

Scanning the Conservation Horizon

A Guide to Climate Change Vulnerability Assessment



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Executive Summary

Rapid climate change is the defining conservation issue of our generation. The effects of climate change are increasingly apparent, from drowned coastal marshes and drying prairie potholes to melting glaciers. These climate-driven changes will profoundly affect our ability to conserve fish and wildlife and the habitats on which they depend. Indeed, preparing for and coping with the effects of climate change—an endeavor referred to as climate change adaptation—is emerging as the overarching framework for conservation and natural resource management.

The ecological impacts associated with climate change do not exist in isolation, but combine with and exacerbate existing stresses on our natural systems. Understanding those interactions will be critical to designing effective conservation measures. Conservation in an era of climate change will require that we not only acknowledge and address the environmental problems of the past but also anticipate and prepare for those of an increasingly uncertain future.

Developing and implementing effective adaptation strategies first requires an understanding of the potential impacts of climate change on our natural world. To provide the best possible chance for conserving species and ecosystems in a rapidly changing climate, it is essential that managers have the ability to both identify what we need to do differently in the future, as well as which existing strategies and activities continue to make sense from a climate adaptation perspective.

Vulnerability assessments are a key tool for informing adaptation planning and enabling resource managers to make such judgments.

Scanning the Conservation Horizon is designed to assist fish and wildlife managers and other conservation and resource professionals to better plan, execute, and interpret climate change vulnerability assessments.



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Climate change vulnerability assessments provide two essential contributions to adaptation planning. Specifically, they help in:

- Identifying **which** species or systems are likely to be most strongly affected by projected changes; and
- Understanding **why** these resources are likely to be vulnerable, including the interaction between climate shifts and existing stressors.

Determining **which** resources are most vulnerable enables managers to better set priorities for conservation action, while understanding **why** they are vulnerable provides a basis for developing appropriate management and conservation responses.

Vulnerability to climate change, as the term is used in this guide, has three principle components: sensitivity, exposure, and adaptive capacity.

Vulnerability to climate change, as the term is used in this guide, has three principal components: **sensitivity, exposure, and adaptive capacity**. Vulnerability assessments are, therefore, structured

and rate of change the species or system is likely to experience. *Adaptive capacity* addresses the ability of a species or system to accommodate or cope with climate change impacts with minimal disruption.

Key Steps for Assessing Vulnerability to Climate Change

Determine objectives and scope

- Identify audience, user requirements, and needed products
- Engage key internal and external stakeholders
- Establish and agree on goals and objectives
- Identify suitable assessment targets
- Determine appropriate spatial and temporal scales
- Select assessment approach based on targets, user needs, and available resources

Gather relevant data and expertise

- Review existing literature on assessment targets and climate impacts
- Reach out to subject experts on target species or systems
- Obtain or develop climatic projections, focusing on ecologically relevant variables and suitable spatial and temporal scales
- Obtain or develop ecological response projections

Assess components of vulnerability

- Evaluate climate sensitivity of assessment targets
- Determine likely exposure of targets to climatic/ecological change
- Consider adaptive capacity of targets that can moderate potential impact
- Estimate overall vulnerability of targets
- Document level of confidence or uncertainty in assessments

Apply assessment in adaptation planning

- Explore why specific targets are vulnerable to inform possible adaptation responses
- Consider how targets might fare under various management and climatic scenarios
- Share assessment results with stakeholders and decision-makers
- Use results to advance development of adaptation strategies and plans

Although climate change vulnerability assessments can be applied to human infrastructure as well as natural systems, our focus here is on approaches designed to support wildlife conservation and ecosystem-based adaptation. Such assessments can target various levels of ecological or biological diversity. Because of their relevance to most wildlife management and conservation practitioners, this guidance focuses on assessments of **species, habitats, and ecosystems**, detailing approaches for assessing sensitivity, exposure, and adaptive capacity at each of these biological levels. Understanding likely future change is central to these assessments, and we also provide an overview and guidance for the use of climate and ecological response models relevant to conducting fish and wildlife vulnerability assessments.

Climate change vulnerability assessments are, first and foremost, intended to support decision-making, and as such they should be designed from the start with an eye toward the needs of the end users, whether they be on-the-ground managers, policy-makers, or others in the management or scientific communities. A critical first step is to identify the scope and objectives of the assessment based on the intended

around assessments of these distinct components. *Sensitivity* generally refers to innate characteristics of a species or system and considers tolerance to changes in such things as temperature, precipitation, fire regimes, or other key processes. *Exposure*, in contrast, refers to extrinsic factors, focusing on the character, magnitude,

user, their information needs, and existing decision processes. We also provide guidance on successful approaches for engaging stakeholders. Designing assessments requires attention to several other key considerations, including selection of the appropriate geographic and temporal scales, the features to be assessed (e.g., species or ecosystems), and level of detail and complexity. Given the inherent uncertainties associated with various aspects of climate projections and vulnerability assessments, we provide specific guidance on understanding, addressing, and documenting uncertainty. Finally, climate change is not occurring in a vacuum, and assessments must be carried out in the context of existing stresses on our species and systems—from the fragmentation and loss of habitat to the ongoing deluge of invasive species.

Vulnerability assessments can provide a factual underpinning for differentiating between species and systems likely to decline and those likely to thrive, but do not in themselves dictate adaptation strategies and management responses. Indeed, a continuum of possible adaptation approaches exists ranging from: (1) building *resistance* to climate-related stressors as a way of maintaining high-priority species or systems; (2) enhancing *resilience* in order to provide species and systems with a better chance for accommodating and weathering changes; and (3) anticipating and facilitating ecological *transitions* that reflect the changing environmental conditions.

To help bring the concepts behind vulnerability assessment alive, the guide concludes with a series of seven case studies, profiling efforts of varying



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scope and complexity. These examples include assessments that employ different analytical approaches (e.g., expert opinion vs. computer models), conservation targets (e.g., species vs. habitats), and spatial scales (e.g., states vs. regions) among other variables. Collectively, these case studies represent many of the leading examples of wildlife and ecosystem-oriented climate change vulnerability assessments.

There is no single right approach to vulnerability assessment that applies to all situations. Rather, the design and execution of an assessment must be based on a firm understanding of the user needs, the decision processes into which it will feed, and the availability of resources such as time, money, data, and expertise. *Scanning the Conservation Horizon* is intended to provide resource managers and conservationists with much-needed guidance for understanding the basic concepts behind vulnerability assessments, and for identifying which approaches may best serve their specific needs as together we rise to the challenge of conserving our fish and wildlife resources in an era of rapid climate change.