



Statement of Stephen Saunders  
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Field Hearing on Climate Change and National Parks  
Subcommittee on National Parks  
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Thank you for the opportunity to testify before you today. I am Stephen Saunders, president of the Rocky Mountain Climate Organization, a Denver-based group working to bring about action to reduce the contributions and vulnerabilities of the interior American West to human-caused climate change. Our group is a mainstream coalition, with partners that include 14 local governments; Denver Water, the largest water provider in Colorado; five businesses, from the Aspen Skiing Company to Wright Water Engineers; and six nonprofits, from the Colorado Association of Ski Towns to Western Resource Advocates.

In 2006, the Rocky Mountain Climate Organization prepared, and released with the Natural Resources Defense Council, a report, “Losing Ground: Western National Park Endangered by Climate Disruption.” It addressed national parks in the 11 western states, and identified 12 that we believed to be at the greatest risk. RMCO is again working with NRDC on an updated and expanded report, for release later this year, on the effects of climate change on national parks across the country, not just in the West. I am a principal author of both reports.

Also relevant to my testimony today is my service from 1998 to 2001, during President Clinton’s second administration, as the Deputy Assistant Secretary of the U.S. Department of the Interior over the National Park Service and the U.S. Fish and Wildlife Service.

Of course, climate change is a global phenomenon, with global causes and effects. But its effects on national parks are a very appropriate focus. Our national parks preserve the very best of our natural and cultural heritages. To continue to provide for their continued enjoyment by future generations—to fulfill the central purpose of the parks—we have to understand and then address the threats to them. And in figuring out how to address a changed climate in our national parks, we also will learn some of what we need to know to address it everywhere. That, too, is in the best tradition of our national park system.

Human disruption of the climate is the greatest threat our national parks have ever faced. If we continue adding heat-trapping gases to the atmosphere in the way we now are, we could, for the first time, lose entire national parks. Both Dry Tortugas National Park and Ellis Island National Monument are barely above the current sea level, less than the three feet that the U.S. government has said is an appropriate planning scenario for human-caused sea-level rise in this

century. Most of Everglades National Park is also less than three feet above the sea level, and the rest is not much higher. All three parks could be lost to rising seas. Glacier National Park could lose all its glaciers. Joshua Tree National Park could lose all its Joshua trees. Saguaro National Park could lose all its saguaros. Virgin Islands Coral Reef National Monument could lose all its coral reefs. Mount Rainier National Park was recently closed for six full months because of heavy downpours and flooding, examples of the extreme weather now occurring more often.

How much the climate continues to change, and how much the national parks suffer these kinds of impacts, is still up in the air—more precisely, up to what we put in the air. Both climate disruption and its impacts on parks will be far greater if we continue stumbling into a high-emissions future. Or we can choose a lower-emissions future and avoid the worst projections of future climate change and its effects. Time is already running short, but it is still possible to bring down emissions sharply enough to ward off unacceptable changes. As the U.S. government recently said in an important, new overall report on climate change, that will require stabilizing atmospheric levels of heat-trapping gases about where they now are, adding no more additional pollution than can be removed by natural processes.

I am convinced we can and will do that. One of the many, many reasons to do so is to avoid unacceptable effects on the national parks that Americans love. Let me describe just some of those impacts, with a particular focus on national parks in Colorado. And let me point out at the outset that in our 2006 report, “Losing Ground,” we identified both Rocky Mountain and Mesa Verde national parks as among the 12 western parks most at risk to the effects of an altered climate.

In Colorado and the rest of the interior West, many of the impacts of climate change flow from its two key manifestations—as a result of heat-trapping gases, it will be both hotter and drier here. Not all regions will get drier. Generally, the wetter parts of the globe are expected to get wetter and the drier parts drier. Here, we already are seeing reductions in snowpack, earlier snowmelt, and reduced streamflows. Of particular significance is the projection of scientists that the flows of the Colorado River, which begins in Rocky Mountain National Park, will be diminished by perhaps 4 to 14 percent in this century.<sup>1</sup> This is of great significance not only to the one-tenth of all Americans who depend on the Colorado River for water supplies, but also to the ecosystems of the national parks in the Colorado River basin, the largest such concentration in the national park system.

