Chapter 11

# Outdoor Recreation and Wilderness

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Forests and rangelands, along with other natural resources and open space, provide opportunities for U.S. residents and visitors to participate in outdoor recreation. In this Resources Planning Act (RPA) Assessment chapter, we focus on outdoor recreation that is nature-based—specifically, those activities where natural resources, such as forests, rivers, and rangelands, are central to the recreation experience. Recreation is a primary means through which people in the United States interact with these natural resources. Recreational use of forests, water, rangelands, and other natural resources is considered here, just as we consider the use of natural resources to provide for timber, grazing, or carbon sequestration elsewhere in the RPA Assessment. In this chapter we describe (1) the current supply of recreation opportunities in the United States and how future population and land use changes may influence that supply, (2) recent patterns of outdoor recreation across the United States, and (3) projected future patterns in outdoor recreation in the conterminous United States under a range of future scenarios that integrate socioeconomic and climatic change.

## Key Findings

- Publicly managed recreation resources, at all levels of government, provide most opportunities for outdoor recreation.
- Per capita participation in outdoor recreation activities has been relatively stable in recent years, but population growth has led to an increase in the number of participants.
- Forest recreation resource availability, per capita, is expected to continue to decline in future decades for locations experiencing population growth.
- Greater income and population growth generally result in higher rates of per capita participation in outdoor recreation.
- Continued population growth results in a greater number of outdoor recreation participants, even potentially offsetting any declines in per capita participation.
- Greater atmospheric warming is projected to have a negative influence on recreation engagement in many activities and little positive influence.
- Projections of consumption, measured as annual days of recreation, show increases across most activities, with the greatest numbers of recreation days in activities of a general or broadly accessible nature, i.e., day hiking, viewing nature, developed site use, and developed site camping.

## Outdoor Recreation Resources

- ❖ Forests and other natural resources offer abundant public and private outdoor recreation opportunities.
- ❖ Data on the number and types of recreation resources in the United States are limited, especially for local-government-managed lands and privately owned forests and rangelands.
- ❖ Federal lands and Wilderness are disproportionately located in the West, offering greater acreage under public management for outdoor recreation, especially in dispersed settings, undeveloped experiences unique to designated Wilderness, and national parks and associated areas managed by the U.S. National Park Service.
- ❖ Private lands can offer unique recreation opportunities, but those opportunities are often available only to owners and their friends and relatives or those who can purchase access.
- ❖ Increased frequency and severity of disturbance resulting from climate change may reduce the availability and condition of recreation opportunities.

Forests, rivers, rangelands, and other natural resources provide settings conducive to outdoor recreation. Just as current and projected forest conditions define the potential supply of timber, wildlife habitat, and carbon sequestration, the extent and characteristics of natural resources, now and in the future, define the opportunities that people have (and will have) to engage in outdoor recreation. Outdoor recreation pursuits are diverse, with the environments and conditions necessary for engaging in outdoor recreation equally variable. Some activities, such as fishing and canoeing, require a specific type of resource (water) while other activities, such as hiking or viewing nature, can take place in a range of settings (e.g., forests, rangelands, and urban open space). In addition to the diversity in resource needs for outdoor recreation, outdoor recreationists themselves are diverse in their desires for various settings to recreate. We characterize recreation supply across a variety of land ownerships and natural resource types in order to recognize this diversity.

### Public Land Resources

From town parks to State parks to national forests, public lands for recreation are provided at every level of government: local, county, State, and Federal. In the United States, we often look to publicly owned lands as primary providers of places for outdoor recreation. The recreation opportunities offered by governments differ in their natural settings, locations relative to population centers, and types.

**Local—**There is no comprehensive enumeration of the extent or location of outdoor recreation resources managed by local governments. These public lands can range from small "pocket parks" that provide for short respites, to larger urban parks where people picnic, walk/hike, or relax, to county park systems that offer a myriad of recreation opportunities. Among public lands, those managed by local governments are typically the closest to population centers. For those living in or visiting urban and peri-urban areas, these public lands generally offer the most-accessible spaces for nature-based outdoor recreation. Local government public lands typically offer opportunities to engage in the most-popular outdoor recreation activities, such as walking/hiking, viewing nature and wildlife, and simply relaxing in the outdoors, and often accommodate those with a wide range of skills and abilities.

The most extensive data on outdoor recreation opportunities managed by local governments come from The Trust for Public Land's annual City Park Facts. Those data provide insight into the characteristics of park and open-space resources in the 100 most-populated U.S. cities. In 2020, there were slightly more than 2 million acres of parks and open space in the 100 most-populated U.S. cities—many of those acres managed by State or Federal government agencies. In 2020, about 835,000 acres of parks and open space in the most populated U.S. cities were managed by local governments (The Trust for Public Land 2020). That land area has remained steady since 2017. Owing to a change in how City Park Facts data are collected, examination over a longer timeframe is not possible. The size of urban open spaces ranges widely, but most are relatively small. The median size of parks and open space in the 100 most-populated cities was 3.8 acres (The Trust for Public Land 2020). Seventy percent of the populations in the largest cities live within a 10-minute walk of an urban park (The Trust for Public Land 2018).

**State—**A variety of agencies in State governments manage lands and waters available to the public for outdoor recreation. Although outdoor recreation is central to the missions of State park agencies, other State-level agencies that focus on forestry, wildlife, land conservation, or other natural resource uses also often provide public recreation opportunities. However, the acres available for recreation and the types of recreation opportunities offered by those other agencies are not well documented nationally. In general, our best understanding of recreation opportunities provided by State agencies comes from State parks and State forestry agencies.

In 2017, State park systems across the United States managed 18.7 million acres (Smith and Leung 2019). Among RPA regions (see figure 2-1 for RPA region designations), the North Region contains the greatest State park acreage (8.2 million), followed by the Pacific Coast

Region (5.3 million) (table 11-1). Across the entire United States, the area of State park systems has increased steadily since the mid-1980s (Smith and Leung 2018). Between 2009 and 2017, the acreage of State park agencies increased by about 33 percent (Smith and Leung 2019); however, that increase primarily reflects mergers of other State agencies into State park systems, rather than movement of lands into public ownership or changes in public access. The greatest increases in State park agency acreage have taken place in the RPA Rocky Mountain Region (1.4 million acres, 102 percent) and the RPA North Region (3 million acres, 57 percent). For the Rocky Mountain Region, the increase in acreage traces primarily to an approximately 1-million-acre increase following the merger of Colorado State Parks and Colorado Division of Wildlife. In the North Region, the increase in acreage is driven by a 2.9-million-acre increase in the State park system of New York State, between 2013 and 2015, that resulted from changes in agency reporting. Expenditures for operating State park agencies in the United States totaled $2.6 billion in 2017 (Smith and Leung 2018). Although that is greater than the spending in the mid-1980s (after adjusting for inflation), the expenditures in support of State park operation have been declining year over year since the mid-2000s (Smith and Leung 2018).

State forestry agencies often have responsibility for managing recreation opportunities on State forests and other State lands. There are about 76 million acres of State-owned forests in the United States, and this acreage has remained steady to slightly increasing in recent years. Although there are a substantial number of acres managed by State forestry agencies, the workforce dedicated to managing recreation is limited. In 2018, across all State forestry agencies, fewer than 500 seasonal positions were dedicated to managing recreation (National Association of State Foresters 2019). Agencies in the RPA North Region accounted for the greatest numbers of seasonal positions focused on recreation. The number of seasonal employees dedicated to recreation has remained steady in recent years. In 2018, State forestry agencies spent about $43 million on recreation programs (National Association of State Foresters 2019), with State agencies in the North Region accounting for more than half of expenditures in support of recreation.

**Federal—**Seven Federal agencies provide the majority of recreation opportunities on federally managed lands. The diversity of recreation opportunities provided on Federal lands parallels the diversity of the managing agencies' missions and origins. In general, Federal lands are most common in the West (Vincent et al. 2020) but are prominent in every RPA region (table 11-2). The U.S. Bureau of Land Management (BLM), with lands almost exclusively in the West, manages the largest land area of any Federal agency. Although there are important exceptions, in general the recreation resources of the BLM focus on dispersed recreation in rangeland settings with limited or lightly developed recreation facilities and infrastructure. The U.S. Department of Agriculture (USDA), Forest Service is the next largest Federal provider of lands for recreation. The USDA Forest Service manages a range of recreation resources that support a wide variety of recreation activities and settings. Lands managed by the USDA Forest Service are located across the United States but are more common in the West. The U.S. National Park Service (NPS) is widely recognized by the public as a provider of keystone recreation opportunities. In addition to national parks, the NPS manages numerous national historic sites, national monuments, national recreation areas, national seashores, and other units. Although the majority of NPS lands are in the West, a greater relative share of lands managed by the NPS are in the East, compared to the USDA Forest Service and BLM. The NPS provides diverse recreation settings and opportunities, including highly developed facilities and interpretive sites.

Four other Federal agencies provide the remaining Federal recreation opportunities. The U.S. Fish and Wildlife Service

**Table 11-1**. Acres in State park systems by RPA region.

| Year | Pacific Coast | Rocky Mountain | North | South | Grand total |
|---|---|---|---|---|---|
| | | | (acres) | | |
| **2009** | 5,176,228 | 1,395,813 | 5,183,851 | 2,217,453 | 13,973,345 |
| **2010** | 5,203,469 | 1,188,091 | 5,366,119 | 2,239,543 | 13,997,222 |
| **2011** | 5,227,872 | 1,298,298 | 5,215,357 | 2,256,921 | 13,998,448 |
| **2012** | 5,250,954 | 1,070,932 | 5,230,013 | 2,370,263 | 13,922,162 |
| **2013** | 5,255,256 | 2,283,562 | 5,242,108 | 2,366,587 | 15,147,513 |
| **2014** | 5,275,180 | 2,456,972 | 3,892,200 | 2,318,864 | 13,943,216 |
| **2015** | 5,262,699 | 2,597,620 | 8,135,730 | 2,376,461 | 18,372,510 |
| **2016** | 5,271,493 | 2,818,660 | 8,117,502 | 2,389,873 | 18,597,528 |
| **2017** | 5,306,258 | 2,822,394 | 8,165,824 | 2,400,094 | 18,694,570 |
| **Total region area** | **415,728,000** | **538,203,520** | **743,325,440** | **574,086,400** | **2,271,343,360** |

*Although subsequent modeling and simulations examine the RPA Pacific Coast Region as defined within the conterminous United States, this table presents summaries on the State park systems relative to the entire country, including Alaska and Hawaii.*

*Sources: Smith and Leung 2019, Vincent et al. 2020.*

**Table 11-2**. Area of Federal land and percentage (relative to combined States' total acreage) by RPA region and Federal land manager in 2018.

| RPA region | Total Federal acreage (1000s) | Total acreage in RPA region (1000s) | Federal acreage (%) |
|---|---|---|---|
| **North** | 15,963 | 415,728 | 3.8% |
| BLM | 5 | | |
| USDA Forest Service | 12,300 | | |
| FWS | 1,468 | | |
| NPS | 1,381 | | |
| ACOE | 809 | | |
| **South** | 25,363 | 538,204 | 4.7% |
| BLM | 29 | | |
| USDA Forest Service | 13,391 | | |
| FWS | 3,424 | | |
| NPS | 5,122 | | |
| ACOE | 3,397 | | |
| **Rocky Mountain** | 260,558 | 743,325 | 35.1% |
| BLM | 141,692 | | |
| USDA Forest Service | 99,265 | | |
| FWS | 6,319 | | |
| NPS | 10,985 | | |
| ACOE | 2,297 | | |
| **Pacific Coast** | 89,930 | 204,499 | 44.0% |
| BLM | 31,268 | | |
| USDA Forest Service | 45,824 | | |
| FWS | 1,036 | | |
| NPS | 9,644 | | |
| ACOE | 2,158 | | |

*ACOE = U.S. Army Corps of Engineers; BLM = U.S. Bureau of Land Management; FWS = U.S. Fish and Wildlife Service; NPS = U.S. National Park Service.*

*U.S. Bureau of Reclamation facilities are not presented here.*

*Pacific Coast Region does not include Alaska or Hawaii.*

*Source: Vincent et al. 2020.*

(FWS) provides a variety of recreation opportunities, although with primary recreation focus on wildlife-related recreation. The U.S. Army Corps of Engineers (ACOE) and U.S. Bureau of Reclamation (BOR) primarily provide recreation opportunities centered on waterways and flood- and irrigation-control facilities. The ACOE has facilities located across the United States, while the BOR facilities are nearly exclusively in the South and West. In addition to the land-focused Federal agencies, the National Oceanic and Atmospheric Administration's Office of National Marine Sanctuaries manages a system of 15 national marine sanctuaries and 2 marine national monuments that provide for shore- and ocean-going recreation within the ocean and Great Lakes.

Numerous specially designated areas, identified through Congressional legislation, and proclaimed areas, established by the Executive Branch, are present within Federal recreation lands. These resources include Wilderness, national wild and scenic rivers, national scenic areas, and national monuments. Designated Wilderness areas are established under the Wilderness Act of 1964 and constitute the National Wilderness Preservation System (NWPS). Wilderness areas are designated to preserve lands without human development and with natural processes as the centerpiece. In Wilderness, recreation is limited to non-mechanized opportunities and occurs in dispersed settings. Wilderness is generally thought to supply some of the best opportunities for solitude and remoteness. Although Wilderness areas tend to be far from population centers, many are readily accessible to populated places. The NWPS extends across 44 States with over 109 million acres that are managed by four Federal recreation agencies (Carlson et al. 2016) (table 11-3). The NPS manages the greatest number of NWPS acres (44 million), accounting for more than half of the NPS land base (Hoover 2014). The USDA Forest Service manages the second-greatest number of NWPS acres (36 million), but those lands amount to less than one-fifth of USDA Forest Service-managed lands. Nearly 95 percent of the Wilderness acres managed as part of the USDA Forest Service National Forest System (NFS) are in the West, with nearly equal amounts located in the RPA Rocky Mountain and Pacific Coast Regions (18 and 16 million acres, respectively). The RPA South Region has less than 1 million acres of Wilderness, while the North Region has about 1.5 million acres. This distribution reflects, in part, the presence of land that met the requirements for designation under the Wilderness Act. The spatial distribution of NFS Wilderness means that those living in the West have markedly greater access to Wilderness compared to those living elsewhere.

