



# Recreation

## Introduction

Outdoor recreation is the most ubiquitous and popular activity that is supported by America's public lands, and is an essential way that people interface with America's natural and cultural heritage (White et al. 2016, Cutler et al. 2017). Federal lands are host to over 938 million recreational visits per year (White et al. 2016). Recreation is also an economic driver in its own right, supporting more than 6.1 billion jobs, and generating an estimated \$646 billion in spending per year (White et al. 2016). Climate change will alter the opportunities and demand for outdoor recreation and the infrastructure that supports it in a number of ways. These include challenges to the sustainability and local feasibility of snow-based recreation given predicted changes in natural snowpack; opportunities for an expanded warm-weather recreation season given predicted increases in temperature; and evolving risks to recreationists themselves in the form of extreme weather events; the proliferation of disease-bearing insects and noxious plants; potential road, trail, and bridge failures; and the incidence of heat-induced and other climate-related illnesses.

## Likely Changes

Climate change in the 21st century has generated warmer temperatures and associated alterations in climate phenomena, including precipitation, snow accumulation, extreme events, and wildland fire. Though regional variations occur in terms of how climate change may impact the recreational experience overall, the following paragraphs summarize some of the broader impacts that can be expected in large parts of the United States.

The duration of natural snow cover has decreased and is projected to continue to decrease in the 21st century throughout the northern hemisphere as a result of warmer temperatures and alterations in precipitation (Brown and Mote 2009, Pierce et al. 2008, Wobus et al. 2017). Though winter precipitation in much of the United States is expected to increase, more will come in the form of rain, including rain-on-snow events, which increases the rate of snowmelt. In short, climate change projections anticipate shorter winters with less snow. This will place stress on all forms of winter recreation in the United States, including downhill skiing, cross-country and back-country skiing, snowmobiling, dog-sledding, snowshoeing, and ice-climbing. Snowmobiling and back-country skiing in particular are projected to see marked declines in both participation rates and user days (USDA 2016, White et al. 2016), with potentially acute economic impacts to communities in New England and the upper Midwest. Developed ski resorts, especially those at lower elevations, represent an investment in infrastructure that is highly vulnerable to the effects of a changing climate. The ski industry at large has been listed as one of the most vulnerable industries to climate change, and can be expected to continue its trend of contraction and consolidation (Scott and McBoyle 2007, Dawson and Scott 2012). A longer warm-weather recreational season is being experienced in many



parts of the country, as earlier spring snowmelt and later winter onset produce conditions that are conducive to shoulder-season access into areas at times of the year that had previously been impassable due to snow and soil saturation. The sheer number of recreationists will increase in step with the general trend of population increase, while per capita participation in certain activities, such as interpretive site visitation, motorized and nonmotorized water-based activities, and fishing, is also expected to increase regionally given the projected impacts of climate change (USDA 2016). With increases in both the numbers of recreationists and the length of the warm-weather recreation season, the capacity of public lands to accommodate demand will be tested both in terms of staff, many of which are seasonal hires, as well as infrastructure. Access issues and overcrowding may be felt most acutely in the area of water-based recreation, rates of which are projected to generally increase while reservoir levels and baseline summer streamflow in much of the country are concurrently projected to decrease (USDA 2016, Ho et al. 2018).

Evolving risks to recreationists and the infrastructure that supports them come in multiple forms. Increased total amount and intensity of precipitation in the Northeast and the Upper Midwest, and an altered hydrologic regime in the Pacific Northwest, stand to test the limits of existing infrastructure. Many of the roads, trails, campgrounds, and other infrastructure that support recreational activities were built near water in areas prone to high soil moisture and flooding. Much of this infrastructure was constructed in a manner that restricted stream-channel flow and reduced floodplain connectivity, which today has produced an inability to adequately accommodate higher peak flows and flooding, especially during extreme precipitation events (Strauch et al. 2015). While these roads and trails have become the principal means of recreational access to public lands, hydrologic extremes have also become more recurrent, creating a situation in which access “is increasingly compromised by interrelated climate change impacts (Strauch et al. 2015).” The continued maintenance of this infrastructure stands to increase in frequency and cost, especially in heavily trafficked areas, as extreme precipitation events become more common (Shannon et al. in review).

Warmer temperatures and greater rainfall both create conditions that are conducive to the expansion of the range and intensity of public health threats (APHA 2015). The incidence of Lyme disease, an illness transmitted by a bacterium found on ticks of the genus *Ixodes*, has risen exponentially in the eastern United States (Wake et al. 2014). Reports of the disease in Maine, for example, have gone from approximately 12 per year in the early 1990s to over 1,100 in 2012 (APHA 2015). Impacts of climate change also project a longer pollen season throughout much of the United States, with associated impacts to those suffering from allergies, respiratory impairments, and asthma (APHA 2015). Finally heat-related illnesses, including dehydration, heat exhaustion, and exertional heat stroke, can be expected to increase as exposure to extreme heat also increases across the country (Noe et al. 2013). Outdoor activities may need to adjust in order to accommodate these risks.

## Management Challenges and Opportunities

It can be reasonably assumed that recreationists will find ways to take advantage of new opportunities when and where they present themselves in the form of shorter winters, longer shoulder seasons, new technologies and equipment, new forms of communication, and even climate-related phenomena that become recreational destinations in their own right, such as glacial caves found within retreating glaciers. In order to remain relevant to the public they serve, land managers are challenged to be adaptive to shifting demands, demographics, and use trends. Other major challenges that recreation professionals currently face given future projections of climate change include:

- Climate-induced stress on roads, trails, facilities, campgrounds, and other infrastructure;
- Ecological damage (e.g. high-velocity run-off, erosion, or landslides) exacerbated by inadequate infrastructure that is unable to accommodate regional increases in precipitation and storm surges;
- Managing the demands of a longer shoulder season and higher numbers of visitors given staffing and budgetary constraints;
- Addressing an uncertain future for lower-elevation winter recreation destinations;
- Accommodating projected increases in water-based recreation while reservoir levels and baseline summer streamflows are concurrently projected to decrease; and
- Accounting for the health and safety of staff and visitors alike.