**Plant communities.** The greatest impacts of climate change in Rocky Mountain National Park, as in many parks, probably will be large changes in the park’s plant communities—especially a loss of forests, a loss of tundra, a loss of meadows, and a loss of wildflowers.

We already are losing today’s forests in Rocky Mountain because of a changed climate. To begin with, the Intergovernmental Panel on Climate Change has warned us that it is “very likely” that pest and disease outbreaks in forests will be increased by global warming. A prominent example is the mountain pine beetle epidemic now in the process of killing virtually every mature lodgepole pine tree in Rocky Mountain National Park. The National Park Service has acknowledged that the mountain pine beetles’ “prevalence is likely a direct effect of climate change.”<sup>2</sup> Our forests are now susceptible to a widespread outbreak of beetles, because we have

huge stands of the mature trees the beetles favor, in large part because of previous fire-fighting efforts. Some type of outbreak of mountain pine beetles, a natural occurrence in these forests, is inevitable in these conditions. But the extent of the current episode and the speed with which it has spread are not natural. They have been made possible by human-caused climate change. The warmer winters we already are experiencing have removed the periods of deep winter cold that have served as natural checks on beetle populations. And warmer temperatures in their active seasons have allowed the beetles to both go higher up the mountains and expand their populations more quickly than is natural. In particular, in lodgepole forests between 9,500 and 11,000 feet high, beetles used to take two years to complete their life cycle; now they are able to produce a new generation in a single year.<sup>3</sup> This has enabled this epidemic to spread so far and so fast, including over mountain ranges that used to serve as natural barriers stopping or slowing previous outbreaks.

Also recently linked to a changed climate is a rapid dieback of aspen trees that scientists have labeled “sudden aspen decline.” Beginning in 2004, people began to notice that aspen trees in Colorado, particularly in the southwestern part of the state, were dying in large numbers and that the dead trees were not regenerating as usual through new trees growing from the roots of the old. This aspen dieback has increased rapidly, with the affected acreage in Colorado having increased four-fold between 2006 and 2008. Aspen die-off has also been observed in northern Arizona, southern Utah, and Montana. Research by the U.S. Forest Service has linked the sudden aspen decline in Colorado to the hotter and drier conditions that represent an altered climate in the interior West.<sup>4</sup> The emblematic aspens of the West, including those near here in Rocky Mountain National Park, could be at risk.

A loss of other kinds of forests has occurred in Mesa Verde National Park and elsewhere in the Southwest, where a combination of hotter and drier conditions and another beetle, the piñon ips bark beetle, has led to widespread forest dieback in the piñons of the piñon-juniper forests that are of the dominant forest type of the Colorado Plateau. In just the two years of 2002 and 2003, beetles killed 90 percent of the piñon pines in studied portions of Mesa Verde and of Bandelier National Monument in New Mexico. Researchers have attributed the underlying cause of the piñon die-off to climatic factors, as sustained heat and drought left the trees particularly vulnerable to bark beetles. More trees died than during an even drier period in the 1950s, pointing the researchers to the higher temperatures of the recent drought as the key factor in the extent of the recent forest die-off.<sup>5</sup>