**Table 11-3**. Acres (1,000s) in the National Wilderness Preservation System by Federal agency and RPA region, circa 2012.

| RPA region | USDA Forest Service | NPS | FWS | BLM | Region total |
|---|---|---|---|---|---|
| **North** | 1,432 | 179 | 64 | 0 | 1,675 |
| **South** | 754 | 1,487 | 470 | 0 | 2,711 |
| **Rocky Mountain** | 18,188 | 1,349 | 1,465 | 4,611 | 25,614 |
| **Pacific Coast** | 15,777 | 40,885 | 18,704 | 4,089 | 79,455 |
| **Federal agency total** | 36,151 | 43,900 | 20,703 | 8,701 | 109,455 |

*Pacific Coast Region does not include Alaska or Hawaii.*

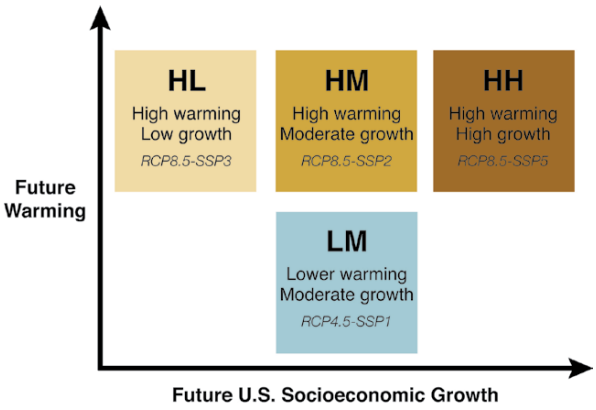
*Source: Hoover 2014.*

## RPA Scenarios

The RPA Assessment uses a set of scenarios of coordinated future climate, population, and socioeconomic change to project resource availability and condition over the next 50 years. These scenarios provide a framework for objectively evaluating a plausible range of future resource outcomes.

The 2020 RPA Assessment draws from the global scenarios developed by the Intergovernmental Panel on Climate Change to examine the 2020 to 2070 time period (IPCC 2014). The RPA scenarios pair two alternative climate futures (Representative Concentration Pathways or RCPs) with four alternative socioeconomic futures (Shared Socioeconomic Pathways or SSPs) in the following combinations: RCP 4.5 and SSP1 (lower warming-moderate U.S. growth, LM), RCP 8.5 and SSP3 (high warming-low U.S. growth, HL), RCP 8.5 and SSP2 (high warming-moderate U.S. growth, HM), and RCP 8.5 and SSP5 (high warming-high U.S. growth, HH) (figure 11-1). The four 2020 RPA Assessment scenarios encompass the projected range of climate change from the RCPs and projected quantitative and qualitative range of socioeconomic change from the SSPs, resulting in four distinct futures that vary across a multitude of characteristics (figure 11-2), and providing a unifying framework that organizes the RPA Assessment natural

**Figure 11-1**. Characterization of the 2020 RPA Assessment scenarios in terms of future changes in atmospheric warming and U.S. socioeconomic growth. These characteristics are associated with the four underlying Representative Concentration Pathway (RCP) – Shared Socioeconomic Pathway (SSP) combinations.




*Source: Langner et al. 2020.*

**Figure 11-2**. Characteristics differentiating the 2020 RPA Assessment scenarios. These characteristics are associated with the four underlying Representative Concentration Pathway (RCP) – Shared Socioeconomic Pathway (SSP) combinations.

| RPA Scenario (RCP-SSP) | Global Temperature Rise | U.S. Population Growth | U.S. Economic Growth Rate | Bioenergy Demand | Energy Sector Focus | Global Energy Usage | International Trade Openness |
|---|---|---|---|---|---|---|---|
| **LM** Lower warming Moderate growth *RCP4.5-SSP1* | Lower | Medium | Medium-High | High | Renewables | Low | Medium |
| **HL** High warming Low growth *RCP8.5-SSP3* | High | Low | Low | Low | Fossil fuels | Medium | Low |
| **HM** High warming Moderate growth *RCP8.5-SSP2* | High | Medium | Medium | Medium | Mixed | Medium | Medium |
| **HH** High warming High growth *RCP8.5-SSP5* | High | High | High | High | Fossil fuels | High | High |

resource sector analyses around a consistent set of possible world views. The Scenarios Chapter describes how these scenarios were selected and paired; more details are provided in Langner et al. (2020).

The 2020 RPA Assessment pairs these four RPA scenarios with five different climate models that capture the wide range of projected future temperature and precipitation across the conterminous United States. An ensemble climate projection that averages across the multiple model projections is not used because of the importance of preserving individual model variability for resource modeling efforts. The five climate models selected by RPA represent least warm, hot, dry, wet, and middle-of-the-road climate futures for the conterminous United States (table 11-4); however, characteristics can vary at finer spatial scales. Although the same models were selected to develop climate projections for both lower and high-warming futures, there are distinct climate projections for each model associated with RCP 4.5 and RCP 8.5. The Scenarios Chapter describes how these climate models were selected. Joyce and Coulson (2020) give a more extensive explanation.

Throughout the RPA Assessment, individual scenario-climate futures are referred to by pairing RPA scenarios with selected climate projections. For example, an analysis run under "HL-wet" assumes a future with high atmospheric warming and low U.S. population and economic growth (HL RPA scenario), as well as a wetter climate for the conterminous United States (wet climate projection).

**Table 11-4**. Five climate models selected to reflect the range of the full set of 20 climate models in the year 2070. Each model was run under RCP 4.5 and RCP 8.5, providing a range of different U.S. climate projections.

| | Least warm | Hot | Dry | Wet | Middle |
|---|---|---|---|---|---|
| **Climate model** | MRI-CGCM3 | HadGEM2-ES | IPSL-CM5A-MR | CNRM-CM5 | NorESM1-M |
| **Institution** | Meteorological Research Institute, Japan | Met Office Hadley Centre, United Kingdom | Institut Pierre Simon Laplace, France | National Centre of Meteorological Research, France | Norwegian Climate Center, Norway |

*Source: Joyce and Coulson 2020.*

*RCP = Representative Concentration Pathway.*

## Private Land Resources

The approximately 459 million acres of forests owned by individuals and families, private businesses, and land trusts and community-owned forests provide recreation opportunities for many in the United States. However, data are limited on the use of some of these lands for recreation and their availability to the public for recreation. Recreation opportunity on forests owned by individuals and families (272 million acres across the country) is almost exclusively available only to the owners' families and friends (Butler et al. 2020). Approximately 56 percent of the land owned by these individuals has been used in recent years for recreation by the owners, while 46 percent has been used by the owners' children and 41 percent by owners' friends (Butler et al. 2020). Individual and family forest parcels greater than 10 acres in size are more likely to be used for recreation by owners, family/friends, or the public (Butler et al. 2016, Butler and Snyder 2017). Owners identify recreation as a "very important" or "important" reason for owning about half of the forest land acres owned by individuals and families (Butler et al. 2020). Although recreation was often viewed as an important reason for owning land, only a small share of that forest land is managed to improve recreation opportunity. Approximately 25 percent of individual and family forest land acres (and 14 percent of ownerships) are part of holdings that have had trail improvements, and about 35 percent of acres (13 percent of ownerships) are part of holdings that have undergone management to improve wildlife habitat in the last 5 years (Butler et al. 2020).

Another source of recreation opportunity is the many forest industry corporations that make their lands at least partially available to the public. Many large corporate forest landowners (i.e., those owning more than 45,000 acres) provide a mix of free and fee-based recreation opportunities. In a survey of these owners, 74 percent reported allowing public recreation access for free and 85 percent for a fee (Sass, personal communication). In general, recreation is a low-priority management objective of corporate landowners (Sass et al. 2021). Somewhere between 15 and 75 percent of corporate owners (depending on company type) reported

hunting as an ownership objective, while less than 40 percent reported recreation (more generally speaking) as an ownership objective (not mutually exclusive categories) (Sass et al. 2021).

Local, State, and national land trusts and community forests provide recreation opportunities on many lands they manage. In 2015, land trusts were responsible for conservation efforts on about 56 million open space acres across the United States and owned about 8 million of those acres (Land Trust Alliance 2016). More than 70 percent of lands managed by land trusts nationally are open for recreation. Like many landowners, land trusts often specify which recreation activities are permitted on lands they manage. For example, recreation activities may be limited to those that are non-consumptive and non-mechanized. Community forests—often owned by a nonprofit organization or local government—where management goals are guided by community boards, are also often open to recreation. Like land trusts, community forests can have restrictions on the types of recreation activities allowed on the lands they manage. The area managed as community forests across the United States is unknown (in part because what constitutes a community forest is poorly defined in the United States) but is less than the area managed by land trusts.

## Changes Influencing Recreation Resources

**Land Use and Ownership Change—**Changes in land use and land ownership can alter the availability of both private and public land recreation resources. Conversion of private land from open space to developed uses, such as housing, businesses, or infrastructure, can reduce recreation opportunities that were historically available. This conversion can result in a reduction in the total area available for recreation and increased pressure on public land recreation resources, assuming the recreation engagement that historically happened on private land is displaced to public land—for example, an annual hunting trip to privately owned land that now occurs on State land. Although conversion to developed land uses is less common on publicly owned lands, changes in management or land designation can alter the availability of publicly owned land for recreation. Such changes can both increase (e.g., designation of lands where recreation opportunity is the primary focus) or restrict (e.g., expanding area designated for resource extraction or implementing a cap on the number of visitors) recreation opportunity.

Beyond land use changes, changes in property ownership can also alter access to recreation opportunities. In some cases, such as a land trust purchasing a property, recreation access may increase because of an ownership change. In other cases, changes in ownership can reduce recreation opportunities when new landowners restrict access that was previously granted.

How projected land use change may alter the availability of non-federally owned forests for recreation can be explored by examining the joint projections of future land use (described in the Land Resources Chapter) and population (described in the Scenarios Chapter) under the 2020 RPA Assessment scenarios (see the sidebar RPA Scenarios). Looking toward 2040 (and using the middle climate projection for illustration of potential scenario differences), many areas of the United States are projected to experience modest change in per capita non-federal forest area (figure 11-3). Under the moderate population and economic growth RPA scenario (LM), slight or moderate declines in forest area are most typical for 2040. In contrast, if population and economic growth is lower (the HL scenario), per capita non-Federal forest area declines are projected to be less and in some cases forest area may increase. When gains in per capita non-Federal forest area are projected, they are most commonly in northern areas of the RPA North and Rocky Mountain Regions. Gains in per capita non-Federal forest area become less common under moderate growth (LM) and almost nonexistent under a high-growth scenario (HH) as land use conversion rates increase. In the low-growth scenario, projected losses in per capita non-Federal forest area are mostly confined to the RPA South and southern Rocky Mountain Regions. Under the greater growth in the LM and HH scenarios, projected losses in per capita non-Federal forest area are found in every region and are most significant in the far north of the North Region, the northern portions of the Pacific Coast Region, and the southern portions of the Rocky Mountain Region. We use the lower atmospheric warming (LM) and the higher atmospheric warming (HL, HH) scenarios here to explore the range of potential forest land use changes under the middle climate projection and different atmospheric warming levels. However, these results can also differ with different climate projections (see the Land Resources Chapter for discussion of how a climate model influences land use projections).

Looking to 2070, the projected changes in per capita non-federal forest area are similar in pattern to those found in the 2040 projections (figure 11-4). Modest changes in per capita non-Federal forest area are still projected for multiple locations in each RPA region. When changes are projected, they are of greater magnitude in 2070 than in 2040. For example, gains in per capita forest area in the HL scenario and losses in per capita forest area in the HH scenario more frequently approach 5 percent.

**Climate Change—**Climate change can alter natural resource and environmental conditions in ways that change their desirability for recreation. Changing climate conditions can affect the frequency of natural disturbances (e.g., wildfire and flooding) with potential for dramatic, rapid changes in resource conditions, necessitating such managerial actions as limiting access to recreation resources. Changes in resource and

**Figure 11-3**. Differences in non-Federal forest acres per capita, 2012 to 2040. Differences are computed as the ratio of acres (hundreds) to population (tens), for RPA scenarios (a) Low Medium (LM), (b) High Low (HL), and (c) High High (HH) under the middle climate projection. Blue/purple areas have increasing per capita non-Federal forest lands, while red areas have decreasing per capita non-Federal forest lands. Areas shaded in gray (N/A) have no non-Federal forest lands or lack projections due to insufficient land use transition data.

