



A Primer for Conservation Professionals

The Role of Adaptation

The effects of climate change are already apparent on wildlife, habitats and the natural resources we depend on. Climate change has caused species extinctions, shifted species ranges towards the poles and up the sides of mountains, and reduced the ranges of other species. Changes in the timing of biological processes such as the blossoming of spring flowers are also occurring, altering essential relationships between species. Pest and disease outbreaks and species invasions are becoming more common under climate change and species are losing habitat due to sea level rise, changes in wildfire frequency and intensity, changes in water availability, warming of habitat, glacial recession, pest outbreaks and altered weather patterns.



The American pika, a montane species that lives on talus slopes is already moving upslope as temperatures increase. Ultimately the pika faces significant habitat reduction and potential extinction.

Photo: © Jim Clark

Responding to climate change through the reduction of greenhouse gas emissions is an essential component of a climate change response. But even with immediate action to reduce greenhouse gas emissions the effects of climate change will continue for decades to come because greenhouse gases can remain in the atmosphere for centuries after they are produced. It is essential that we take action to help safeguard ecosystems and species in a warming world.

Climate change adaptation is an approach to help species and ecosystems cope with climate change and ongoing ecological threats. The term adaptation refers to

strategies taken to anticipate, prepare for and respond to the expected impacts of climate change in order to promote ecological resilience in natural ecosystems and to allow these ecosystems and species to respond to change.

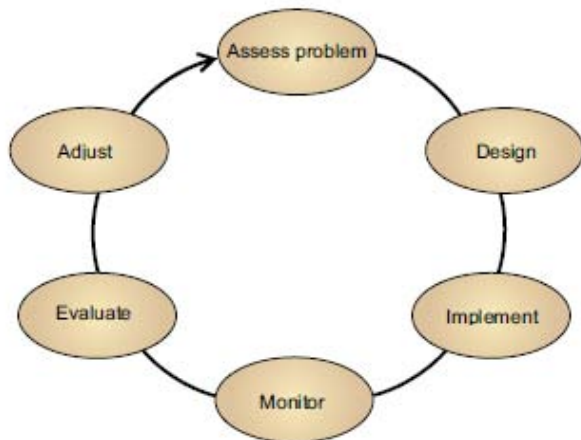
Resilience is the capacity of an ecosystem to tolerate disturbance without fundamentally changing into a different system. In other words, resilient systems bounce back from change with little damage. Climate change adaptation is a relatively new concept in the field of conservation, but scientists, natural resource managers, policy makers and conservationists are moving forward to help implement policies, plans and actions that support natural resource adaptation.

Adaptation Planning

Planning for and management of natural resources should include careful consideration of climate changes projected across the region of interest, and should incorporate flexibility to continue refinement of strategies as information increases. Developing adaptation plans and implementing adaptation strategies requires setting clear goals and objectives, identifying conservation targets, and planning detailed monitoring and assessment approaches. Planning will require conservation practitioners to evaluate current management and conservation actions through the lens of climate change and determine which strategies need to be continued, which need to be altered or halted, and which need to be reprioritized based on the immediacy of current threats. In addition to re-evaluating practices we are already familiar with, adapting to climate change will also require conservation practitioners to develop new tools and approaches and to work across borders and jurisdictional responsibilities.

Adaptive management is a systematic approach to improving management by learning from doing. The process involves exploring alternative ways to meet management goals, developing predictions of the outcomes from alternative management, implementing one or more of these alternatives, monitoring to learn about the impacts of management actions, and then using the results to update knowledge and adjust management actions. This process of learning through doing is an essential part of planning and managing for uncertain condition

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Adaptive management allows managers and planning to learn while doing and revise plans based on new information. Figure taken from the U.S. Department of Interior's Technical Guide to Adaptive Management.

Planning for climate change adaptation can be undertaken as part of an adaptive management cycle, pictured above.