Perhaps most ominous, a recent study of undisturbed forest plots across the West found that all types and ages of trees are dying at higher rates, “with regional warming and consequent drought stress being the most likely drivers.” Led by two U.S. Geological Survey scientists stationed in Sequoia and Kings Canyon national parks, a team of researchers examined records of 76 undisturbed forest plots in which all individual trees had been counted in census records going back as far as 1955. The studied forests were in Yosemite and Sequoia/Kings Canyon national parks in California and elsewhere across the West, including in Colorado. Almost all plots had experienced an increase in overall tree mortality, including both young and old trees. In the Northwest, the tree mortality rate had doubled in 17 years; in the interior West, in 29 years. The researchers believed that higher temperatures and drier conditions—again, manifestations of a changed climate—were the reasons for the accelerated tree deaths.<sup>6</sup> This study builds on earlier

work by the same two USGS researchers showing increasing tree mortality in Sequoia/Kings Canyon and Yosemite national parks. Based on that work, they warned:

if forests in the Sierra Nevada are as sensitive to increasing evaporative demand as our findings imply, they may now be poised for die-back during otherwise normal periods of reduced precipitation, similar to the recently documented die-back in the piñon-juniper woodlands of south-western North America. But even in the absence of periods of significantly reduced precipitation, continued temperature-driven changes in mortality rate have the potential to dramatically alter forests.<sup>7</sup>

A loss of mountaintop tundra may well be another change in plant communities resulting from a hotter climate. For Rocky Mountain National Park, home to the largest expanse of alpine tundra in the United States outside of Alaska, one group of scientists projected that warming of 5.6°F could cut the park's area of tundra in half and that of 9 to 11°F of additional heat could virtually eliminate it, as forests move upslope.<sup>8</sup> In Glacier National Park, where there has been an effort to study changes in the extent of tundra, scientists using repeat photography have documented that trees just below timberline have already begun to grow more upright and have filled in forest edges.<sup>9</sup>

Other changes in plant communities include a loss of mountain meadows, which exist where the combination of heavy snow cover in the winter and a short growing season in the summer keep tree seedlings from surviving. Scientists have predicted that a hotter climate will reduce snow cover and extend the growing season, shrinking alpine meadows. I know of no studies yet in Rocky Mountain National Park, but scientists have already detected a loss of mountain meadows in Glacier, Olympic, Sequoia/Kings Canyon, and Yosemite national parks.<sup>10</sup>

Scientists also have documented how higher temperatures suppress the growth of mountain wildflowers. Researchers at the Rocky Mountain Biological Laboratory near Crested Butte, Colorado—the official wildflower capital of the state—have found that using heat lamps to warm mountain test plots by 4°F leads to a substantial reduction in wildflowers and their replacement by sagebrush, normally found in lower-elevation, dryer areas.<sup>11</sup>

To step back from the scientific studies and put this in its proper perspective, earlier this month I sat on a log at the edge of Mill Creek Basin in Rocky Mountain National Park, reveling in that meadow and its profusion of wildflowers, set off against a backdrop of aspens and, behind them, a pine-forested mountainside. I thought that I had better let this scene really soak into my memory, because each of those elements—the meadow, the wildflowers, the aspens, and the pines—are already being disrupted by the changes we are making in our climate. And I feared that my children may not be able to enjoy such a scene in their adult lifetimes.

**Wildlife.** An altered climate also will change the wildlife species in our parks. At particular risk are alpine species that can run out of higher elevations to climb to find cooler conditions. Rocky Mountain National Park's tundra along Trail Ridge Road has what has long been one of the most accessible and famous populations of white-tailed ptarmigan in the country. In just two decades, however, the numbers of this local population have been cut in half, and researchers predict their extinction in the park by mid-century if temperatures rise as predicted.<sup>12</sup> I've been going up there

for over three decades, and I certainly notice the change in the ptarmigan numbers. Pikas, little known across much of the country but well known to visitors to Trail Ridge Road, are not able to survive even short periods of temperatures above 75°F or so. Across the West at elevations lower than on Trail Ridge Road, some local pika populations have already disappeared.<sup>13</sup> The U.S. Fish and Wildlife Service is currently considering whether pikas should be listed for protection under the Endangered Species Act because of the threat to them of a hotter climate. In Yosemite National Park, about half of small mammal species are now found at different ranges of elevation than early in the last century; on average, the range of the mammals is now about 500 yards higher.<sup>14</sup>

Mountaintop species are not the only vulnerable ones. In Mesa Verde National Park, the Mexican spotted owl—a threatened species—is disappearing from the park. The park’s chief of natural resources attributes this to the drier conditions so far this century—conditions consistent with the hotter and drier effects of climate change in the interior West.