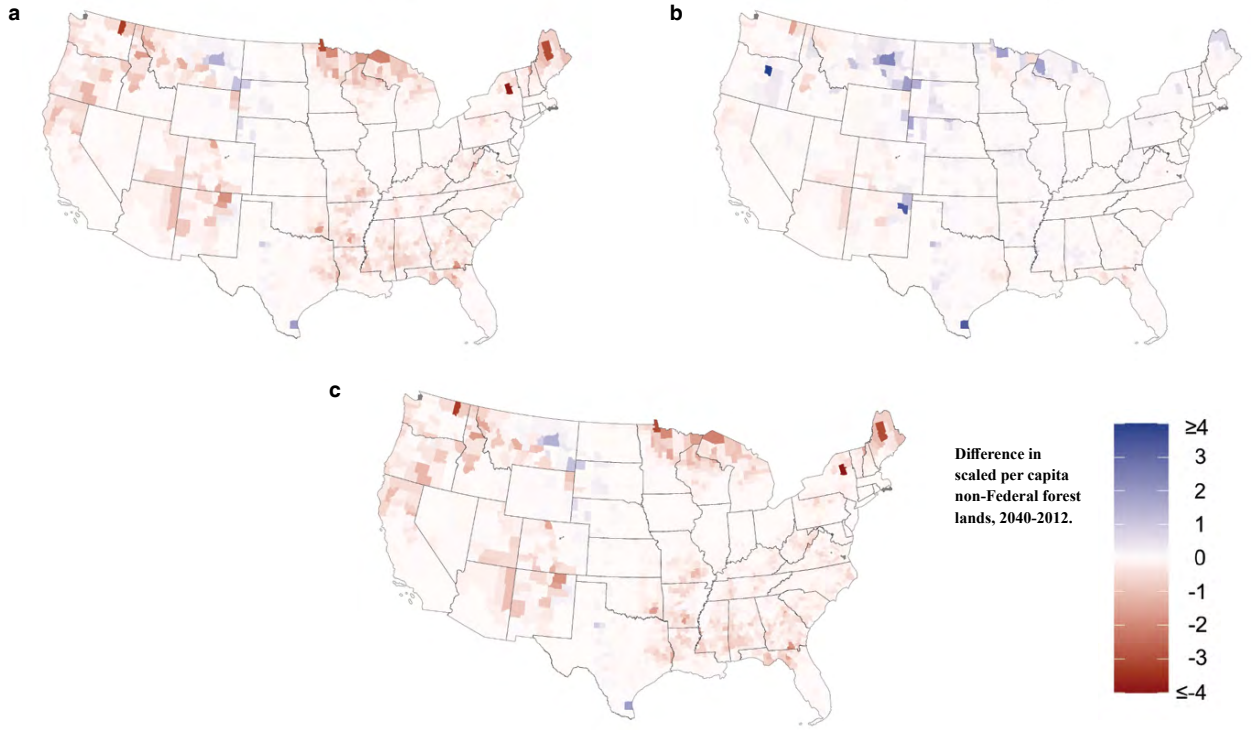
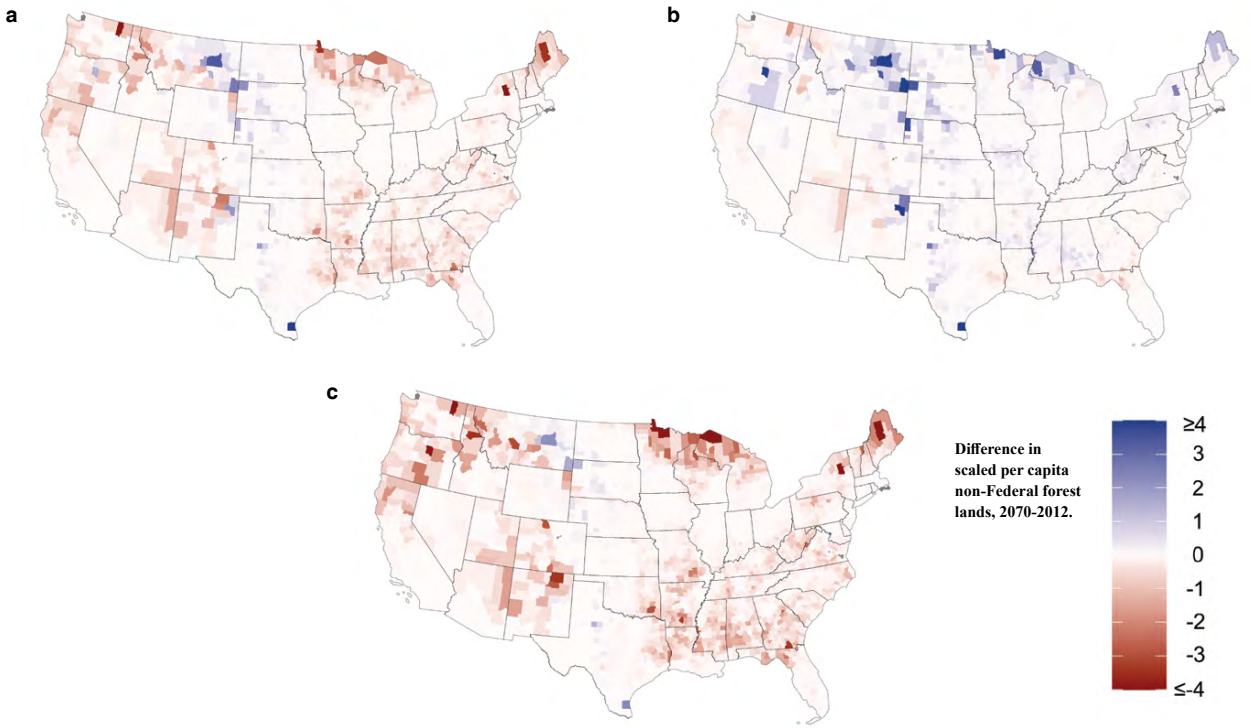



**Figure 11-4**. Differences in non-Federal forest acres per capita, 2012 to 2070. Differences are computed as the ratio of acres (hundreds) to population (tens), for RPA scenarios (a) Low Medium (LM), (b) High Low (HL), and (c) High High (HH) under the middle climate projection. Blue/purple areas have increasing per capita non-Federal forest lands, while red areas have decreasing per capita non-Federal forest lands. Areas shaded in gray (N/A) have no non-Federal forest lands or lack projections due to insufficient land use transition data.



environmental conditions can include those that make recreating more or less pleasant (e.g., temperatures that are too hot or not as cold as typical) or that change the feasibility or desirability of recreation (e.g., low water levels, changes in numbers or timing of flowers, shifts in bird migration patterns). Although many outcomes from climate change will likely reduce recreation opportunities (e.g., loss of natural snow in areas popular for snowmobiling or skiing), climate change may increase the availability of some recreation resources. For example, less snow and warmer springs may increase the length of time that some warm-weather recreation resources are snow-free and accessible. In this case, climate change has made snow-based activities less opportune while potentially favoring day hiking or horseback riding on trails.

Natural disturbances, such as wildfires, floods, and wind events, are ecological processes that have shaped the natural resources we see today. Present-day natural disturbance events can influence the availability of recreation resources by changing resource conditions or by creating hazardous conditions that result in managers or landowners reducing or restricting access to recreation resources. High-severity disturbances (e.g., severe wildfire) can dramatically alter vegetation conditions very rapidly. In general, the research conducted onsite in post-fire landscapes has found that recreation levels drop modestly immediately post-fire but trend back to pre-fire levels in relatively short order (e.g., Brown et al. 2008, McCaffrey et al. 2013, White et al. 2020). Onsite studies have found indications that burned landscapes do not dramatically change visitor satisfaction or reduce opportunities (e.g., White et al. 2020), but they do influence decisions about specific trail and campsite use (e.g., Love and Watson 1992, Schroeder and Schneider 2010). Other studies have examined how recreationists state they would respond to hypothetical burned landscapes, generally finding that burned landscapes reduce the value of recreation for recreationists and that post-fire landscapes can have different effects on recreation depending on fire severity and recreation activity (Bawa 2017). Less is known about the effects of high-severity flooding events on recreation-resource desirability. Over the last decade, public and private landowners have enacted temporary closures of their lands to recreation use in response to active wildfire, weather and forest conditions that yield a high risk of wildfire, and post-disturbance conditions (e.g., unstable slopes or dead trees) that may threaten visitor safety. In addition, there is now preliminary evidence that existing or potential smoke from wildfire is beginning to influence where and when visitors take outdoor recreation trips (e.g., Gellman et al. 2021, White et al. 2020). Continued increases in the frequency of natural disturbances over the coming decades may lead to more periods when natural resources are unavailable for recreation use. This has the potential to compress outdoor recreation to shorter periods during the year, to change the locations where people recreate, and to reduce the number of people engaging in outdoor recreation.

# Engagement in Outdoor Recreation

- Participation rates have been steady in recent years with about 50 percent of the population engaging in outdoor recreation.
- The relative popularities of individual nature-based outdoor recreation activities have been generally stable over the last decade or longer with hiking, fishing, and camping being the most-popular activities.
- Outdoor recreation participation rates among minority groups and women have been increasing, albeit slowly.
- Public lands visitation has been increasing modestly at the Federal level and more rapidly at the State level.
- For those who have access, private lands are important providers of recreation opportunity for hunting, day hiking, fishing, and motorized off-road use.

## Participation in Outdoor Recreation

About half of the U.S. population age 6 and older participates in some type of outdoor recreation (Outdoor Foundation 2019). That level of engagement in recreation has held relatively steady since 2007 (Outdoor Foundation 2018). In 2018, camping/backpacking, fishing, and day hiking were the nature-based outdoor recreation activities with the greatest numbers of participants (Outdoor Foundation 2019), with about 13 to 16 percent of the population participating in each of those activities. Beyond those three activities, participation rates for nature-based outdoor recreation activities range between about 1 to 10 percent of the population (Outdoor Foundation 2019). The motivations most cited for engaging in recreation were improvement of health, spending time with family and friends, experiencing nature, and getting away from other demands (Outdoor Foundation 2018).

Outdoor recreation participants are disproportionately male relative to the U.S. population, although participation rates among women have been increasing in recent years (Outdoor Foundation 2019). People under 24 typically have the highest rates of participation in outdoor recreation, but those over 25 account for most recreation participants (Outdoor Foundation 2018). The majority (74 percent) of outdoor recreation participants are White and about a third have annual household incomes over $100,000 (Outdoor Foundation 2019)—both disproportionately high relative to the U.S. population. Within their respective ethnicities, Asians have the highest rates of participation in

**Table 11-5**. Most-popular outdoor recreation activities by racial and ethnic group, 2018.

| | White | | Black | | Hispanic | | Asian | |
|---|---|---|---|---|---|---|---|---|
| Rank | Activity | Percent participating | Activity | Percent participating | Activity | Percent participating | Activity | Percent participating |
| 1 | Hiking | 20.0 | Running | 17.3 | Running | 20.6 | Running | 26.1 |
| 2 | Fishing | 18.2 | Biking | 10.4 | Biking | 14.7 | Hiking | 21.2 |
| 3 | Running | 16.9 | Fishing | 9.9 | Hiking | 14.6 | Biking | 16.4 |
| 4 | Camping | 16.3 | Camping | 5.9 | Camping | 14.2 | Camping | 11.3 |
| 5 | Biking | 15.5 | Hiking | 5.5 | Fishing | 13.2 | Fishing | 9.9 |

*Source: Adapted from Outdoor Foundation 2019.*

outdoor recreation (nearly 70 percent engaging in outdoor recreation), followed by Whites (nearly 53 percent) and Hispanics (more than 40 percent). Participation among Asian and Pacific Islanders and Hispanics has been increasing since the 2010s (Outdoor Foundation 2019). Participation by Blacks in outdoor recreation is less than 40 percent and generally unchanged from observations in the early 2010s. Across all racial/ethnic groups, there was consistency in the set of most-popular outdoor recreation activities, but the popularity rankings of specific activities within the set differed across groups (table 11-5).

For most nature-based outdoor recreation activities, the share of the population participating was stable between 2007 and 2018 (Outdoor Foundation 2018, 2019) (table 11-6). With some exceptions, the share of the population participating in a specific activity in 2018 was within 1 to 2 percentage points of what was observed in 2007. The share of the population participating in day hiking did increase by about 5 percentage points over the timeframe, and the share of the population that engaged in freshwater fishing decreased by 3 percentage points. Camping (driven by losses in car camping and camping outside a home) and wildlife viewing both experienced declines in shares of the population participating that approached 2 percentage points. Trail running and recreational kayaking both saw gains in participation of 1 to 2 percentage points, although less than 4 percent of the population participated in those activities.

Although the share of the population that engaged in outdoor recreation remained relatively stable at around 50 percent between 2008 and 2018, the number of participants in outdoor recreation increased by about 15 million individuals because of continued U.S. population growth (Outdoor Foundation 2019). The increasing number of overall outdoor recreation participants was mirrored by growth in the number of participants engaging in many individual outdoor recreation activities. For those activities gaining participants, increases typically ranged between about 1 and 4 million new participants (table 11-7). However, day hiking experienced a gain of about 18 million additional participants between 2007 and 2018. Recreational kayaking and trail running each experienced about 6 million new participants over that period (Outdoor Foundation 2019).

Freshwater fishing saw the largest decline in number of participants during the period: a loss of about 5 million. The other largest declines in participant numbers were associated with wildlife viewing (2 million) and birdwatching away from home (1 million).

