Wilderness and Global Climate Change (GCC) Frequently Asked Questions (FAQs)

1. What are the direct ecological effects of Global Climate Change?

Climate change is likely to have extensive and substantial ecological effects on all wilderness lands. While the magnitude and specifics cannot be detailed for individual areas, some broad impacts can be described:

**Effects on water/hydrology systems.** Climate change in western mountains is projected to increase drought severity, decrease snow pack, cause floods due to rapid snow melt-off and more frequent rain on snow events, and reduce summer stream flow, thereby decreasing critically important water supplies. Forests provide nearly two-thirds of the freshwater in the 48 conterminous states and National Forest System lands are the single largest source of drinking water in the United States; in western states they provide more than 50% of the water supply. Most national forest headwater watersheds are located in wilderness.

**Effects on fire regimes.** Warmer temperatures, reflected in longer growing seasons, drier soils and drier fuels have already been implicated in an increase in the frequency, intensity and size of wildfires. Longer, more severe fire seasons will likely affect fire management capabilities and effectiveness. As the risk of catastrophic fire increases, so does the risk to lives and property, the cost of fire fighting, smoke pollution, soil erosion and its adverse effects on water quality—risks that are also exacerbated by the enlarging wildland-urban interface.

**Effects on Biodiversity/Habitat/Endemic species.** It has been estimated that between 20 and 30% of plant and animal species are likely to be at an increased risk of extinction if increases in global average temperatures exceed 2.7 to 4.5°F. Biological diversity is also likely to be further taxed by the increasing spread of invasive species that are better adapted to disturbed areas and climatic shifts and a rise in outbreaks of pestilence and disease. Loss of biodiversity, resulting from climate change, will be inversely related to the ability of species to either adapt to new conditions (“adaptation in place”) or move to environments where they are better adapted (“migration”). Global climate change amplifies the adverse effects of habitat fragmentation by increasing the need for some species to migrate.

Many more effects will occur, many of which cannot be predicted at this time. It should also be noted that these effects are intertwined and compounding. For example, enhanced risk of catastrophic wildfire may lead to attempted fire suppression when a fire first starts which ultimately further exacerbates the fire risk, the insect and disease problems and other attributes of unhealthy forests.

---

1 Developed by the “Wilderness and Global Climate Change Subteam” of the Forest Service’s Wilderness Advisory Group, consisting of Dr. David Cole, Kevin Hood, Joshua Simpson and Steve Boutcher
2. What are the areas of concern for management actions that might be taken in response to GCC?

Management actions that might be taken in response to global climate change are as endless as the potential effects. However, the most likely scenarios to unfold on lands administered or stewarded by agency personnel revolve around water, vegetation manipulation for wildlife habitat, and fire, both prescribed and natural.

**Water.** Wilderness provides essential services related to water in several ways, including filtering/purifying, providing regulated flows, providing drinking water as well as supporting habitat and wildlife, agriculture and recreation. Compounding the situation are the facts that demand for fresh water increasingly exceeds the supply and that laws governing water rights were written in a bygone era that could not foresee present complexities. There will be increasing pressure, particularly given climate change, to manipulate water supplies, even in wilderness. Protecting the integrity of water sources is a key component to sustaining fresh, clean and available water in the long term.

**Vegetation Manipulation for Wildlife.** Management actions that deal with wildlife are intimately related to those management actions that deal with vegetation manipulation. Wildlife are as dependent on the vegetation that comprise their habitat as the vegetation is dependent on the wildlife they support. If managers try to re-establish lost or declining habitat types they may inadvertently open up space that can be used by more versatile invasive species which affects the ability of the native species to thrive and perpetuate a healthy and resilient ecosystem beneficial to particular wildlife species. The outcomes of such a scenario are the loss or increased depletion of wildlife species dependent on that habitat, which in turn leads to a loss of native vegetation to invasive species.