**Fishing.** Some of the best trout fishing in the western United States is in our national parks, including Rocky Mountain. But trout are cold-water fish, and higher temperatures could lead to losses of western trout populations exceeding 60 percent in certain regions by 2050.<sup>15</sup> At Yellowstone, the extreme heat of July 2007 led the National Park Service to close 232 miles on 17 prime fishing rivers during afternoons. The high temperatures killed enough trout to produce the largest fish kill in the park’s history. A park biologist predicted that it would become the norm for the future.

**Overcrowding.** As temperatures soar with a changed climate, to escape the oppressive heat people may well flock to cooler mountain parks, overcrowding them. In Rocky Mountain National Park, a survey of park visitors suggests that under the climate conditions projected by 2020 enough visitors would come more often and stay longer to increase the number of visitor days each year by more than one million—nearly a one-third increase.<sup>16</sup> So far, there has been little attention paid by the National Park Service or others on how higher temperatures may increase summer visitation to cooler parks, national seashores, and national lakeshores—or on how that increased visitation can be accommodated. In Canada, researchers concluded that heat-driven increases in visitation to Canadian national parks could be so large that "parks that already report visitor-related ecological stress would require more intensive visitor management, perhaps including strategies such as de-marketing, visitor quotas, and variable pricing for peak periods."<sup>17</sup> I am not advocating those particular measures, just using these suggestions to illustrate that the effects of increased visitation could be significant enough to necessitate real responses of some kind.

**More wildfires.** The U.S. government, in its overview report this year on climate change, noted, “In the western United States, both the frequency of large wildfires and the length of the fire season have increased substantially in recent decades, due primarily to earlier spring snowmelt and higher spring and summer temperatures.” Wildfires can disrupt summer vacations for park visitors. In the summer of 2002, when hot and dry conditions combined to produce Colorado’s worst fire season in history, the number of July visitors to Rocky Mountain National Park dropped by nearly 100,000 from the previous year, even without any fires in the park itself. Two

years earlier, in Mesa Verde National Park, two back-to-back fires burned more than half the park and closed it to visitors for nearly three weeks.

I am afraid that I could go on at even greater length, detailing other ways in which climate change is affecting our national parks, from a loss of glaciers, snowfields, and opportunities for winter recreation to a loss of historical and archaeological resources. Instead, though, let me turn to what the National Park Service should be doing about all this.

**Recommendations for NPS actions.** When it comes to protection of the resources and values of the national parks, the National Park Service has an obligation under law, its own policies, and its long, proud tradition of environmental stewardship to take a leading role. “The Service will use all available authorities to protect park resources and values from potentially harmful activities,” the NPS *Management Policies* boldly declares. Sadly, the NPS has not yet followed its creed and exercised its authorities to address human disruption of the climate and its effects, the greatest threat ever to park resources and values. As the U.S. Government Accountability Office concluded in 2007 about the Park Service and other federal natural resource management agencies, they:

have not made climate change a priority, and the agencies’ strategic plans do not specifically address climate change. Resource managers focus first on near-term, required activities, leaving less time for addressing longer-term issues such as climate change. In addition, resource managers have limited guidance about whether or how to address climate change and, therefore, are uncertain about what actions, if any, they should take. In general, resource managers lack specific guidance for incorporating climate change into their management actions and planning efforts. Without such guidance, their ability to address climate change and effectively manage resources is constrained.

Too often, the NPS has so far just looked the other way when it comes to climate-change impacts. In preparing in 2000 a management plan for Dry Tortugas National Park, at risk of being totally submerged by rising seas, the Service wrote about climate-change risks and what to do about them: “These external forces are beyond the scope of this plan.”