The average number of outings by those engaging in outdoor recreation has been declining year over year over the last decade or more (Outdoor Foundation 2019). Between 2017 and 2018, the average number of outings annually per participant declined by 7.4—a 10-percent decline (Outdoor Foundation 2018, 2019). However, those averages are

**Table 11-6**. Percent of U.S. population age 6 and older engaging in outdoor recreation activities, 2007, 2010, 2015, 2018.

| Activity | 2007 | 2010 | 2015 | 2018 |
|---|---|---|---|---|
| Hiking (day) | 10.8 | 11.5 | 12.7 | 15.9 |
| Camping (car, backyard, backpacking, & RV) | 15.1 | 14.9 | 13.6 | 13.9 |
| Fishing (freshwater/other) | 15.8 | 13.7 | 12.8 | 13 |
| Wildlife viewing[a] | 8.3 | 7.4 | 7 | 6.8 |
| Hunting (rifle/shotgun/handgun/bow) | 5.1 | 4.9 | 5.3 | 5.2 |
| Birdwatching[a] | 4.9 | 4.7 | 4.5 | 4.1 |
| Kayaking (recreational) | 1.8 | 2.3 | 3.2 | 3.7 |
| Backpacking[a] | 2.4 | 2.9 | 3.4 | 3.5 |
| Skiing (Alpine/downhill)[b] | 3.7 | 3.8 | 3.2 | |
| Trail running | 1.5 | 1.8 | 2.8 | 3.3 |
| Canoeing | 3.5 | 3.7 | 3.5 | 3 |
| Bicycling (mountain/non-paved surface) | 2.5 | 2.5 | 2.8 | 2.9 |
| Snowboarding | 2.5 | 2.6 | 2.6 | 2.4 |
| Skiing (cross-country) | 1.3 | 1.5 | 1.4 | 1.7 |
| Sailing | 1.4 | 1.4 | 1.4 | 1.2 |
| Snowshoeing | 0.9 | 1.2 | 1.3 | 1.2 |
| Rafting | 1.6 | 1.6 | 1.3 | 1.1 |
| Kayaking (sea/touring) | 0.5 | 0.8 | 1 | 0.9 |
| Kayaking (white water) | 0.4 | 0.6 | 0.9 | 0.9 |
| Climbing (traditional/ice/mountaineering) | 0.8 | 0.8 | 0.9 | 0.8 |

[a] *More than 1/4 mile from vehicle/home.*

[b] *No data available for 2018 due to redefinition of skiing aggregate from Alpine/Downhill to Alpine/Downhill/Freeski/Telemark (Outdoor Foundation 2019).*

*Source: Outdoor Foundation 2019.*

**Table 11-7**. Number of individuals age 6 and older engaging in outdoor recreation activities (millions), 2007, 2010, 2015, 2018.

| Activity | 2007 | 2010 | 2015 | 2018 |
|---|---|---|---|---|
| **Hiking (day)** | 30 | 32.5 | 37.2 | 47.9 |
| **Camping (car, backyard, backpacking, & RV)** | 41.7 | 42.3 | 40 | 41.7 |
| **Fishing (freshwater/other)** | 43.9 | 38.9 | 37.7 | 39 |
| **Wildlife viewing[a]** | 23 | 21 | 20.7 | 20.6 |
| **Hunting (rifle/shotgun/ handgun/bow)** | 14.1 | 14 | 15.5 | 15.7 |
| **Birdwatching[a]** | 13.5 | 13.3 | 13.1 | 12.3 |
| **Kayaking (recreational)** | 5.1 | 6.5 | 9.5 | 11 |
| **Backpacking[a]** | 6.6 | 8.3 | 10.1 | 10.5 |
| **Skiing (Alpine/downhill)[b]** | 10.4 | 10.9 | 9.4 | |
| **Trail running** | 4.2 | 5.1 | 8.1 | 10 |
| **Canoeing** | 9.8 | 10.6 | 10.2 | 9.1 |
| **Bicycling (mountain/non-paved surface)** | 6.9 | 7.2 | 8.3 | 8.7 |
| **Snowboarding** | 6.8 | 7.4 | 7.7 | 7.1 |
| **Skiing (cross-country)** | 3.5 | 4.2 | 4.1 | 5.1 |
| **Sailing** | 3.8 | 3.9 | 4.1 | 3.8 |
| **Snowshoeing** | 2.4 | 3.4 | 3.9 | 3.5 |
| **Rafting** | 4.3 | 4.5 | 3.9 | 3.4 |
| **Kayaking (sea/touring)** | 1.5 | 2.1 | 3.1 | 2.8 |
| **Kayaking (white water)** | 1.2 | 1.8 | 2.5 | 2.6 |
| **Climbing (traditional/ice/ mountaineering)** | 2.1 | 2.2 | 2.6 | 2.5 |

*[a] More than 1/4 mile from vehicle/home.*

*[b] No data available for 2018 due to redefinition of skiing aggregate from Alpine/Downhill to Alpine/ Downhill/Freeski/Telemark (Outdoor Foundation 2019).*

*Source: Outdoor Foundation 2019.*

driven, since 2014, by a reduction in engagement by the participants who recreate very frequently. In 2014, those participating in more than 100 outdoor recreation outings per year—the most avid recreationists—accounted for about 22.3 percent of all annual outings. By 2017, that most-avid group accounted for about 20.7 percent of all outings. Over that same period, those recreating 12 to 51 times per year accounted for a nearly constant share of outings and the share of outings from those engaging less than monthly increased slightly (Outdoor Foundation 2019). Ultimately, the share of outdoor recreationists with the greatest avidity levels has declined. In 2018, for those nature-based outdoor recreation activities for which values are reported, participants reported an average of 18 outings per year for fishing, 14 for day hiking, and 13 for camping (Outdoor Foundation 2019) (see the sidebar How COVID-19 Infection Rates and Location Characteristics Have Impacted USDA Forest Service Campground Reservations).

Youth between the ages of 6 and 17 had greater rates of participation in outdoor recreation than their adult counterparts (Outdoor Foundation 2018, 2019). The pattern of greater youth participation rates, relative to adults, has held since the mid-2000s (Outdoor Foundation 2018).

Despite their greater participation relative to adults, youth participation rates in outdoor recreation have declined slightly in recent years (Outdoor Foundation 2019). Among nature-based outdoor recreation activities, youth were most likely to participate in camping, fishing, and day hiking (table 11-8). Youth had higher rates of participation than adults for all activities except wildlife viewing and birdwatching, snowshoeing, and trail running. Participation rates by youth in specific outdoor recreation activities have been relatively stable over the last decade or more. However, there were marginal increases in participation rates for day hiking, kayaking, and hunting, and small declines for camping and fishing.

In addition to having greater participation in outdoor recreation than adults, youth also had more frequent engagement in recreation. Youth participants in outdoor recreation averaged more than 76 outings a year in recreational pursuits. On average, youth engaged in running (including trail running) and biking nearly weekly (45 and 40 outings per year, respectively). Outings for nature-based outdoor recreation occurred less often, with between 15 and 16 outings a year for day hiking and fishing, respectively, and 11 outings a year for camping.

**Table 11-8**. Percent of U.S. population ages 6 to 18 engaging in outdoor recreation activities, 2007, 2010, 2015, 2018.

| Activity | 2007 | 2010 | 2015 | 2018 |
|---|---|---|---|---|
| **Camping (car, backyard, backpacking, & RV)** | 24.3 | 23 | 21.1 | 20.5 |
| **Fishing (freshwater/other)** | 21.7 | 17.8 | 18.6 | 17.5 |
| **Hiking (day)** | 11.5 | 11.9 | 15 | 16.1 |
| **Wildlife viewing[a]** | 5.9 | 6 | 6.4 | 7.1 |
| **Hunting (rifle/shotgun/ handgun/bow)** | 4.2 | 4.4 | 6.7 | 6 |
| **Snowboarding** | 4.8 | 5.1 | 4 | 6 |
| **Kayaking (recreational)** | 2.1 | 2.3 | 4 | 4.9 |
| **Trail running** | 1.3 | 1.3 | 3.1 | 4.7 |
| **Backpacking[a]** | 3.6 | 4.4 | 5.8 | 4.6 |
| **Bicycling (mountain/non-paved surface)** | 3.5 | 3.8 | 3.8 | 3.8 |
| **Canoeing** | 5.1 | 5.6 | 4.8 | 3.8 |
| **Skiing (Alpine/downhill)[b]** | 4.4 | 4.8 | 4.2 | |
| **Birdwatching[a]** | 2.4 | 3.2 | 3.1 | 2.9 |
| **Skiing (cross-country)** | 1.1 | 1.5 | 2.1 | 2.7 |
| **Kayaking (sea/touring)** | 0.5 | 0.7 | 1.7 | 1.6 |
| **Kayaking (white water)** | 0.4 | 0.5 | 1.6 | 1.6 |
| **Sailing** | 1 | 1.2 | 1.8 | 1.6 |
| **Snowshoeing** | 0.8 | 1.2 | 1.4 | 1.4 |
| **Climbing (traditional/ice/ mountaineering)** | 1 | 0.7 | 1.5 | 1.3 |
| **Rafting** | 2 | 1.9 | 2.1 | 1.2 |

*[a] More than 1/4 mile from vehicle/home.*

*[b] No data available for 2018 due to redefinition of skiing aggregate from Alpine/Downhill to Alpine/ Downhill/Freeski/Telemark (Outdoor Foundation 2019).*

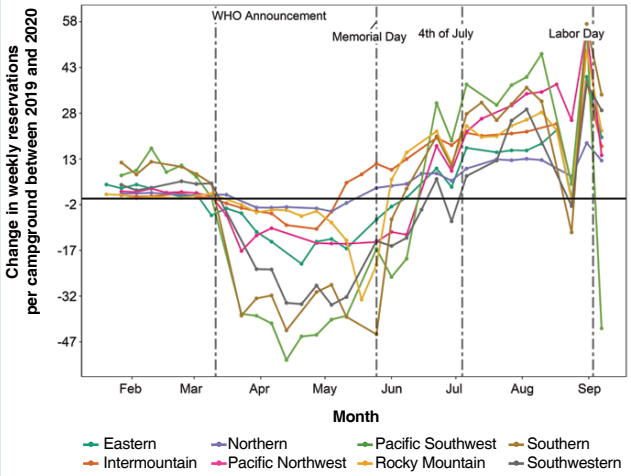
*Source: Outdoor Foundation 2019.*

## How COVID-19 Infection Rates and Location Characteristics Have Impacted USDA Forest Service Campground Reservations

During the COVID-19 pandemic, U.S. public land managers were faced with the unique challenge of maintaining social distancing requirements while experiencing increased visitation. Shartaj et al. (2022) investigated the sizeable increase in reservations that occurred during the summer of 2020 by analyzing final reservations to National Forest System (NFS) campgrounds in the conterminous United States (figure 11-5). The authors highlight the local infection rates, public policies, and proximity to national parks, metropolitan areas, and wildfire on NFS camping demand.

Camping has typically been perceived as a safer form of leisure activity during periods of high virus transmission risk. During the summer of 2020, campgrounds saw a nearly 40-percent increase in average nightly reservations. The mean weekly nights reserved per campground stood at 50.35 during the year. This analysis revealed a positive correlation between the number of reservations at a campground and COVID infection rates in the surrounding county. Public policies were also shown to affect campground reservations: stay-at-home advisory orders significantly reduced campground reservations in both the spring and the summer of 2020. The study showed that being near a national park or a metropolitan area also resulted in considerable increases in summertime NFS campground nights reserved. The magnitude of the increases due to proximity to national parks and metropolitan areas represent 13 and 27 of mean camping nights reserved in 2020, respectively. USDA Forest Service campgrounds near national parks saw particularly large increases when individuals visiting national parks for other recreation activities camped at NFS campgrounds due either to preference or because of national park campground unavailability. NFS campgrounds located near populated metropolitan areas faced increased visitation due to travel restrictions and general lack of COVID-safe recreation activities. Finally, campgrounds located near wildfire boundaries experienced declines in nights reserved in the weeks that the fires were active.

**Figure 11-5**. Changes in weekly nights reserved per campground between 2019 and 2020 by week for USDA Forest Service regions.




*See https://www.fs.usda.gov/about-agency/contact-us/regional-offices for region locations.*

*The World Health Organization (WHO) characterized COVID-19 as a pandemic on March 11, 2020.*

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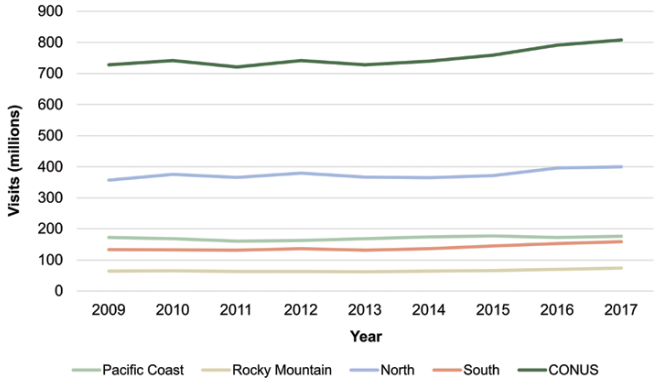
## Use of Recreation Resources

**Local and State Governments**—Local government public lands provide ready access for those living in cities, towns, and residential areas. Although the amount of recreation use at these places in aggregate is likely substantial because of the sheer number of resources and proximity to potential users, there is no reliable estimate of total recreation use at lands managed by local governments. Despite some local governments monitoring the amount of recreation use, there is no comprehensive system to compile those estimates. Partial accounting by The Trust for Public Land's City Park Facts indicates there are more than 240 million visits each year to the most-visited units within the local park systems of the 100 most-populated cities (The Trust for Public Land 2020). Ultimately, many local governments simply lack the funding, capacity, and tools to quantify recreation use at their parks and open spaces (see the sidebar Using Crowd-Sourced and Social Media Data to Understand Recreation Use).

