

Chapter 12

Toward Climate-Smart Resource Management in the Northern Rockies

Jessica E. Halofsky, David L. Peterson, S. Karen Dante-Wood,
and Linh Hoang

Abstract The Northern Rockies Adaptation Partnership facilitated the largest climate change adaptation effort on public lands to date, including participants from federal agencies and stakeholder organizations interested in a broad range of resource issues. It achieved specific goals of national climate change strategies for the U.S. Forest Service and National Park Service, providing a scientific foundation for resource management and planning in the Northern Rockies. The large number of adaptation strategies and tactics, many of which are a component of current management practice, provide a pathway for slowing the rate of deleterious change in resource conditions. Rapid implementation of adaptation—in land management plans, National Environmental Policy Act documents, project plans, and restoration—will help maintain functionality of terrestrial and aquatic ecosystems in the Northern Rockies, as well as build the organizational capacity of federal agencies to incorporate climate change in their mission of sustainable resource management. Long-term monitoring will help detect potential climate change effects on natural resources, and evaluate the effectiveness of adaptation options that have been implemented.

Keywords Adaptation • Management planning • Implementation • Science-management partnerships • Organizational capacity

J.E. Halofsky (✉)

School of Environmental and Forest Sciences, University of Washington, Seattle, WA, USA

e-mail: jhalo@uw.edu

D.L. Peterson

U.S. Forest Service, Pacific Northwest Research Station, Seattle, WA, USA

e-mail: peterson@fs.fed.us

S. Karen Dante-Wood

U.S. Forest Service, Office of Sustainability and Climate, Washington, DC, USA

e-mail: skdante@fs.fed.us

L. Hoang

U.S. Forest Service, Northern Region, Missoula, MT, USA

e-mail: lhoang@fs.fed.us

12.1 Partnership and Process

The Northern Rockies Adaptation Partnership (NRAP) provided the scientific documentation for understanding and responding to climate change in Northern Rockies ecosystems. The assessment team synthesized scientific information to evaluate climate change vulnerability, working with resource managers to (1) develop adaptation options that reduce the negative effects of climate change, and (2) transition ecosystems and organizations to a permanently warmer world. Vulnerability assessment information and adaptation options developed by the NRAP are now being used to support national forests and national parks in implementing agency climate change strategies (NPS 2010; USFS 2010, 2012; Chap. 1). In addition, we catalyzed a collaboration of 35 land management agencies and stakeholders with common interests in addressing climate change in the Northern Rockies, an enduring partnership that will ensure timely and consistent application of the assessment in the years ahead.

12.1.1 *Increasing Organizational Capacity to Address Climate Change*

Although the NRAP was led primarily by federal agencies, the assessment information that was developed should be relevant for other land management agencies, tribes, and nongovernmental organizations in the Northern Rockies. This process can be replicated and implemented by other organizations, and the adaptation options can be used in the Northern Rockies and beyond. Like previous adaptation projects (Halofsky et al. 2011; Swanston et al. 2011; Raymond et al. 2014; Halofsky and Peterson 2016, 2017), a science-management partnership was critical to the success of the Northern Rockies effort. For others interested in emulating this approach, we encourage them to pursue this type of partnership as the foundation for increasing climate change awareness, assessing vulnerability, and developing adaptation plans. In addition, this project made a major contribution to the Climate Change Adaptation Library (Halofsky and Peterson 2016, 2017; <http://adaptation-partners.org/library.php>), which is being used by land managers throughout the western United States.

Organizational capacity to address climate change requires building the institutional knowledge and ability of leadership, resource specialists, and management units to address climate change in agency operations. Training and education were built into the NRAP process through workshops and webinars that provided information about the effects of climate change on water resources, fisheries, vegetation, disturbance, wildlife, recreation, ecosystem services, and cultural resources. The workshops introduced climate tools and processes for assessing vulnerability and planning for adaptation. The participation of over 250 people in climate change

workshops ensured the direct participation of agency employees in the NRAP, including their contributions to the assessment and adaptation options.

The NRAP science-management partnership and process were as important as the products that were developed, because partnerships are the cornerstone of successful agency responses to climate change. Land management agencies in the western United States have embraced partnerships in order accomplish their mission of sustainable resource stewardship, because diverse perspectives, timely feedback, and consensus building improve the likelihood of successful implementation of plans and projects, and reduce the likelihood of appeals and litigation. *Working across boundaries*—both geographic and sociopolitical—ensures that consistent approaches are applied to natural resource issues, especially for those resources that overlap jurisdictions (water, large animals, fish, etc.) (Olliff and Hansen 2016). Building enduring relationships and developing a shared vision are becoming more common in federal resource management and beyond. The NRAP process allowed the U.S. Forest Service (USFS) and National Park Service to achieve unit-level compliance in their agency-specific climate responses, but the influence of the project on broad landscapes inside and outside their borders was a more important outcome. The *all-lands approach* used in the Northern Rockies is critical for improving the resilience of ecosystems and organizations in the future.