**Fire.** The intentional allowance of natural wildfire, or use of prescribed wildfire, to provide resource benefits to wildlife and vegetation will have to address the increasing severity of fire conditions and the possibility of catastrophic escapement. Bad timing of implementation, or weather related phenomenon can play a role in how effective fire treatments are. Extra scrutiny should be applied particularly if a project area has a heavy fuel load or a large concentration of invasive, non-native plant species.
3. What are the effects of GCC on the Natural, Untrammeled, Undeveloped, and Outstanding Opportunities Qualities of Wilderness Character?

Global climate change, and our attempt to manage its impacts, has the potential to affect each of the four qualities which comprise wilderness character:

**Natural.** The changes to the natural quality are the most obvious effect of GCC, with likely alterations of such ecosystem attributes as vegetative patterns, stressors to wildlife, statuses of populations of threatened or endangered species, and alterations to water flow and fire regimes. The desire to mitigate GCC may also result in actions that influence the natural quality, such as attempts to maximize carbon sequestration.

**Untrammeled.** The effects of GCC will increase pressure to conduct intentional acts to manipulate resources inside wilderness, with the goal of either mitigating the effects of GCC or helping ecosystems to adapt, such as the restoration of natural fire regimes, the assisted migration of a sensitive plant or wildlife species or the building of resilient genetic reservoirs.

**Undeveloped.** As the effects of GCC become more widespread, the desire to know more about its effects will also rise, leading to an increased demand for the installation of various types of instrumentation inside wilderness to monitor the inputs related to global climate change, such as remote snowpack sensors and stream gauging stations. Additionally, developments may be proposed to help endangered species adapt, such as installing water guzzlers for bighorn sheep in drought-stricken deserts. There may also be an increased potential for previously unexercised provisions of the Wilderness Act to be used in an effort to promote greener energy sources, such as building reservoirs and transmission lines.

**Outstanding Opportunities for Solitude.** While less obvious than effects to the other qualities, climate change may affect how people appreciate wilderness. The impacts of climate change will stress human civilization to an unprecedented degree. The need for refuge from the bad news of extreme weather, high prices, displaced populations and the need for connection with resilient nature and for fellow humans will be great. The wilderness experience may play a critical role in supporting our mental and spiritual well-being.

In addition to these effects on independent qualities, GCC also heightens the tension between qualities, most notably between the natural and untrammeled qualities. For example, in order to provide sustainable habitat for certain plant species that can no longer survive in their native range due to GCC, managers may decide to assist with migration to more favorable habitats through an active transplant program. The interplay between qualities and the trade-offs that will be necessary will require managers to think more critically about their wilderness stewardship goals.
4. How does GCC affect wilderness stewardship goals?

The goal of wilderness stewardship, since passage of the Wilderness Act and further refined in Forest Service policy, has been the preservation of wilderness character. Central to this tenet has been the perpetuation of “natural conditions,” which have been typically defined as those conditions that existed in the past, that would exist now if not for human disturbance and that would persist in the absence of human intervention. The breadth and scope of the changes resulting from GCC make this central goal of wilderness stewardship problematic. Not only is the perpetuation of natural conditions highly unlikely in the face of GCC, it may not even be desirable. Ecosystems preserved at a fixed point in time will likely be poorly adapted to future climates. Some aspects of “naturalness” may best be protected by human intervention, while others aspects may be degraded by intervention. Further guidance is needed to articulate the wilderness values we will strive to sustain into a future that will be unprecedented and unpredictable—that is we need to reframe the desired future condition of the areas we manage using concepts more specific than naturalness. This is needed to help wilderness managers make better decisions about where and when to intervene in ecological processes and what the desired outcomes of interventions are.
5. How can wilderness help with mitigation and adaptation to the effects of GCC?

The designation of lands as wilderness, when contrasted with land development, contributes substantially to climate change mitigation efforts. For example, largely undisturbed wilderness lands are significant sinks for greenhouse gases and most activities in wilderness do not emit large quantities of the greenhouse gases. As long as management is consistent with the Wilderness Act, wilderness designation and traditional wilderness stewardship will contribute substantially to mitigation efforts; there appears to be little potential to further mitigation efforts by changing time-tested approaches to wilderness designation and stewardship.