Fortunately, change is already underway at the National Park Service. President Obama’s choice as NPS Director, Jon Jarvis, when he was Regional Director of the Service’s Pacific West Region, established the strongest record of leadership on climate of any senior NPS manager. I hope and expect that Director Jarvis will bring the same vision to his management of the entire Service, and am confident that if he does he will be met by enthusiastic support from other NPS managers and employees. I know that frustration is widespread within the Service about its failure so far to take a leading role in addressing climate change. With proper leadership, I believe that the National Park Service will live up to its proud history in taking on this major challenge.

But I certainly do not think that Congress, or the American people, should just blindly trust that there will be the needed changes. It seems entirely prudent to me for this Subcommittee to hold a thorough oversight hearing on what I expect will be major new Park Service plans to address

climate change, once Jon Jarvis is confirmed and he and Secretary Salazar have had a chance to develop those new plans.

An agenda of actions that would be appropriate for the National Park Service in addressing a changing climate and its effects on national parks includes the following.

**Making climate change a priority.** Human-caused changes in the climate are the greatest threat ever to national parks, and the National Park Service should act accordingly. Particular recommendations are:

- The NPS Director should issue a Director's Order making it clear that addressing climate change and its impacts is among the highest priorities throughout the Service. The Order should launch action on some of the particular recommendations outlined below.
- The NPS should amend its Management Policies to incorporate specific references to management responsibilities with respect to climate change and its impacts in parks.
- The Park Service should have a separate NPS climate change office within the Service, to ensure crosscutting support for Service actions to address climate change and its impacts in parks. The Administration requested a modest \$800,000 for such an office for next fiscal year, but the House appropriations bill would block that new office.

**Expanding scientific knowledge.** Identifying and monitoring climate change effects on key resources of national parks are not only essential for protection of those resources, but also important for a broader understanding of climate change effects in the world at large. National parks are areas with spectacular resources, usually much less affected by human activities and other stresses than other lands; the parks provide some of our very best opportunities to learn how climate change is affecting and will affect natural and cultural resources. Much of the research I have cited above, such as about a loss of today's forests, represents not just what we know about those effects in national parks, but all of what we know about those effects anywhere. Specific recommendations:

- The NPS should identify in every park the resources and processes at risk from climate change. This need not await full park management planning efforts; it can be accomplished through summaries of the literature, guided research, gatherings of experts, and simple brainstorming. Climate Friendly Parks workshops (see below) are a beginning.
- The NPS should review its Inventory and Monitoring Program, in which every national park has established a number of vital signs for monitoring change over time; these should be reviewed to ensure they adequately include the impacts of climate change. If not—and I fear that will nearly always be the case—the vital signs and the monitoring plans should be updated.

**Planning and managing to protect resources.** According to the Service's *Management Policies*, "NPS managers must always seek ways to avoid, or minimize to the greatest degree

possible, adverse impacts on park resources and values.” To do this in the case of climate change and its impacts, specific recommendations are:

- The NPS should develop park-specific and resource-specific plans for protection of the resources most at risk in individual parks.
- The NPS should be innovative in considering and using a broad array of tools, including unconventional ones, to preserve resources most at risk in individual parks. Protected corridors to allow migration of species between areas of changing habitat may often be necessary, which would require cooperative action with other land managers. Experience with ecosystem-wide approaches such as the one by different federal agencies through the Greater Yellowstone Coordinating Committee should be examined for lessons that can be applied to deal on a landscape-wide scale with climate change and its impacts.
- The NPS should plan for different possible future scenarios—plausible conditions that could occur but may not. To await certainty in what the future will bring may take away the ability to address it in a sufficient and timely manner.
- The NPS should consider the combined effects of climate change and of other stresses on park resources and values and work to reduce those other stresses when doing so may ease the effects of climate change.