The science-management dialogue created by NRAP identified management practices that are useful for increasing resilience and reducing stressors from climate change and other causes. Although implementation of all options developed in the NRAP process may not be feasible, resource managers can draw from the menu of options as needed. Some adaptation strategies and tactics can be implemented on the ground now, whereas others may require changes in policies and practices, or can be implemented when management plans are revised or as threats become more apparent.

Various components of the NRAP process identified *information gaps and uncertainties* important to understanding climate change vulnerabilities and adaptation. This is especially relevant for developing monitoring and research that will decrease uncertainties inherent to management decisions. In addition, current monitoring programs that provide information for detecting climate change effects—as well as indicators, species, and ecosystems that require additional monitoring—were identified for some components of the assessment. Working across multiple jurisdictions and boundaries will allow NRAP participants to increase collaborative monitoring and research on climate change effects and on the effectiveness of adaptation.

12.1.2 Implementation: The Path Forward

The NRAP built on previous science-management partnerships by creating an inclusive forum for local and regional stakeholders to address issues related to climate change vulnerability and adaptation. Although this partnership was conducted

at the regional scale, more work is needed to truly achieve an all-lands approach to adaptation. Agencies used this process to share different approaches and experiences, and opportunities for creating a collaborative adaptation plan were explored. In the future, it would be valuable to *develop partnerships around specific resource issues and implement adaptation options accordingly*. In addition, *working at the subregional scale* would address specific management issues at a more geographically appropriate scale. Finally, because the NRAP process was able to engage only a subset of the total federal workforce represented by federal agencies, *continued internal and external communication* focused on climate-smart thinking, planning, and management will be necessary to ensure consistency and compliance with agency mandates.

Implementing adaptation options is challenging, although it builds on a solid foundation of planning principles and management practices that are already climate smart. Thinning of dry forests to increase vigor and reduce fuel loadings, restoration of riparian areas to enhance cold-water fish habitat, and removing roads from floodplains and other vulnerable locations are climate-smart practices that have been part of sustainable resource management for many years. Broader implementation will occur gradually over time in response to new policies, plan revisions, and programmatic directives. In some cases, extreme weather events (e.g., prolonged droughts) and major ecological disturbances (e.g., large wildfires) may provide the motivation to implement climate-smart actions. As previously stated, collaboration among landowners and management agencies will produce more successful adaptation outcomes than operating independently.

Landscape management strategies provide a context for decision making in which managers can be transparent in decisions to apply any given strategy or tactic. Appropriate adaptation options must consider resource conditions, social and ecological values, and likelihood of successful outcomes in a warmer climate (Peterson et al. 2011). The use of planning teams to develop resource-specific critical questions, and their responses to those questions, can inform broadly applicable management strategies (Figs. 12.1 and 12.2). The Climate Project Screening Tool (Morelli et al. 2012) and similar straightforward approaches can be applied to both strategic and project management.

Adaptation options that provide benefits to multiple resources will often have the greatest benefit in a particular landscape (Halofsky et al. 2011; Peterson et al. 2011; Raymond et al. 2014; Halofsky and Peterson 2016, 2017). However, some adaptation options involve tradeoffs and uncertainties that need further exploration. Assembling an interdisciplinary team to tackle this issue will be critical for assessing risks and developing risk management options.

The climate change vulnerability assessment and adaptation approach developed by the NRAP can be used by the USFS, National Park Service, and other organizations in many ways (Table 12.1):

- *Landscape management assessments/planning*: The vulnerability assessment provides information on departure from desired conditions and best science on effects of climate change on resources for inclusion in planning assessments.

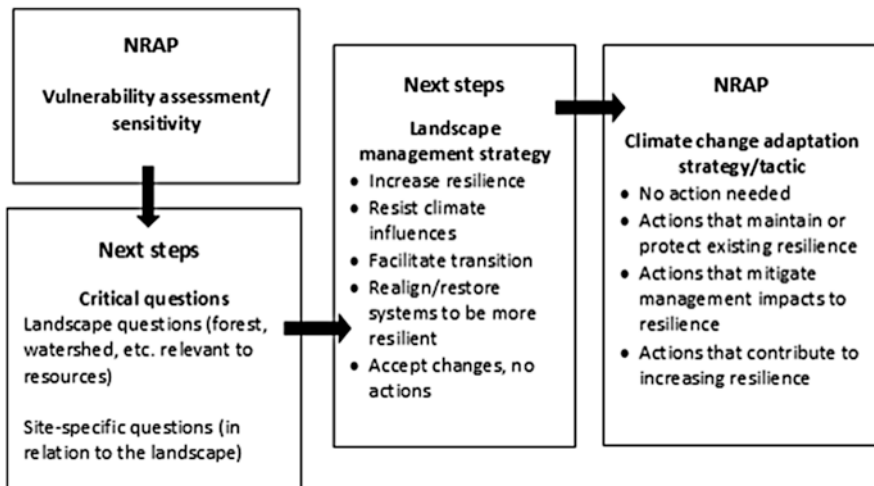


Fig. 12.1 General framework for using NRAP vulnerability assessment and adaptation information to ask critical questions and develop a landscape management strategy