Assess Problem

- Identify target species, habitats and ecosystems, and scale;
- Clearly define management goals and objectives and refine as necessary based on climate changes projected;
- Assess potential impacts, opportunities and vulnerabilities arising from future scenarios of climate, ecological conditions, socio-economic factors, and other drivers and build a conceptual model to illustrate these impacts;

Design Solutions

- Identify intervention points and develop adaptation actions for species or ecosystems and design monitoring protocols to assess the effectiveness of these actions
- Evaluate the benefits of these actions as well as feasibility and barriers to implementation based on socio-economic factors and management capacity;

Implement

- Implement adaptation strategies

Monitor, Evaluate and Adjust

- Monitor climate change impacts on targets and effectiveness of adaptation strategies in meeting objectives and goals
- Evaluate strategy effectiveness and alternatives

- Re-evaluate and adjust strategies in light of new climate change information

The process should be reiterated by continually reviewing management objectives and actions, incorporating new information and adjusting conservation actions as needed.

Throughout the planning process it will be important to engage diverse partners, identify the right scales to make management decisions, and to deal with uncertainty. Helping species and ecosystems cope with climate change will require collaboration beyond traditional boundaries. In the future management decisions will need to be coordinated with the larger landscape context and the social and economic situation in mind. The temporal scale of planning also needs to be considered. Planning horizons are generally short (5-10 years), but climate change adaptation planning requires considering a longer time scale since the impacts of climate change occur over longer timeframes.

The greatest challenge to natural resource managers in planning for climate change may lie in dealing with the uncertainty that comes both from projecting future climate changes and from implementing new management strategies. Managing under uncertainty requires a flexible, adaptive management approach and recognition that some management strategies are likely to be beneficial under a range of future climate conditions while others may be more dependent on specific climate change trajectories. To be successful all management strategies should be implemented using an active adaptive management approach.

On the Ground Adaptation Strategies

Climate change adaptation strategies are actions that increase the resistance and resilience of a system to climate change and those that help facilitate a change in condition in response to the impacts of climate change.

Resistance strategies are designed to keep an ecosystem or species from changing in response to climate change by reducing exposure to the impacts of climate changes. These types of strategies may help to “buy-time” for a system in the short term until other adaptation strategies are developed or help to maintain conditions in sensitive or high value ecosystems but are unlikely to be viable over longer time periods due to the pace of climate change. Building fuel breaks around forests to prevent increased wildfire is an example of a resistance strategy.

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Resilience strategies aim to support an ecosystem or species by increasing the amount of change that an ecosystem or species can absorb. Removing invasive species to increase an ecosystem's ability to recover from other disturbances is a resilience building strategy.

Facilitation strategies are direct interventions taken to enable a change in the ecosystem or species population towards a desirable future condition with native species, intact ecological functions and continued provisioning of ecological services. These actions help an ecosystem or species to change in a way that managers believe is acceptable. Actions to facilitate change may include increasing landscape connectivity and permeability to allow species and ecological communities to shift in response to climate change, and trans-locating sensitive species that are unable to keep pace with climate change.



Working to build a protected network of conservation lands will be increasingly important as we prepare for climate change. Photo: Heart of the Rockies, heart-of-rockies.org

Resistance, resilience and facilitation strategies can be further broken down into general categories of adaptation actions. On-the-ground adaptation strategies will be context specific, and depend on the conservation targets and goals, the projected climate change impacts, the location of the project, the socio-economic environment, and other regional and local factors. General categories of adaptation action include the following strategies:

1. Prevent undesired effects of climate change – These strategies include efforts to manage species and ecosystems so that they are better able to resist the impacts of climate change. For example, building oyster reefs to prevent coastal erosion due to sea level rise is an example of a resistance strategy.

2. Reduce non-climate threats –In general, systems and species that are already stressed will be less resilient to climate change and reducing non-climate threats will give wildlife species maximum flexibility to respond to climate change. Strategies in this category include reducing invasive species or limiting pollution.