**Reducing emissions.** National parks are among the most important places to concentrate efforts to reduce emissions of heat-trapping gases, because successful actions there can inspire the millions of Americans visiting the parks to make and support similar efforts elsewhere. Specific recommendations:

- The NPS should work to reduce the emissions from its own operations, on a Service-wide basis, as undertaken in the Pacific West Region through Regional Director Jarvis’s Climate Change Leadership Initiative.
- The NPS should give an even greater priority to reducing emissions from visitor activities than from its own operations, as emissions from visitor activities dwarf those from NPS operations.
- The NPS and Congress should review the Federal Lands Recreation Enhancement Act to consider the use of funds from national park entrance and recreation fees to address climate change and its impacts in national parks, so long as information on those expenditures and their purposes and accomplishments is communicated to park visitors.

**Expanding Climate Friendly Parks.** Fifty-three national parks (out of 391) have held an initial workshop in the Climate Friendly Parks program, NPS’s most visible climate-change initiative to date. That program is a partnership between NPS and the U.S. Environmental Protection Agency to help those parks protect their natural and cultural resources from climate change. Twenty-three have conducted an inventory of their emissions of heat-trapping gases, and 16 have action plans to reduce their emissions. That is a start, but clearly more can be done. Recommendations:

- The NPS should make a national commitment and develop a schedule to expand the Climate Friendly Parks program to all parks (with exceptions only for those few parks with small enough operations and visitation where doing so would not make sense.)
- The NPS should post online summaries of all Climate Friendly Parks workshops in particular parks. (Not all now are posted.)
- The NPS should post online all emission inventories and climate action plans for parks for which they are completed. (Not all now are posted.)

**Communicating with others.** With 275 million visitor-days of visitation to national parks in 2008, the NPS has an enormous, unique opportunity to communicate what climate change may do to us and what we can do about it. Recommendations:

- NPS officials, beginning with the Director, should speak out publicly about the threats that climate change and its impacts pose to national parks. The NPS *Management Policies* state that when park resources and values are at risk from external threats, “It is appropriate for superintendents to engage constructively with the broader community in the same way that any good neighbor would . . . When engaged in these activities, superintendents should promote better understanding and communication by documenting the park’s concerns and by sharing them with all who are interested.”
- NPS should require concessionaires in a position to provide environmental education to park visitors (and many are required to do so) to provide information on climate change and its effects in national parks and what NPS and the concessionaires are doing to address them.

**Partnering with other agencies and organizations.** Much of the best work done in national parks to understand climate change and its effects is done by others besides the NPS, including the U.S. Geological Survey, universities, and others. Cooperation with other federal, state, and local natural resources agencies and land managers can also be more important than ever in dealing with the broad-scale effects of climate changes. A recommendation:

- The NPS should continue and even expand its cooperative efforts with other researchers, land management agencies, and others to address climate change and its effects in national parks and surrounding lands.

**Exercising international leadership.** The National Park Service is the best-known and most respected natural resource management agency in the world. A recommendation:

- The NPS should exercise leadership in promoting cooperation and communication among natural resource management agencies around the world in how to address climate change and its impacts in protected areas.

In taking these actions, the National Park Service will need support from this Subcommittee, Congress as a whole, and, especially, the American people. We Americans deeply love our national parks, and have always rallied around when they have been in peril. Now, more than ever, is such a time.

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<sup>1</sup> M. Hoerling and others, “Reconciling projections of Colorado River streamflow,” *Southwest Hydrology* 8, no. 3 (2009), pp. 20-21, 31.

<sup>2</sup> Continental Divide Research Learning Center, Rocky Mountain National Park, National Park Service, “Climate change in Rocky Mountain National Park: Preservation in the face of uncertainty,” 2008, [http://www.nps.gov/romo/parkmgmt/upload/climate\\_change\\_rocky\\_mountain2.pdf](http://www.nps.gov/romo/parkmgmt/upload/climate_change_rocky_mountain2.pdf).