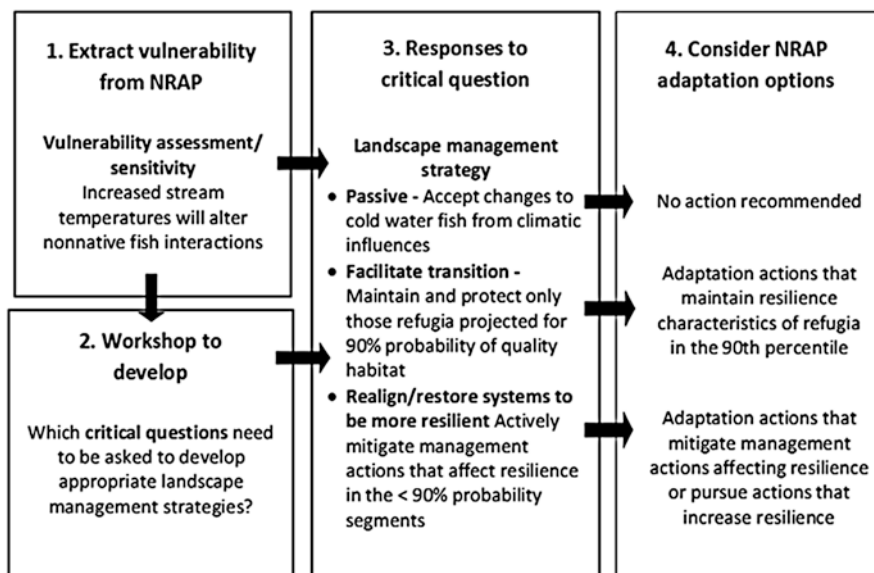


Fig. 12.2 Example of how to answer critical questions and develop a landscape management strategy for cold-water fish

Table 12.1 Example of how information on climate change vulnerability and adaptation can be used in land management applications in dry forests

Vulnerability and adaptation information	Land management application
<i>Sensitivity to climatic variability and change</i>	
Potential conversion to grassland	Forest planning: assessment phase
Many ponderosa pine forests have converted to Douglas-fir types because of fire exclusion and are therefore more susceptible to future fires	National Environmental Policy Act (NEPA) project analysis: existing condition and best science on effects of climate change on resource
<i>Adaption strategy</i>	
Restore fire-adapted ponderosa pine stand conditions in order to facilitate transition	Forest planning: desired conditions Project NEPA analysis: purpose and needs
<i>Adaptation tactics</i>	
Reduce competition from Douglas-fir and grand fir (thin, burn) in current mature pine stands	Forest planning: objectives Project NEPA analysis: project design features and other mitigation
Conduce frequent understory burning	
Retain current mature and older ponderosa pine stands	
Plant ponderosa pine where it has been lost	

Adaptation strategies and tactics provide desired conditions, objectives, standards, and guidelines for land management plans and general management assessments.

- *Resource management strategies:* Vulnerability assessment and adaptation strategies and tactics can be used to incorporate best science into conservation strategies, fire management plans, infrastructure planning, and State Wildlife Action Plans.
- *National Environmental Policy Act (NEPA) analysis for projects:* The vulnerability assessment provides best available science for documentation of resource conditions, effects analysis, and development of alternatives. Adaptation strategies and tactics provide mitigation and design tactics at specific locations.
- *Monitoring plans:* The vulnerability assessment identifies knowledge gaps that can be addressed by monitoring in broad-scale strategies, plan-level programs, and project-level data collection.

We are optimistic that climate change awareness, climate-smart planning and management, and implementation of adaptation in the Northern Rockies will progress quickly in the years ahead. We anticipate that:

- The effects of climate change on natural and human systems will be continually assessed.
- Monitoring activities will include indicators to detect the effects of climate change on species and ecosystems.

- Agency planning processes will provide opportunities to manage across boundaries.
- Managers will implement climate-informed practices in long-term planning and management.
- Restoration activities will be implemented in the context of a changing climate.
- Institutional capacity to manage for climate change will increase within federal agencies and other organizations.

Some climate-related changes in natural resources will be gradual, and others will occur abruptly. Timely actions will be necessary in some cases to protect critical ecosystem components and valued species, especially in the face of increasing frequency of extreme events (e.g., drought) and disturbances (e.g., wildfire, insect outbreaks). It will be critical for federal agencies and other organizations to share their experiences with implementation of climate-smart planning and management, building on successes and modifying approaches as necessary.

Federal agencies have demonstrated leadership in the implementation of ecosystem-based management, ecological restoration, and conservation of biological diversity over the past 30 years. Incorporating these paradigms in sustainable resource management required an enormous shift in organizational focus, whereas incorporating climate change will require mostly “fine tuning” of existing programs and practice. We are confident that resource managers and scientists in the Northern Rockies will improve the resilience of both ecosystems and organizations to a warmer climate, thus ensuring long-term sustainability.

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