impacting habitat that offers protection from storm surges |
| Climate-informed approach | Favor native species that are expected to thrive under future climate; source seeds/seedlings from warmer and/or drier locations to assist migration to climatically suitable areas | Urgently thin mesic tree species and plant native drought-tolerant species to bolster resilience to hotter droughts | Modify tactics to manage for altered fire regimes; encourage postfire regeneration via planting of tree species or genetic stock better suited to future climate; conduct burns with local landowners and tribal entities to expand support and incorporate diverse knowledge and information sources | Prioritize stream restoration in basins that are more likely to sustain suitable stream temperatures and flows as snowpack declines in snowmelt-fed watersheds | Broaden goals to include reducing impacts of floods on people and infrastructure, and reducing exposure to polluted runoff in surrounding communities | Strategically and urgently expand protections for land upslope from current coastal marshes; actively facilitate marsh migration inland as sea levels rise |

**Key considerations resulting from 5Ws review**

- What; where
- What; when
- What; who
- Where
- Why; who
- What; where; when
adaptation benefits for ecosystems and biodiversity, but many offer co-benefits for people, including climate mitigation outcomes.

These projects offer tangible examples of practitioners doing their conservation work differently as the climate changes. Managers of fire-and drought-prone landscapes in New Mexico, for example, modified their tactics by adopting new approaches to wetland restoration to reduce postfire flooding events and offset drought impacts by storing water for later release. Practitioners in Texas changed their reforestation planting mix to include more drought-resistant species that could provide habitat for threatened and endangered species while also sequestering carbon in the coming decades; they also selected strategic locations for planting that would enable wildlife movements in response to shifting conditions. In Montana, actions rooted in the customs and practices of the Aaniih and Nakoda Tribes leveraged Western science and traditional knowledge to develop adaptation practices designed to improve forest health, protect biodiversity, and reduce the risks of severe wildfire to sites of cultural significance.

5 | UPTAKE AND COMPLEMENTARY APPROACHES

The 5Ws framework does not supplant more rigorous tools, but offers an initial, less daunting entry into the climate-informed planning process for practitioners...
endeavoring to make their projects more robust to future conditions. A rapid assessment of how traditional conservation approaches might need to be altered in light of climate change provides a feasible stepping stone to adaptation planning that can inform near-term adjustments while also flagging areas that warrant follow-up via a rigorous planning process. Once more practitioners are regularly engaged in such a rapid assessment process, they may be better-positioned to use other more detailed approaches (e.g., Swanston et al., 2016, Stein et al., 2014, Cross et al., 2012, and others).

Practitioners who are comfortable using other approaches could also consider integrating the 5Ws into those stepwise processes. For example, the questions outlined in Table 1 could be incorporated into the “Review/Revise Goals” and “Identify Adaptation Options” steps of the Climate-Smart Conservation Cycle (Stein et al., 2014), or the “Evaluate objectives considering climate impacts” and “Identify adaptation approaches and tactics for implementation” steps of the NIACS Adaptation Workbook (Swanston et al., 2016). They could also be used alongside adaptation guidance that is tailored to the needs and values of tribal communities (Tribal Adaptation Menu Team, 2019).

6 | MAINSTREAMING

Specifics vary between projects, but a shared approach to climate-informed action is applicable to practitioners that are ramping up NbS across the planet. The Global Commission on Adaptation called for a $1.8-trillion investment (2020–2030) to help communities worldwide adapt to climate change and highlighted approaches based on protecting and restoring nature (Global Commission on Adaptation, 2019). As climate finance reaches record levels and practitioners increasingly endeavor to work with nature, the need to ensure that NbS to climate change deliver expected outcomes hinges on consideration of current and future climate in design and implementation.

Practitioners can use available science and local knowledge to address climate risks to traditional investments in reforestation, fire management, watershed restoration, and habitat protection (Table 2). Climate adaptation also needs to become a long-term strategy in other areas such as pandemic preparedness as risks compound (Phillips et al., 2020), with strategic investments in NbS reducing the likelihood of future zoonotic events and enhancing carbon sequestration if their design accounts for climate change.

Using the 5Ws as a rapid assessment can help lower barriers to incorporation of climate futures into planning and accelerate a transition to climate-robust project design in conservation that reduces climate risks to projects. Delivering expected benefits for nature, people, and the climate system is crucial to uptake and expansion of NbS. Mainstreaming a simple, climate-informed planning process that can be used by practitioners at the project level and by funders in guiding investments could help safeguard NbS and the long-term benefits they offer.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS

Lauren E. Oakes and Molly S. Cross: Conceptualized the manuscript and all authors conceived the framework. Lauren E. Oakes led writing, with Molly S. Cross contributing and developing Table 1. Erika S. Zavaleta: Contributed to the framing and application of the framework, as well as to the framework’s expansion to include “who.” All authors reviewed and approved the final version to be published.

DATA AVAILABILITY STATEMENT

No data were collected for this article.

ORCID

Lauren E. Oakes https://orcid.org/0000-0002-0049-1925

Erika S. Zavaleta https://orcid.org/0000-0002-1769-6492

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