<sup>3</sup> Colorado State Forest Service, Colorado Department of Natural Resources, “2006 Report on the Health of Colorado’s Forests,” p. 15, <http://csfs.colostate.edu/pdfs/06fhr.pdf>.

<sup>4</sup> J. J. Worrall and others, “Rapid mortality of *Populus tremuloides* in southwestern Colorado, USA,” *Forest Ecology and Management* 255 (2008): 686–696, [http://www.fs.fed.us/r2/fhm/reports/sad\\_2008.pdf](http://www.fs.fed.us/r2/fhm/reports/sad_2008.pdf).

<sup>5</sup> D. D. Breshears and others, “Regional vegetation die-off in response to global-change-type drought,” *Proceedings of the National Academy of Sciences* 102, no. 42 (2005): 15144-15148.

<sup>6</sup> P. J. van Mantgem and others, “Widespread increase of tree mortality rates in the western United States,” *Science* 323 (2009): 521-523.

<sup>7</sup> P. J. van Mantgem and N. L. Stephenson, “Apparent climatically induced increase of tree mortality rates in a temperate forest,” *Ecology Letters* 10 (2007): 909–916.

<sup>8</sup> N. Hobbs and others, “Future impacts of global climate on Rocky Mountain National Park: Its ecosystems, visitors, and the economy of its gateway community – Estes Park” (2003), pp. 16-17, [http://www.nrel.colostate.edu/projects/star/papers/2003\\_final\\_report.pdf](http://www.nrel.colostate.edu/projects/star/papers/2003_final_report.pdf).

<sup>9</sup> D. B. Fagre, “Spatial changes in alpine treeline patterns, Glacier National Park, Montana,” [http://www.nrmsc.usgs.gov/research/treeline\\_rsrch.htm](http://www.nrmsc.usgs.gov/research/treeline_rsrch.htm).

<sup>10</sup> D. B. Fagre and D. L. Peterson, “Ecosystem dynamics and disturbance in mountain wildernesses: Assessing vulnerability of natural resources to change,” *Climatic Change* 59, nos. 1-2 (2003): 74-81. C. Millar and others, “Response of subalpine conifers in the Sierra Nevada, California, U.S.A., to 20th-century warming and decadal climate variability,” *Arctic, Antarctic and Alpine Research* 36 (2004):181-200.

<sup>11</sup> T.J. Perfors, J. Harte, and S. Alter, “Enhanced growth of sagebrush (*Artemisia tridentata*) in response to manipulated ecosystem warming,” *Global Change Biology* 9, no. 5 (2003): 736-742. F. Saavedra and others, “Changes in flowering and abundance of *Delphinium nuttalianum* (Ranunculaceae) in response to a subalpine climate warming experiment,” *Global Change Biology* 9, no. 6 (2003): 885-894.

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<sup>12</sup> Hobbs and others; see note 1.

<sup>13</sup> E. A. Beever and others, "Patterns of apparent extirpation among isolated populations of pikas (*Ochotona princeps*) in the Great Basin," *Journal of Mammalogy*, 84, no. 1 (2003): 37-54.

<sup>14</sup> C. Moritz and others, "Impact of a century of climate change on small-mammal communities in Yosemite National Park, USA," *Science* 322(5899) (2008): 261-264.

<sup>15</sup> U.S. Global Change Research Program, *Global Climate Change Impacts in the United States* (2009), p. 87.

<sup>16</sup> R.B. Richardson and J.B. Loomis, "The Effects of Global Warming on Mountain Tourism: A Contingent Behavior Methodology," prepared for Hobbs and others; see note 1.

<sup>17</sup> B. Jones and D. Scott, "Climate change, seasonality and visitation to Canada's national parks," Department of Geography, University of Waterloo, Waterloo, Ontario (2005), p. 2, <http://lin.ca/Uploads/cclr11/CCLR11-132.pdf>.