Wilderness can directly help the Forest Service adapt to the changes caused by climate in numerous ways, such as:

**Understanding ecological systems.** Because wilderness receives minimal hands-on management, it provides the best baseline we have for monitoring to understand ecological systems and their response to a changing climate.

**Sustaining biodiversity.** The large scale and long-term protection of wilderness provides one of the best, and least expensive, opportunities to sustain the full suite of biodiversity in the face of climate change. The legal mandate to protect “the community of life” in wilderness allows Forest Service wilderness to uniquely protect entire ecosystems, which function as refugia and genetic reservoirs.

**Connecting landscapes.** Climate change will cause species to move to environments where they are better adapted. If species are unsuccessful in migrating to a suitable environment, we will see increasing extinction rates and loss of biodiversity. Wilderness lands provide undisturbed corridors and elevation gradients in an otherwise fragmented landscape for species migration.

**Providing ecosystem services.** Wilderness provides many goods and services that benefit people in surrounding landscapes, such as fresh water, erosion control and carbon sequestration. Free ecosystem services will likely be increasingly important under a changing climate. For example, in the western states, more than 50% of the water supply comes for National Forest System land and most headwater watersheds are located in wilderness. With projected changes in precipitation patterns and increasing temperatures across much of this area, the water that falls in wilderness headwaters will be increasingly important for surface and underground water recharge to municipal water systems.

**Fostering human-nature relationships.** Wilderness provides one of the last reminders of the human connection to the natural world. With the effects of climate change becoming increasingly apparent and our response to these effects becoming increasingly strident, wilderness is increasingly important as a place where a more mutualistic human-nature relationship contrasts with the human domination of nature so prevalent elsewhere.
6. What can managers do proactively to anticipate and respond to GCC?

Wilderness managers have expertise in synthesizing information and holistically managing the wilderness resource that transfers directly to formulating a response to global climate change. Such knowledge shepherding is incorporated in the USDA Climate Change Performance Scorecard which comprises actions agencies should undertake in response to Climate Change. Examples of actions wilderness managers can engage in are listed below. The listed actions implement or support Climate Change Performance Scorecard Elements as noted.

Identify Experts, Build Rapport and Acquire Knowledge
(Scorecard Elements 4-Integrate Science and Management & 5-External Partnerships)
Identify accessible scientific experts in fields such as: carbon sequestration and cycling; climatology; hydrology; botany, ecology and wildlife biology. Ask them to educate you and your employees about trends, current and projected effects of climate change and how resilience might best be supported in your wilderness. Educate them about the history and purpose of wilderness and discuss the implications of climate change for wilderness management. Ask them to keep you apprised of new findings. Examine areas of common interest where partnering may be mutually beneficial, such as with inventorying or monitoring efforts.

Identify and Assess Wilderness Ecosystem Services to be Managed for in Response to Global Climate Change.
(Scorecard Elements 6-Vulnerability Assessment & 8-Monitoring)
Identify and assess ecosystem services provided by designated wilderness areas. These are benefits afforded by natural ecosystem functions and they are aspects of wilderness character. Some ecosystem services may already be recorded as part of wilderness character monitoring; some may comprise newly considered aspects of wilderness character. For each service, assess the natural historic range of variability, the projected range of variability in the climate change context, current and projected statuses and trends, and the effects of anticipated drivers of change, including land management activities and human disturbances.

Assess Wilderness Species Vulnerability to Climate Change
(Scorecard Elements 6-Vulnerability Assessment & 8-Monitoring)
Develop and implement a strategy for assessing plant and wildlife species’ vulnerability to climate change. Species to be assessed may include: threatened, endangered and sensitive species; designated management indicator species; top-of-the-food-web predators; near-bottom-of-the-food-web converters of sun energy/plants to calories, and others. Much of this information already exists and simply needs to be marshaled into a unified format. List: each species’ minimum viable population and related habitat requirements; stressors from climate change; a species’ contributions to ecosystem services; a historic context for the species (how old is it; what climate fluctuations has it endured in the past); and how land management activities and human disturbances (other than climate change) might affect the species.
7. How does global climate change affect the scale at which we normally manage wilderness?