Visitation to State park systems in the United States has increased in recent years after a slowdown in the mid-2000s. In 2018, visitation to State park agencies (813 million visits) was greater than any year since consistent national-level accounting began (Smith et al. 2020). State park systems in the RPA North Region account for nearly half of all visits

in the conterminous United States (figure 11-6). The RPA Pacific Coast and South Regions account for nearly equal shares of visits; the RPA Rocky Mountain Region has the lowest total visitation to State park system lands. Since 2009, the RPA South Region has experienced the greatest increase in State park visitation: an 18-percent increase over the period. Over the same timeframe, State park visitation in the RPA Pacific Coast Region increased by only 2 percent.

**Figure 11-6**. Annual visitation to State park systems by RPA region and conterminous United States (CONUS), 2009 to 2017. Most State park visitation regionally occurs in the North Region, comprising approximately half of the visits for the conterminous United States.



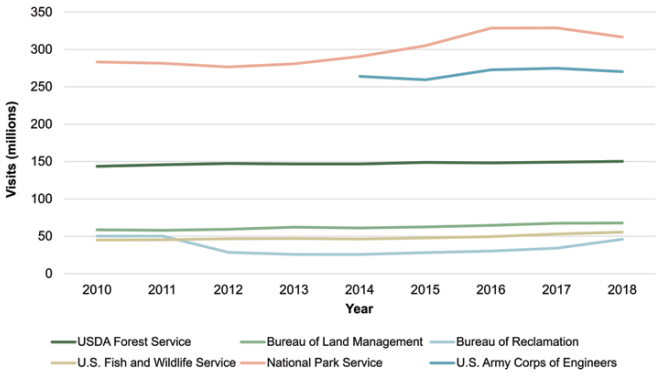

*Source: Smith and Leung 2019.*

**Federal Agencies**—Recreation is the primary way that most people engage with federally owned natural resource lands. There are more than 900 million visits each year to federally managed recreation lands. The NPS leads the Federal agencies in the number of recreation visits with more than 316 million visits each year (figure 11-7). The USDA Forest Service receives about 150 million visits to NFS lands each year. The number of visits annually to Federal lands (excluding the ACOE) has increased slightly since 2010. The FWS and the BLM had the greatest percentage increases (by 23 and 16 percent, respectively) over the period, while the NPS experienced the greatest nominal visit increase (about 33 million additional visits).

The USDA Forest Service National Visitor Use Monitoring (NVUM) Program provides the most comprehensive and consistent data about recreationists using Federal lands (Leggett et al. 2017). Results from the NVUM Program can provide insight into how recreation patterns on federally managed lands compare to national recreation patterns. The most-popular outdoor recreation activities across the United States (see prior section) are also common on NFS land (USDA Forest Service 2020). For example, both nationally and on NFS lands, hiking is the most common recreation activity. However, the types of recreation opportunities available on NFS land do lead to some key differences. For example, downhill skiing/snowboarding is the second-most common primary activity on NFS land but a less common activity when considering recreation on all lands. That difference results because public lands, particularly NFS lands, provide much more downhill skiing opportunity than private lands. The relative popularity of different recreation activities on NFS lands has been stable over the last decade or more. The most common recreation activities (hiking, viewing nature, and skiing/snowboarding) have maintained their prominence and the number of visits for less-common activities have generally held steady.

More than 60 percent of visits to NFS lands are made by men—generally consistent with the demographic patterns of outdoor recreation participants nationally (USDA Forest Service 2020). Whites account for the vast majority of visits to the NFS. On average, NFS recreation visits come from users with above-average incomes and users between ages 30 and 60 (USDA Forest Service 2020). The demographic patterns of visits to the NFS have been relatively stable over time. On average, more than half of visits come from those who have traveled less than 50 miles from home (USDA Forest Service 2020). That pattern is consistent with the distance people commonly travel to engage in outdoor recreation on all lands (Outdoor Foundation 2019); however, visitors often travel much greater distances to visit unique NFS recreation resources and many NPS destinations. Most outdoor recreation visits on NFS lands are short: nearly 40 percent last less than 3 hours (USDA Forest Service 2020). An additional 30 percent of visits last between 3 and 6 hours.

**Figure 11-7**. Annual visitation to federally managed outdoor recreation resources.




*Note: The Army Corps of Engineers (ACOE) visit estimation procedure was revised beginning in 2014; prior year data is not comparable to the current approach used by ACOE. Day visits to the ACOE are measured in units equivalent to the visits of other agencies. However, overnight visits to the ACOE are measured in person nights, which would yield a higher recreation use estimate than the visits measure used by the other agencies.*

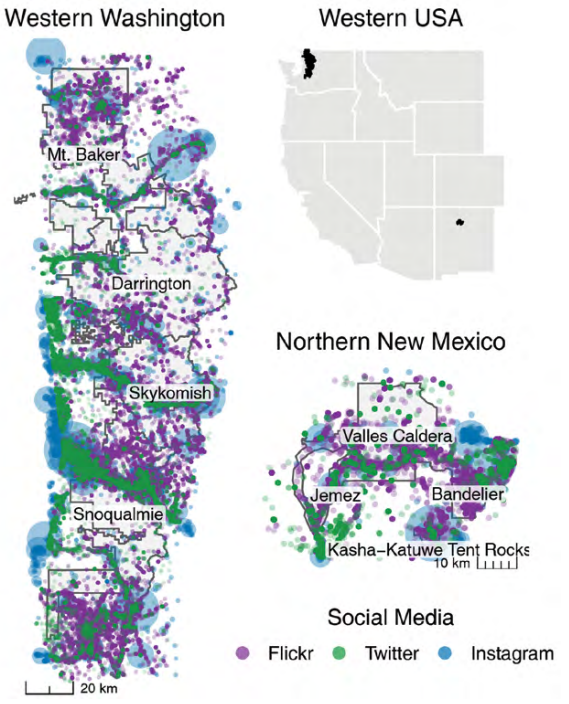
*Sources: Chang 2020 (ACOE); English 2020 (USDA Forest Service); Miller 2020 (NPS, BLM, FWS, and BOR).*

## Using Crowd-Sourced and Social Media Data To Understand Recreation Use

Common approaches to recreation monitoring, such as traffic counters and visitor surveys, are useful for gathering consistent, long-term data about recreation on public lands. Traditional approaches can be time-consuming, relatively costly, and challenging to use. A growing body of peer-reviewed research shows that volunteered geographic data from social media can complement existing information about visitor distributions, behaviors, and preferences (Fisher et al. 2018, Sessions et al. 2018, Wood et al. 2013). Visitors to public lands often share digital information about their experience in the form of photos, posts, or trip logs, some of which are geographically specific. One recent study examining the promise and potential pitfalls of using social media to estimate recreational use in the United States (Wood et al. 2020) found that the number of social media posts shared in a location can substantially improve visitor estimates at unmonitored sites. Visitation estimates are further improved when models are parameterized with onsite counts, showing that although social media posts do not fully substitute for onsite data, they can be a powerful component of recreation research and visitor management.

Studies have concluded that there are potential advantages, but also limitations, to monitoring recreation with volunteered geographic information. The spatial and temporal coverage of social media makes the information widely available year-round and independent of land ownership (figure 11-8). Nonetheless, social media users are a self-selected population. Individuals use a variety of social media platforms, and the cost of data access can vary by source. Social media data may be most beneficial for filling in spatial and temporal gaps in traditional recreation monitoring programs, to capture unique events or other situations that might cause visitation to deviate from the long-term trend (Wood et al. 2020). Future research is necessary to understand how volunteered data can be fully leveraged to improve the accuracy and efficiency of recreation monitoring efforts.

**Figure 11-8**. Spatial coverage of geotagged posts from multiple social media platforms (Flickr, Twitter, and Instagram) across areas in western Washington and northern New Mexico. Points represent the latitude and longitude where a Flickr photograph (purple) or tweet (green) was created. For Instagram, points represent places to which images were assigned by users (blue). Larger points represent a greater number of Instagram posts from the location.

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**Private Lands**—Understanding the amount of recreation use involving recreation resources helps managers, policymakers, and researchers assess the relative contribution of different types of recreation resources in meeting recreation demand. Unfortunately, recreation use of private lands has not been quantified. Although there is no comprehensive estimate of the amount of outdoor recreation use on private lands, surveys of outdoor recreationists and landowners indicate that outdoor recreationists are indeed using private lands to recreate (USDA Forest Service 2012). For example, more than half of the forest land owned by individuals and families is used for recreation by the owners (Butler et al. 2020). Further, about 5 percent of the forest land area owned by individuals and families is available to the public for recreation (Butler et al. 2020). The most common recreational use of forest lands owned by individuals and families is hunting, followed by fishing, hiking/walking, and off-highway vehicle recreation. Private lands are a key recreation provider for some activities and in some regions. For example, across the United States, and

particularly in the RPA South Region, private land recreation resources are important places for hunting (USDA Forest Service 2012). Private land recreation may be informal, such as individuals recreating on lands owned by family or friends, or more formal such as individuals purchasing permits to recreate on lands owned by forest industry (e.g., Mingie et al. 2017).

**COVID-19 Pandemic—**The pandemic, the associated reduction in other leisure opportunities, and the desire to engage in activities that seemingly posed limited COVID exposure risk led to increased participation and engagement in outdoor recreation in 2020. In 2020, the share of the U.S. population participating in recreation increased by 2 percentage points (to 53 percent) and about 7.1 million people (Outdoor Foundation 2021a). Those 2020 participants renewing their participation in outdoor recreation or engaging for the first time were most likely to participate in walking/hiking (47 percent) followed by outdoor running/jogging (28 percent) and outdoor bicycling (26 percent) (Outdoor Foundation 2021b). About half of the newly engaging participants in 2020 reported that they had previously engaged in their recreation activity and were returning (Outdoor Foundation 2021b). Although the number of participants in outdoor recreation increased in 2020, it appeared that participants did not change the number of times

## COVID-19 and Recreation Visitation to NFS Units

The COVID-19 pandemic had wide-ranging and substantial effects on the amount of recreation visitation to National Forest System (NFS) lands during most of 2020. National Visitor Use Monitoring (NVUM) sampling occurred on 24 NFS reporting units spread across the country during fiscal year 2020 (October 2019 to October 2020). These same units were previously sampled in 2015, as part of the 5-year NVUM cycle. The observed differences in visitation between the 2015 and 2020 samples were similar across the sampled units.

We observed a general loss in visitation at developed sites, primarily owing to shortened seasons due to COVID-19 closures. A number of downhill ski areas closed for their spring season, and many saw large reductions in summer use. Visitor centers, picnic areas, and other types of day use facilities that normally support concentrated visitation had closures and/or use limitations from April 2020 onwards. In many parts of the country, larger campgrounds opened later in the year, and group campsites had very little usage. Use of smaller day-use sites and campgrounds, however, rebounded substantially starting in mid-summer.

In comparison, visitation to dispersed settings boomed as people sought outdoor experiences in uncrowded spaces. Visitation rates to undeveloped general forest settings rose by more than 50 percent in April to October 2020, compared to observed visitation in 2015. Access points that normally see lower levels of use saw the greatest increases in visitation. In contrast, the most-popular locations had only moderate levels of increased visitation. Visitation rates to Wilderness access points were more than double the rates observed in 2015. The greatest proportional increases in visitation occurred at less popular locations.

To develop an accurate national visit estimate for 2020, we needed to account for the likely increased visitation at units not sampled in 2020. We calculated the percent change in visitation between the 2015 and 2020 observed on the 2020 sample forests in the last half of the fiscal year, adjusted for a normal growth rate over time, and applied that percentage change to the NFS units that were not sampled in 2020. In total, the NFS saw about 18 million more visits (a 12-percent increase) in 2020 than in 2019. The increase in use is well above the year-to-year increases observed in recent years (table 11-9).

**Table 11-9**. NVUM-based estimates of recreation visits (millions) on NFS lands across four site types for FY2019 and FY2020, with computed differences (millions) between the two time periods.

| | FY2019 (millions) | FY2020 (millions) | Change from 2019 (millions) |
|---|---|---|---|
| **Day use developed sites** | 77.4 | 74.9 | -2.5 |
| **Overnight use developed sites** | 14.2 | 12.9 | -1.3 |
| **General forest areas** | 93.2 | 115.9 | +22.7 |
| **Wilderness** | 9.0 | 16.0 | +7.0 |
| **Total site visits** | 193.9 | 219.7 | +25.8 |
| **National Forest visits** | 150.0 | 168.2 | +18.2 |

*FY = fiscal year; NFS = National Forest System; NVUM = National Visitor Use Monitoring.*

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they engaged in recreation in 2020 (Outdoor Foundation 2020a). There were inconsistent patterns in the change in visitation to Federal lands in 2020. Combined visitation to all NPS units in 2020 declined by 26 percent, but visitation at 15 units set records in 2020 (NPS 2021). For the USDA Forest Service, visitation increased by about 12 percent, but those increases were confined to dispersed recreation opportunities, such as trails (see the sidebar COVID-19 and Recreation Visitation to NFS Units). Although it is unknown what will happen, there is little to suggest that COVID-induced recreation patterns will influence long-term (decades hence) patterns in recreation participation. About 25 percent of the new or renewing participants in 2020 reported their intention to discontinue recreating in future years (Outdoor Foundation 2021b). Further, although the significant events of the first decades of the 21st century (e.g., the September 11th terrorist attacks, the Great Financial Crisis, and spikes in gasoline prices) did yield observable changes in recreation patterns, those changes were ultimately transitory, and patterns returned to baseline trends. However, one important unknown is whether an overly long COVID pandemic, driven by vaccine reluctance, or a cycle of recurring pandemics over the coming decades could yield sustained, long-term changes in recreation patterns.