Options for adaptation can be organized along the continuum of resistance, resilience, and transition. Resistance generally comes in the form of taking action to ensure the persistence of a recreational site or opportunity given its dependence on the local context or character, or due to political or social factors. Examples include:

- Shoreline and riparian stabilization in the vicinity of vulnerable infrastructure, i.e. National Seashores, valley roads, or campgrounds in floodplains;
- Use of climate-resistant materials and designs, i.e. permeable pavement, elevated structures or boardwalks, or hardened road and trail surfacing;
- Use of technological innovations, such as high-efficiency snowmaking equipment at winter recreation areas or early warning systems to alert visitors to impending hazards; and
- Protective measures, such as fuelbreaks and defensible space around infrastructure in fire-prone areas.

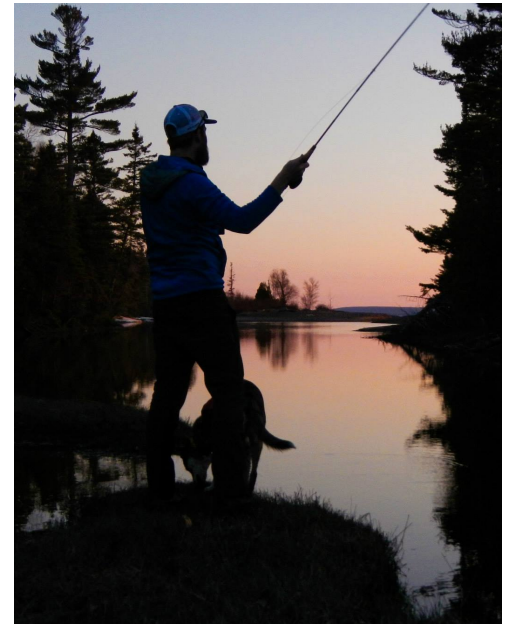
Resilience generally comes in the form of adaptive actions that address risks and impacts and accommodate some degree of change. Examples include:

- Improve stormwater management systems on roads, trails, and infrastructure, i.e. bioretention features and other best management practices for surface water drainage and dispersement;

- Reinforce facilities and infrastructure to prevent or minimize impacts from extreme events, i.e. install bottomless arch culverts, improve existing bridges, or use stream-restoration techniques to dissipate stream energy associated with extreme precipitation events;
- Alter infrastructure and terrain (pitching trails away from prevailing direction of solar radiation, contouring to capture snowmelt and recycle it into snowmaking, creating snow caches, etc) to better capture and use natural snowfall at winter recreation areas, and offer snow-based options that are functional in lower-snow conditions;
- Be flexible in terms of staffing and access to account for shifting seasons of non-winter use and associated maintenance increases (Strauch et al. 2015, Ho et al. 2018); and
- Use communication tools that inform visitors of the reality of environmental change and align expectations with actual conditions (Buzinde et al. 2010).

Transition generally comes in the form of actions that anticipate and facilitate change. These actions could alter the form of infrastructure or the delivery of opportunities in a way that breaks from what could be considered conventional management. Examples include:

- Convert roads to trails where older roads are under-utilized and unsustainable;
- Decommission roads, trails, and campsites and remove culverts from areas vulnerable to climate-induced risks;
- Relocate existing infrastructure and opportunities to areas with less risk of climate-induced damage;
- Focus on four-season and non-skiing recreation at winter sports areas;
- Encourage alternative means of access , i.e. shuttle buses, ferry services, guided services, or reservation systems; and
- Plan for impermanence with temporary structures that can be relocated when necessary, i.e. open-air shelters or tents that can be packed down, portable piers, floating docks, etc. (Beavers et al. 2016).



## How to cite

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## Recommended Reading

*Climate Change Impacts in the United States: The Third National Climate Assessment*, J. M. Melillo, Terese (T.C.) Richmond, and G. W. Yohe, Eds., U.S. Global Change Research Program, 19-67. <https://nca2014.globalchange.gov>

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## Related Links

[The Journal of Park and Recreation Administration Special Issue on Climate Change.](#)

[National Climate Assessment, Climate Change Impacts in the United States](#)

[Climate Change and Your National Parks](#)

National Park Service Climate Change Response Program

National Park Service Cultural Resources Climate Change Strategy

NPS Coastal Adaptation handbook, case studies, and more

Resources Planning Act website

U.S. Global Change Research Program, Climate and Health Assessment

## **Research**

<https://www.globalchange.gov/> U.S. Global Change Research Program

## **Tools**

Climate Change Resource Center, Compendium of Adaptation Approaches

Adaptation Partners Adaptation Library

USDA Climate Hubs, Climate Risk Management Strategies: Recreation

USDA Climate Hubs, The Effects of Drought on Recreation and Wilderness

U.S. Forest Service “Climate Change Vulnerability Assessments Across the Nation” Storymap

U.S. Forest Service “Snow Drought in the 21st Century” Storymap

Webinar: "Effects of Drought on Recreation and Wilderness"

Climate Adaptation Knowledge Exchange

Climate Change Atlas

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