3. Expand the network of protected lands and waters -- Wildlife conservation can no longer be accomplished within the boundaries of federally protected areas alone. Maintaining resilient ecological communities and allowing species to move in response to climate change will require the strategic expansion of a connected network of conservation areas that include federally protected areas, private conservation easements, state and tribal holdings, and private working lands managed for greater conservation benefits. Building this network requires the following actions:

- **Increase the pace of strategic land protection**
Large conservation areas tend to contain more species than small areas and will provide opportunities for species to move between suitable habitats as the climate changes. Similarly, protecting the full range of habitat types and the conditions under which they occur will help species survive. Conservation funding is limited and so investments in land protection must be made in a coordinated, strategic manner that ensures that the most critical landscapes are given priority.
- **Promote landscape connectivity to facilitate species movements and gene flow --** To facilitate species movement and exchange of genetic material we will need to protect areas critical for climate-induced wildlife movement such as corridors for terrestrial species and stepping-stone habitats for species that need stopover locations between protected areas. Increasing stream and river connectivity through dam removals and stream and floodplain restoration projects is also important.
- **Identify and protect climate refugia –** Some areas may be less likely to change in response to climate change due to their topography, geographic location, or other physical factors. These areas are called climate refugia, and identifying and protecting them may be an important adaptation strategy. For example, gorges may provide shelter from hot, dry winds and may therefore be less affected by increasing temperatures and drought. These areas may stay moist and cool enough to enable

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temperature sensitive species to retreat and survive as the climate changes.

4. Implement proactive management and restoration strategies -- Strategies in this category include all *active* interventions in habitats, ecosystems and species populations to enhance the ability of these targets to accommodate climate change impacts. Examples include translocation of species to new locations, facilitating marsh migration in response to sea level rise, and using plant species in restoration projects that are thought to be more resilient to anticipated climate changes in a particular location.

Building Institutional Adaptive Capacity

In order to plan for and implement adaptation strategies, our conservation institutions must themselves adapt and become adaptive to constant change at large scales. The following types of actions are examples of improving institutional adaptive capacity:

- 1. Programmatic Changes:** Addressing adaptation to climate change involves making climate change a part of program priorities, securing increased funding to reflect that new focus, modifying management plans to address projected climate change impacts, forming internal and external working groups, and increasing internal capacity to address adaptation.
- 2. Planning:** A significant amount of planning, revision of existing plans, reprioritization of restoration or conservation actions, identification of new management goals, and development of monitoring protocols is preceding implementation of adaptation projects. The goal of planning should be to ensure that activities are not maladaptive and that conservation investments consider future changes and are re-prioritized as needed.
- 3. Collaboration:** Climate change requires conservation partners to work together at landscape-scales, across jurisdictional boundaries to adequately understand and respond to the impacts of climate change. Forming working groups, partnerships and collaborative structures and processes will be important to effectively work at this scale. The Department of the Interior Landscape Conservation Cooperatives are an example of this type of collaborative institution forming.
- 4. Increasing science and technical capacity:** Developing tools, predictive science, models, guidance documents, and planning information are all key components of adaptation to climate change. Developing

and implementing active adaptive management programs is also a key part of climate change adaptation as many adaptation strategies will be implemented under changing and uncertain conditions with incomplete information. Learning from doing and revising management strategies is an essential part of climate change adaptation.

5. Increasing flexibility: Because of the uncertainty, changing information, and potential for unexpected abrupt changes, climate change adaptation calls for increased flexibility and nimbleness by conservation professionals. Agencies and conservation organizations will be forced to adjust timeframes, plan for alternative future scenarios, and revise resource management plans, actions, and objectives more actively than in the past.

Conclusion

Climate change poses an unprecedented threat to natural resources, and the challenges resource managers and conservationists face are similarly daunting. Moving forward will require advances in science, new and innovative approaches to planning and management, development of collaborative partnerships, and an emphasis on flexibility in institutions, policies and management approaches. However, progress is being made to plan and implement adaptation strategies, develop tools and models for adaptation planning, and to help build capacity in natural resource management agencies and conservation organizations. To learn more about adaptation planning, adaptation strategies and other aspects of climate change, please visit www.defenders.org/climatechange.



Blackwater National Wildlife Refuge at sunset. This important refuge for waterfowl and birds has already lost a third of its wetlands through sea level rise and erosion. Photo: © J. and K. Hollingsworth, Fish and Wildlife Service.