## Projection of Future Recreation Demand

- Modest changes in per capita participation are projected for almost all activities, with a slight majority of activities projected to experience decreased per capita participation rates in the coming decades.
- Downhill skiing and snowboarding, motorized water use, equestrian riding on trails, and mountain biking are projected to see moderate increases in per capita participation levels in most scenarios, while hunting and motorized snow use are projected to have the largest declines in per capita participation in future decades.
- The numbers of participants and days of engagement are projected to increase under most scenarios for most recreation activities, primarily attributable to projected population growth.
- Developed site use, swimming, and day hiking are projected to have the greatest numbers of participants.
- Lower levels of atmospheric warming generally lead to greater participant numbers.
- Projected declines in participants and consumption are generally confined to the low population growth and economic development scenario and the RPA North Region.

To be successful, recreation managers and policymakers plan and manage for both current and anticipated future recreation demand. Understanding how recreation demand might change can provide insight into how people will interact with natural resources in the future and inform short- and long-term planning about recreation resource investment. As in prior RPA Assessments, we project recreation demand 50 years into the future. In this assessment, we use a base year of 2012 and project demand for each decade to 2070. We develop estimates of how many people are projected to engage in outdoor recreation in the future, along with the frequency of their engagement.

### Projection Methods

As in prior RPA Assessments, we develop projections of future recreation participation and consumption for a set of outdoor recreation activities and activity aggregates (hereafter activity(ies)) (table 11-10). Aside from nature viewing, which includes birding, all other activities are mutually exclusive, and recreationists may engage in one or more at least once within the year. The activity set used here differs slightly from those used in prior RPA Assessments (e.g., Bowker et al. 2012). The set of activities we use in this assessment aligns better with those considered by the Outdoor Foundation in their studies of U.S. outdoor recreation engagement (e.g., Outdoor Foundation 2019) and the activity set used by the USDA Forest Service in their recreation monitoring program, National Visitor Use Monitoring. In this RPA Assessment, we treat camping in developed campgrounds as a unique individual activity. Conversely, we merge the previously used developed site use aggregate (minus developed site camping) and the previously used visiting interpretative sites aggregate into a single developed site use aggregate. Finally, after treating mountain biking as an individual activity, we removed from analysis the remaining "challenge activities" considered in prior assessments, an aggregate of mountain climbing, rock climbing, and caving.

We followed the approach used in the 2010 RPA Assessment and the Update to the 2010 RPA Assessment to project future recreation demand (Askew and Bowker 2018, Bowker et al. 2012). For each outdoor recreation activity, we project both future participation and consumption. Participation is a measure of how many people are engaged in each recreation activity; consumption is a measure of the magnitude of recreation occurrences for that activity. The former provides insight into how popular or common a recreation activity is among the population, and the latter can provide information on the number of recreation occurrences that managers and policymakers might expect.

To project future participation in outdoor recreation, we developed statistical models of anticipated per capita

**Table 11-10**. Recreation activities and assumed initial outdoor recreation engagement in 2012.

| Activity or activity grouping | Population participating (percent of the U.S. population, 16 and over) | Days of participation each year |
|---|---|---|
| Developed site recreation | | |
| Developed site use—family gatherings, picnicking, etc. | 37.6 | 12.0 |
| Camping in developed campgrounds | 10.2 | 7.7 |
| Viewing/photographing nature | | |
| Viewing nature—related to fauna, flora, or natural settings | 7.7 | 15.5 |
| Birding—viewing or photographing birds[a] | 4.9 | 14.2 |
| Non-motorized, undeveloped activities | | |
| Day hiking | 12.5 | 15.3 |
| Primitive area activities—undeveloped area camping, backpacking, visiting Wilderness | 2.8 | 1.5 |
| Mountain biking | 2.5 | 19.8 |
| Equestrian riding on trails | 1.4 | 12.7 |
| Motorized activities | | |
| Motorized water use | 11.1 | 13.3 |
| Motorized off-road use | 8.6 | 16.4 |
| Motorized snow use—snowmobiling | 2.5 | 6.7 |
| Hunting and fishing | | |
| Fishing—anadromous, cold-water, saltwater, warm-water | 12.5 | 16.0 |
| Hunting—small game, big game, migratory bird, other | 5.1 | 18.9 |
| Non-motorized winter activities | | |
| Downhill skiing and snowboarding | 6.8 | 6.4 |
| Cross-country skiing and snowshoeing | 3.8 | 5.3 |
| Non-motorized water activities | | |
| Swimming—swimming, snorkeling, and scuba diving | 19.6 | 12.0 |
| Floating—canoeing, kayaking, or rafting | 4.1 | 6.0 |

[a] *Birding participation rates and days of participation are also incorporated in the values for viewing nature.*

*Source: Initial values were based on the Outdoor Industry Association (Outdoor Foundation 2018), in conjunction with the National Survey on Recreation and the Environment (NSRE). These were obtained either directly, by activity matching between the Outdoor Foundation and NSRE, or indirectly, by formulating Outdoor Foundation-based scalars for adjustments of NSRE estimates (for more conservative estimation).*

participation for each activity. The per capita participation rates identify the share of the respective adult populations engaging in each activity. We combined those per capita participation rates with projections of future population to arrive at the projected number of future participants. To project future consumption of outdoor recreation, we developed statistical models to project how many days per year those participating in a specific activity will engage in that activity. We combined those average days per participant with the projections of number of future participants to arrive at an estimate of total projected consumption (measured in total participant days per year).

Models of per capita participation and consumption are estimated for each activity and for all adults (16 and older), within each RPA region. The national-level figures reported here are developed from aggregating the regional-level results, after accounting for differences in regional populations. Our projections of future demand do not include individuals living in Alaska, Hawaii, or the U.S. territories because we lack data to characterize recreation use of those populations. Models include variables to describe anticipated socio-demographic characteristics of future populations as well as variables related to regional recreation resource supply and climatic conditions. Model variables used to describe climatic conditions include seasonal maximum or minimum temperature, seasonal precipitation, and potential evapotranspiration (a water loss measure that combines information about temperature, humidity, sunlight, and wind). Following Askew and Bowker (2018), each activity model incorporates one, best statistically performing, climate variable. More detailed regional-level results and model specifications will be provided in future RPA Assessment supporting documents.

We project recreation demand for the four future scenarios recognized in this RPA Assessment (see the sidebar RPA Scenarios). Taken individually, the scenarios provide information on the potential outcomes in recreation demand under a specific set of future conditions. Collectively, our recreation projections under the four scenarios provide insight into the potential range of demand for outdoor recreation in the future. Pairwise comparisons between scenarios offer the opportunity to isolate the influences of changing climatic and socioeconomic conditions. Because the assumed socioeconomic trajectories in the Low Moderate (LM) and High Moderate (HM) scenarios are very similar (Langner et al. 2020), differences in recreation outcomes between those scenarios primarily trace to different projections of future climatic change as influenced by different levels of atmospheric warming (see the sidebar RPA Scenarios). Thus, we compare the projections of future recreation demand under the LM and HM scenarios to assess the influence of atmospheric warming on recreation demand. Likewise, because the assumed future atmospheric warming conditions are identical in the High Low (HL) and High High (HH) scenarios (Langner et al. 2020), any differences in recreation outcomes reflect the influence of socioeconomic change on recreation demand. Thus, we compare the projections of future demand under the HL and HH scenarios to assess the influence of socioeconomic change on recreation demand.

## Activity Participation Rates and the Influence of Future Climate and Socioeconomic Pathways

Our projections of future participation rates represent the share of the U.S. population age 16 and older expected to participate in an activity at least once a year under each of the RPA scenarios. In this analysis, we focus on projections for 2070 to consider the relative effects of climate and socioeconomic change on per capita participation (results for 2040 are available in the next section of this chapter). For each activity and scenario, we calculated the mean indexed participation (2070 relative to 2012) across the five climate projections. We then compared those mean indexed participation values between paired RPA scenarios (i.e., LM versus HM, HL versus HH) to classify each activity as exhibiting relative sensitivity primarily to future climate, future socioeconomic conditions, both, or neither. Across the 17 activities considered here, we project that between 2012 and 2070, six activities will experience an increase in per capita participation, nine will experience a decline, and two will see little change (table 11-11). Projected participation in six of our activities exhibited sensitivity to differences in the socioeconomic change in our scenarios and six were sensitive to both socioeconomic change and climatic change. Five activities exhibited little sensitivity to either socioeconomic or climatic change. Aside from assumed level of atmospheric warming associated with the RPA scenario, projected per capita participation for several of our activities was sensitive to one or more climate projections. When projected participation rates were sensitive to climate projection, higher rates of participation were frequently associated with the least warm climate projection and lower rates of participation were frequently associated with the hot climate projection.

We use two graphs for each activity to explore the sensitivities of the activity to the influence of changing climate (LM versus HM) and socioeconomic conditions (HL versus HH). In graphing future outlooks for a given activity, the vertical and horizontal axes correspond to paired RPA scenarios ($S_1$ and $S_2$, respectively); each graph depicts a comparison of indexed per capita participation rate in 2070 under the scenarios jointly (figure 11-9). The indexed participation rates are computed relative to the participation rate observed in the base year 2012, and values reflect a percentage change from the 2012 estimate. A value greater than 1.0 indicates a higher projected participation rate than that observed in 2012. For example, if the projected participation rate in 2070 was 20 percent and the observed participation rate in 2012 was 15 percent, the resulting indexed participation rate would be 1.33. Conversely, a value less than 1.0 indicates a lower projected participation rate in 2070 relative to 2012. For example, if the projected participation rate in 2070 was 5 percent and the observed participation rate in 2012 was 10 percent, the resulting indexed participation rate would be 0.50. The markers on the graph represent the pairwise values of projected participation for 2070 between Scenarios $S_1$ and $S_2$. The star marker represents the comparison between scenarios of the mean indexed participation rate across the five climate projections; the other shapes represent comparisons for the individual climate projections (see the sidebar RPA Scenarios). A marker located above the solid diagonal line (area A of the graph) indicates that projected participation rates in 2070 are greater in Scenario $S_1$ compared to Scenario $S_2$ for that climate model. A marker located below the solid diagonal line (area B of the graph) indicates the opposite. The distance the marker is located from the solid line depicts the magnitude of the difference in projected participation rates between the two scenarios: markers nearest the diagonal line indicate smaller differences between the scenarios. Markers above the smaller dashed horizontal line (area C of the graph) indicate the projected participation rate in 2070 is greater than the rate observed in 2012 under Scenario $S_1$. Markers located below the smaller dashed horizontal line (area D in the graph) indicate the projected participation rate in 2070 is lower than the rate observed in 2012 under Scenario $S_1$. Areas on either side of the longer dashed vertical line (E and F in the graph) have the same meanings, but for Scenario $S_2$. It is possible that results under both scenarios $S_1$ and $S_2$ may jointly yield projections of future participation that are higher (or lower) than that observed in 2012.

**Atmospheric Warming as Primary Driver: LM versus HM**—No activities exhibited responsiveness primarily to changing climate conditions alone, represented by the differences in atmospheric warming between our LM and

**Figure 11-9**. Example comparison of relative per capita participation indices in example scenarios $S_1$ and $S_2$. See text for descriptions of letters A through F.

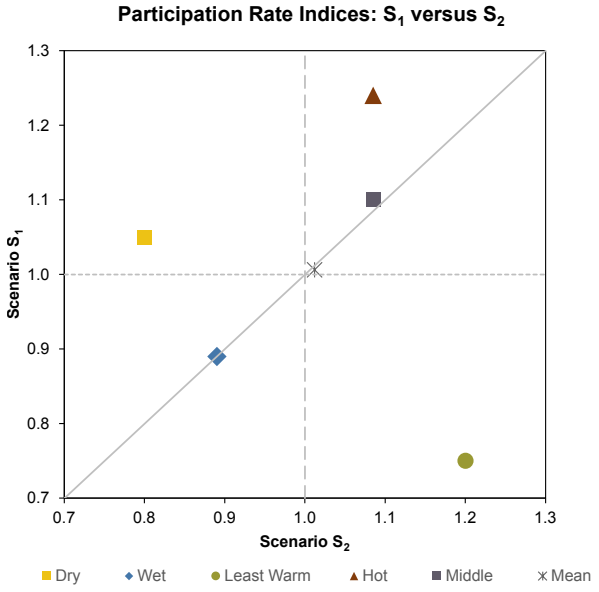


**Table 11-11**. Projected changes in per capita participation between 2012 and 2070 and the relationship of influencing factors to participation rate.