Responding to global climate change requires us to revisit our conventional managerial spheres of influence. A wilderness manager may have the most authority and familiarity within the designated boundaries of the wilderness areas they administer, and they may be able to affect good exercising their expertise within these bounds. However, the scale of global climate change requires a broad-based response: isolated efforts will not be sufficient to address impacts afflicting the entire globe. The scale at which we need to craft solutions is larger: it may be that managers need to consider the spatial and temporal scale within which ecosystem services, species and impacts occur and will migrate in response to GCC. This may necessitate an expanded collaborative management effort including other programs, agencies and publics.

8. In response to GCC, which management actions, under what circumstances, are appropriate to take in wilderness?

One of the first actions wilderness managers should undertake in response to climate change is to update and prioritize their program goals and objectives by addressing climate change considerations and applying the most up-to-date science. Examples of what this might require for wilderness include: adding measures to the Untrammeled and Natural aspects of wilderness character monitoring plans that encompass ecosystem services and species concerns such as minimum viable population and habitat/migration requirements; additional considerations for the Outstanding Opportunities and Undeveloped aspects; augmenting education plans, and ensuring the currency of plans that address climate change impacts, such as invasive plants and fire.

Wilderness managers should keep in mind that in the range of actions that can be undertaken as a response to climate change, many constitute conventional wilderness uses, such as educating, inventorying and monitoring. These actions require the normal sensitivity to minimizing impacts to the wilderness resource and visitors and may require Minimum Requirements Decision Guide and/or National Environmental Policy Act analyses.

When we consider more trammeling actions, such as relocating/introducing species to save them from extinction, or treating invasive plants/pests with chemical herbicides/pesticides, we must engage in a thorough critical analysis as described in the following section.
9. What process should be used to evaluate potential management actions in response to GCC?

To date, a process for evaluating potential management actions in response to global climate change has not been developed. Thus standing management protocol should be followed:

1. Wilderness managers should consult conventional authorities:
   a. The Wilderness Act and an area’s designating legislation;
   b. the Wilderness Management Plan and the Forest Plan;
   c. the National Environmental Policy Act of 1969 (check regularly for new Council on Environmental Quality rules on NEPA and climate change), and
   d. the Minimum Requirements Decision Guide.

2. Additionally, wilderness managers should consult recent guidance, such as:
   a. the USFS Climate Change Performance Scorecard, and
   b. the National Roadmap for Responding to Climate Change.

3. Lastly, wilderness managers should consult newer guidance as it is released.

10. When should actions not be taken in response to GCC?

Intentional inaction – allowing nature to function as she will – should always be a considered alternative when managers assess how to proceed in response to climate change. When inaction occurs, wilderness managers should clearly define it as either intentional inaction - allowing nature to function as she will - or as the inability to pursue a desired course of action due to lack of funds, staff, expertise, etc.

11. What considerations should be weighed in prioritizing where managers should focus their limited resources?

When conferring with experts, it will be necessary to establish a priority or triage list in terms of which ecosystem services and which species deserve the most attention. There are no extraneous dynamics or creatures in nature, but it may be that certain processes or species underpin ecosystem health and resiliency to a greater degree, and by supporting these, other processes and species will be sustained. To the extent possible, wilderness managers should plan for inconstant support and try to design flexibility into programs such that they can be resumed after a lapse or carried on with varying staff and budgets.
12. How should proposals to conduct research activities in wilderness related to GCC be evaluated?

Scientific use, like recreation and education, is one of the public purposes of wilderness. As with all of the public purposes noted in the Wilderness Act, research is to be permitted except where it unacceptably degrades wilderness character. As with recreation use, some impacts from science can be accepted in order to realize scientific values; but there is a limit. Wilderness stewards need to evaluate research proposals and make good decisions about whether the research being proposed degrades wilderness character unacceptably. A process for doing so has been developed and can be accessed on wilderness.net. Navigate to Management Tools, then Toolboxes, then Research and Scientific Activities. That toolbox contains a lengthy description of the framework for evaluating proposals, as well as a number of worksheets for conducting evaluations. These should give wilderness stewards all the tools they need to evaluate proposed research activities in wilderness, including climate change research.