| Activity or activity grouping | Projected change in per capita participation between 2012 and 2070 | Responsiveness to socioeconomic change or climactic change | Influence of higher levels of socioeconomic growth on per capita participation | Influence of higher levels of atmospheric warming on per capita participation | Climate projection(s) leading to highest projected per capita participation | Climate projection(s) leading to lowest projected per capita participation |
|---|---|---|---|---|---|---|
| **Developed site recreation** | | | | | | |
| Developed site use—family gatherings, picnicking, etc. | ⇔ | Neither | ⇔ | ⇔ | ⇔ | ⇔ |
| Camping in developed campgrounds | 🡻 | Socioeconomic change | 🡻 | ⇔ | Dry | Least warm |
| **Viewing/photographing nature** | | | | | | |
| Viewing nature—related to fauna, flora, or natural settings | ⇔ | Neither | ⇔ | ⇔ | ⇔ | ⇔ |
| Birding—viewing or photographing birds[a] | ↓ | Neither | ⇔ | ⇔ | Least warm | Hot |
| **Non-motorized, undeveloped activities** | | | | | | |
| Day hiking | ↑ | Both | 🡹 | 🡻 | Least warm, Wet | Hot |
| Primitive area activities—undeveloped area camping, backpacking, visiting Wilderness | 🡻 | None | ⇔ | ⇔ | Least warm | Hot, Middle |
| Mountain biking | ↑ | Both | 🡹 | 🡻 | ⇔ | ⇔ |
| Equestrian riding on trails | 🡹 | Socioeconomic change | 🡹 | ⇔ | Hot, Middle | ⇔ |
| **Motorized activities** | | | | | | |
| Motorized water use | 🡹 | Socioeconomic change | 🡹 | ⇔ | Hot, Middle | Least warm |
| Motorized off-road use | 🡻 | Socioeconomic change | 🡻 | ⇔ | ⇔ | ⇔ |
| Motorized snow use—snowmobiling | 🡻 | Both | 🡹 | 🡻 | Least warm | Hot, Dry |
| **Hunting and fishing** | | | | | | |
| Fishing—anadromous, cold-water, saltwater, warm-water | ↓ | None | ⇔ | ⇔ | Middle | Hot |
| Hunting—small game, big game, migratory bird, other | 🡻 | Socioeconomic change | 🡻 | ⇔ | ⇔ | ⇔ |
| **Non-motorized winter activities** | | | | | | |
| Downhill skiing and snowboarding | 🡹 | Socioeconomic change | 🡹 | ⇔ | ⇔ | ⇔ |
| Cross-country skiing and snowshoeing | ↓ | Both | 🡹 | 🡻 | Least warm | ⇔ |
| **Non-motorized water activities** | | | | | | |
| Swimming—swimming, snorkeling, and scuba diving | ↑ | Both | 🡹 | 🡻 | Wet, Least warm | Hot |
| Floating—canoeing, kayaking, or rafting | 🡻 | Both | 🡹 | 🡻 | Wet, Least warm | ⇔ |

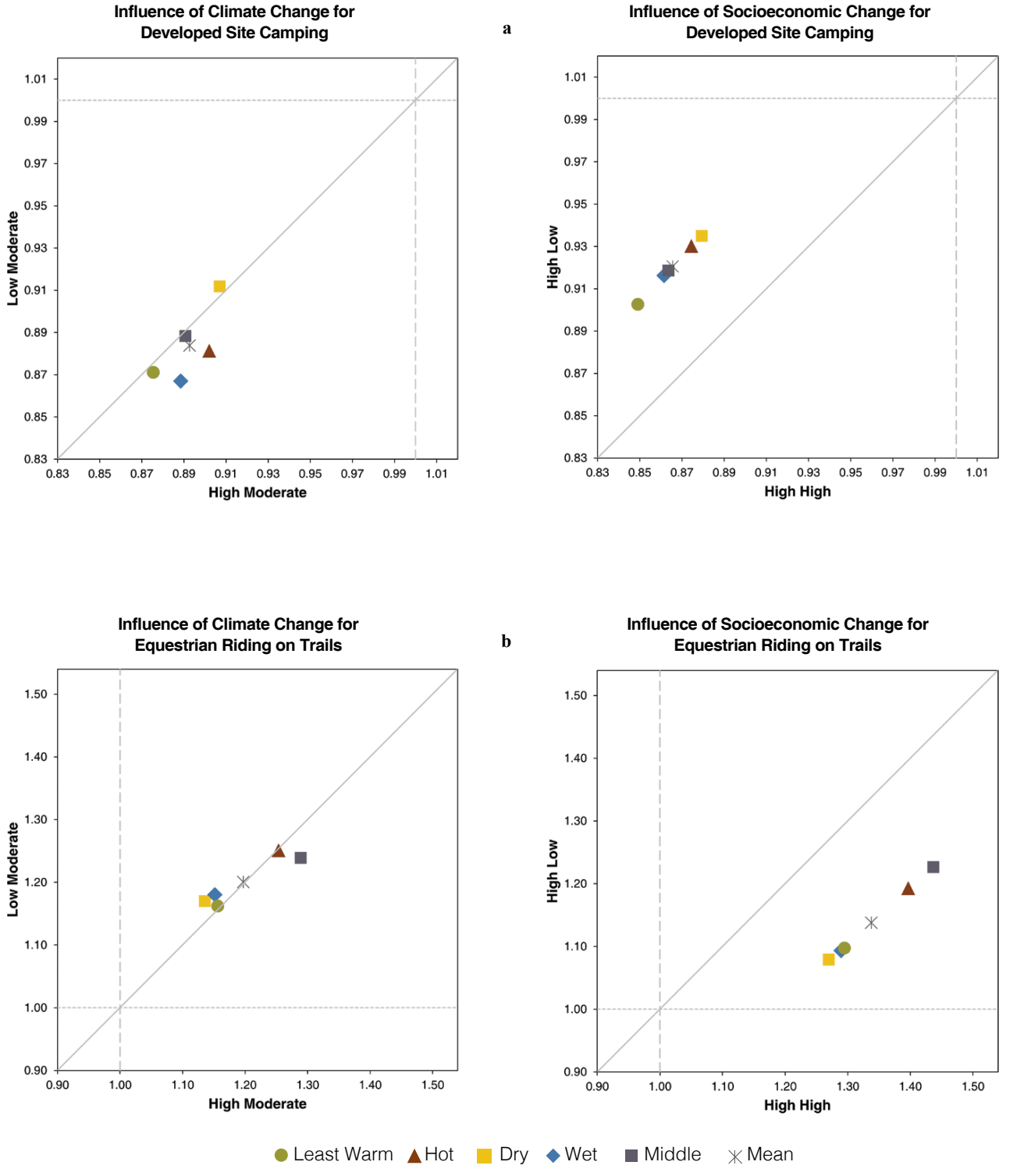
[a] *Birding participation rates and days of participation are also incorporated in the values for viewing nature.*

🡹🡻 = *unambiguous increase or decrease in projected per capita participation,* ↑↓ = *increase or decrease in per capita participation in most projection cases,* ⇔ = *no clear outcome or relationship.*

HM scenarios. Six activities (discussed in a later section) exhibited responsiveness to both atmospheric warming and changing socioeconomic conditions. Further, many activities (discussed in subsequent sections) exhibited responsiveness to different climate futures (e.g., wet, least warm, hot) within the individual RPA scenarios.

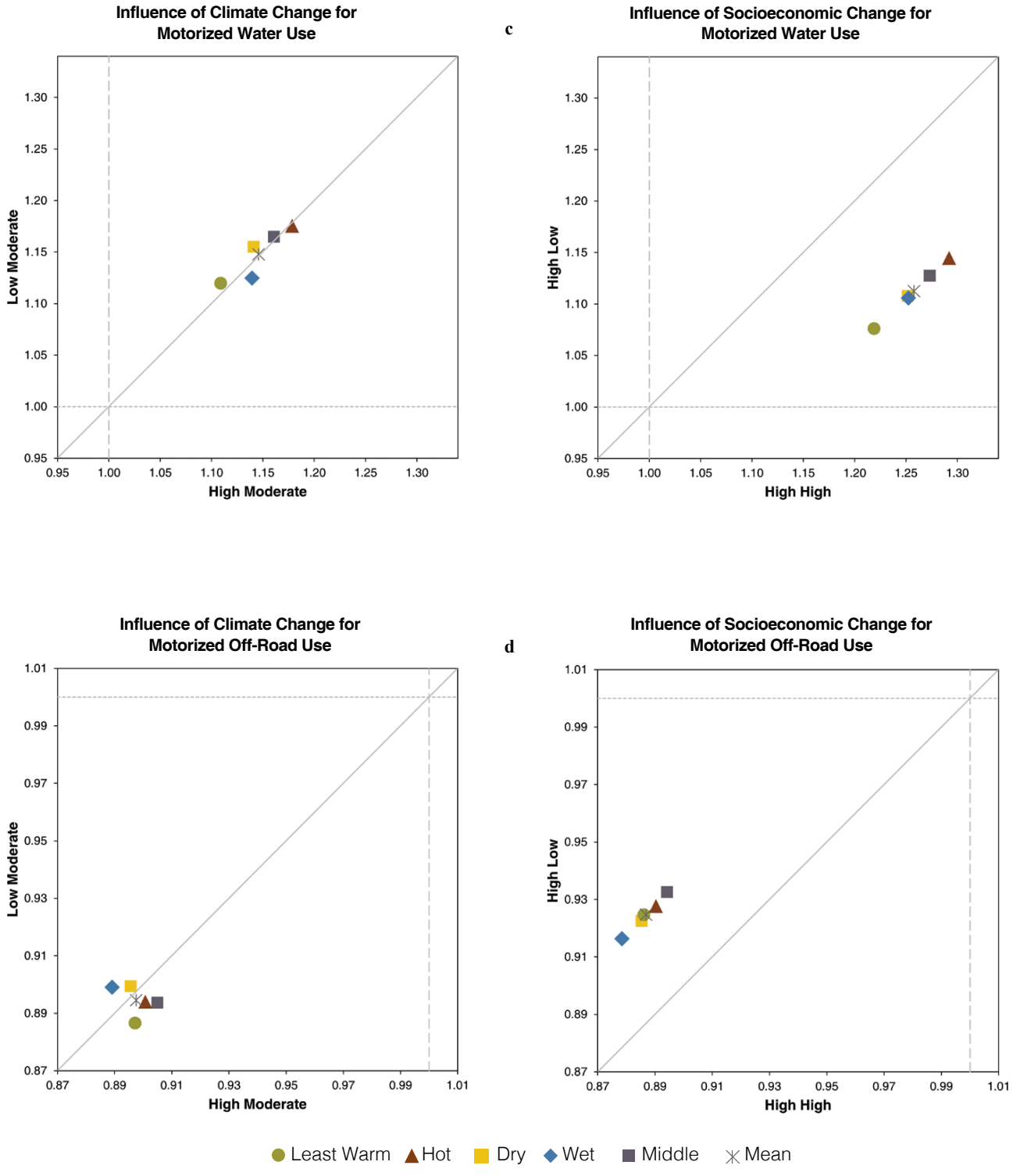
**Economic Development and Population Growth as Primary Driver: HL versus HH—**Participation rates in developed site camping, equestrian riding on trails, motorized water use, motorized off-road use, hunting, and downhill skiing and snowboarding exhibit responsiveness to the levels of population and economic growth but are relatively unchanged by differing levels of future atmospheric warming (demonstrated by increased distance from markers to diagonal line for the HL/HH figure relative to the LM/HM figure; figure 11-10). Projected participation rates in 2070 for developed site camping, motorized off-road use, and hunting are all greater under the HL scenario than

**Figure 11-10**. Projected per capita participation in 2070 indexed to 2012, comparing RPA scenarios LM with HM (climate change, left) and HL with HH (socioeconomic change, right) for (a) developed site camping, (b) equestrian riding on trails, (c) motorized water use, (d) motorized off-road use, (e) hunting, and (f) downhill skiing and snowboarding.



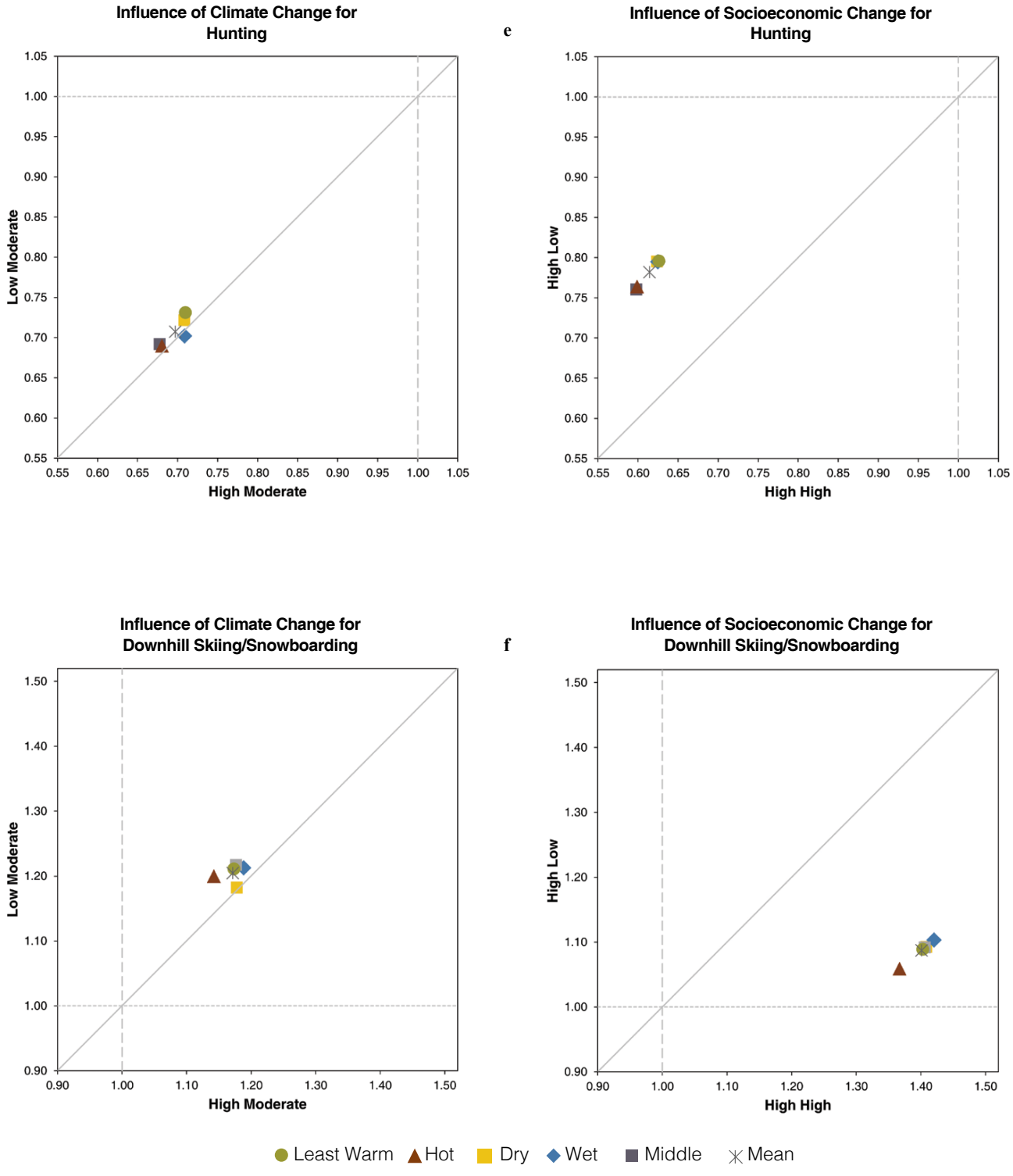

*LM = lower warming-moderate U.S. growth; HL = high warming-low U.S. growth; HM = high warming-moderate U.S. growth; HH = high warming-high U.S. growth.*

**Figure 11-10 continued**. Projected per capita participation in 2070 indexed to 2012, comparing RPA scenarios LM with HM (climate change, left) and HL with HH (socioeconomic change, right) for (a) developed site camping, (b) equestrian riding on trails, (c) motorized water use, (d) motorized off-road use, (e) hunting, and (f) downhill skiing and snowboarding.




*LM = lower warming-moderate U.S. growth; HL = high warming-low U.S. growth; HM = high warming-moderate U.S. growth; HH = high warming-high U.S. growth.*

**Figure 11-10 continued**. Projected per capita participation in 2070 indexed to 2012, comparing RPA scenarios LM with HM (climate change, left) and HL with HH (socioeconomic change, right) for (a) developed site camping, (b) equestrian riding on trails, (c) motorized water use, (d) motorized off-road use, (e) hunting, and (f) downhill skiing and snowboarding.




*LM = lower warming-moderate U.S. growth; HL = high warming-low U.S. growth; HM = high warming-moderate U.S. growth; HH = high warming-high U.S. growth.*

HH because the improved economic well-being and greater population growth of the HH scenario result in lower future rates of per capita participation in those activities. This relationship is most pronounced for hunting. In contrast, improved economic well-being and increased population growth lead to higher rates of participation in equestrian riding on trails, motorized water use, and downhill skiing and snowboarding.

Although the projections of per capita participation for these activities do not exhibit much responsiveness to changes in the levels of future atmospheric warming (LM versus. HM scenarios), projected per capita participation rates for developed site camping, equestrian riding on trails, and motorized water use exhibit responsiveness to individual climate projections (depicted by the more dispersed participation projections for those activities). For developed site camping, projected participation rates are highest when using the dry projection and lowest under the least warm projection. For equestrian riding and motorized water use, the hot and middle projections result in per capita participation rates that are meaningfully higher than the other climate projections across all RPA scenarios. For motorized water use, the least warm projection yields a per capita participation rate that is meaningfully lower than other climate projections across all RPA scenarios.

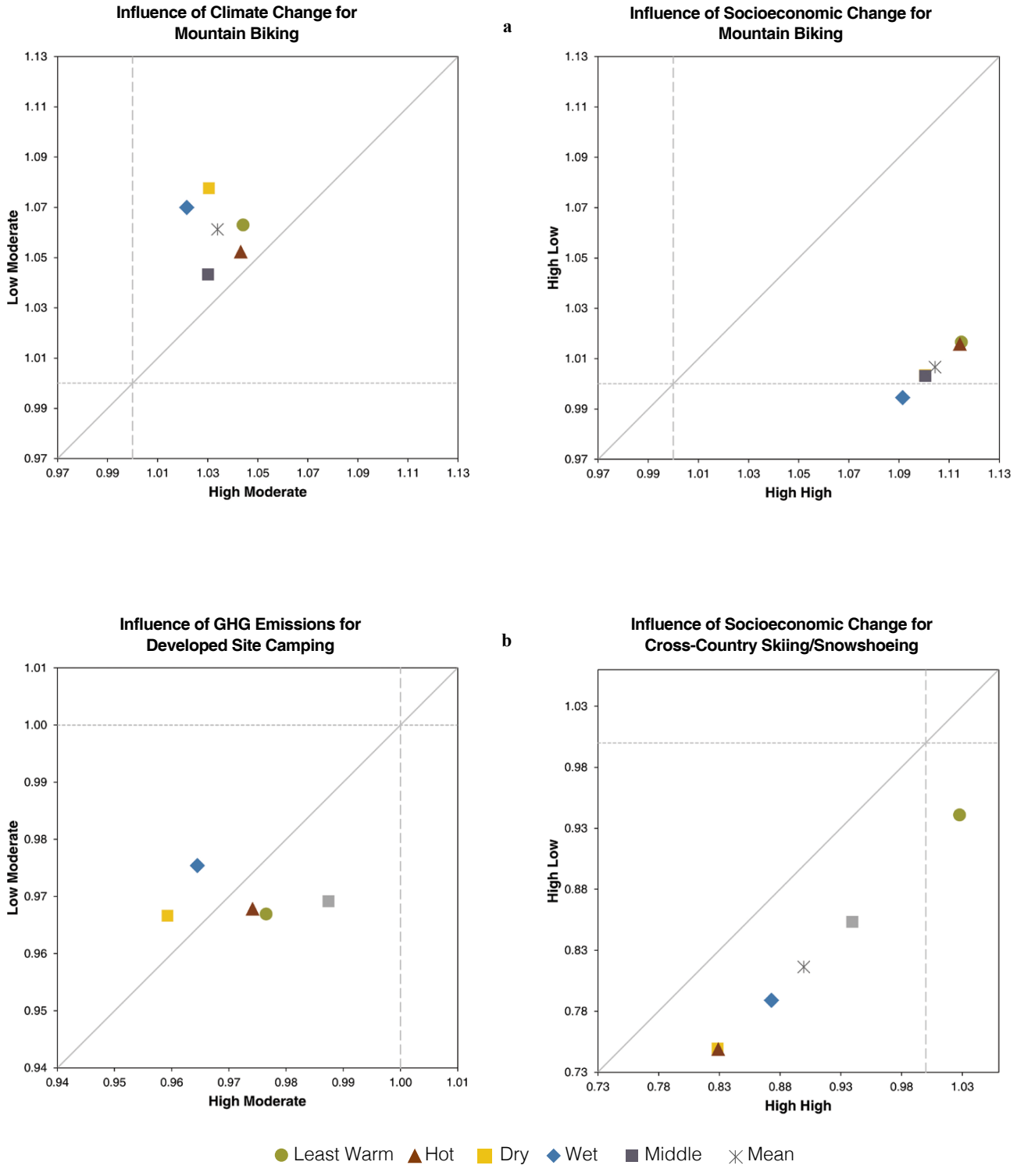
***Per Capita Participation Relative to 2012*—**Projected per capita participation in equestrian riding on trails, motorized water use, and downhill skiing and snowboarding is projected to be greater in 2070 than in 2012 across all scenarios (depicted by projections greater than 1.0). The greatest increases in per capita participation are projected for downhill skiing and snowboarding under the HH scenario, with participation rates potentially up to around 140 percent of observed 2012 participation. Projected per capita participation in developed site camping, motorized off-road use, and hunting are projected to be lower in 2070 than 2012 across all scenarios and all projections. Hunting is projected to experience the greatest per capita participation declines, with projected relative 2070 per capita participation as low as 60 percent (under HH-middle and HH-hot) and as high as 80 percent (under HL-dry and HL-least warm) of observed 2012 participation rates.

**Responsive to Both Drivers—**Projections of per capita participation in mountain biking, cross-country skiing and snowshoeing, motorized snow use, floating, swimming, and day hiking are responsive to both levels of atmospheric warming and population growth and economic development (figure 11-11) (depicted by projections off the diagonal line in both the LM/HM and HL/HH graphs). For all of these activities, per capita participation is projected to be greater under lower atmospheric warming (the LM scenario compared to the HM scenario). In addition, each activity has higher levels of projected per capita participation in the high-growth HH scenario compared to the low-growth HL scenario.

Although the lower atmospheric warming in the LM scenario leads to higher projected per capita participation relative to the HM scenario for each activity, the potential range in future climate alters the degree to which there is a positive influence on per capita participation (i.e., the distance from the diagonal line). For day hiking, the most pronounced differences between the lower and high climatic change scenarios are found when using the wet and the hot climate projections; for mountain biking, the wet and dry climate projections yield the greatest differences. Finally, the dry climate projection produces the greatest differences in projected participation in cross-country skiing and snowshoeing and motorized snow use.

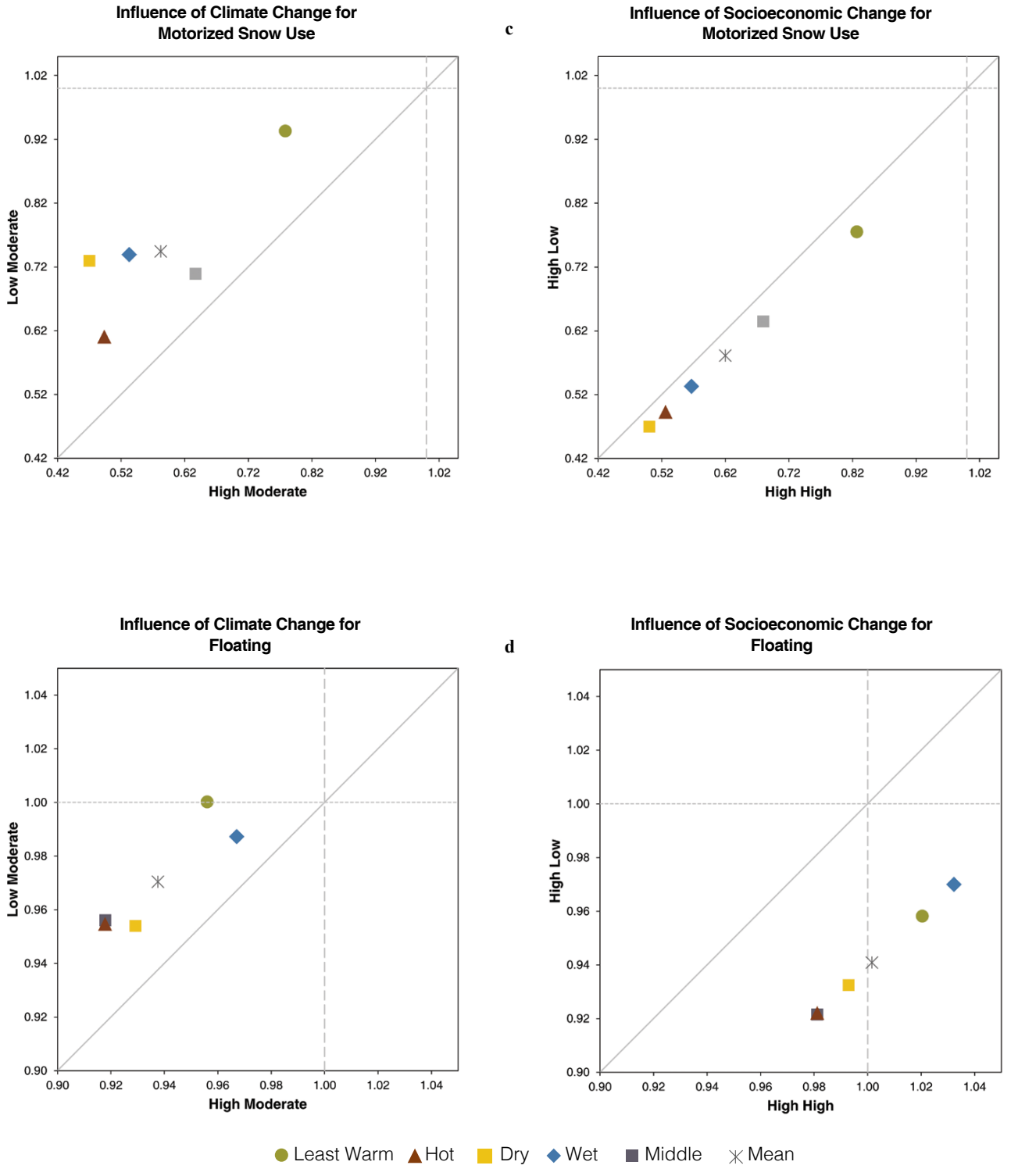
***Per Capita Participation Relative to 2012*—**For this set of activities, there is high variation across the 20 RPA scenario-climate futures in how projected per capita participation in 2070 compares to 2012. For every activity except motorized snow use, at least two scenario-climate futures project growth in per capita participation between 2012 and 2070 (i.e., participation values greater than 1.0). For mountain biking, an increase in per capita participation is projected in all combinations except HL-wet. Cross-country skiing and snowshoeing aggregate exhibits pathways to growth in per capita participation, relative to 2012, under LM-least warm and HH-least warm. For floating and swimming, the greatest participation rates correspond to the wet and least warm climate projections (across all scenarios), either by greatest increase or slowest decline from 2012. Finally, projected per capita participation in day hiking exhibits increases in all scenario-climate futures except HH-hot, LM-least warm, and LM-wet. The smallest reduction in participation in motorized snow use (93 percent of 2012 participation) is projected for LM-least warm; the least warm climate projection yields the highest motorized snow use participation rates across all four scenarios.

**Figure 11-11**. Projected per capita participation in 2070 indexed to 2012 comparing RPA scenarios LM with HM (climate change, left) and HL with HH (socioeconomic change, right) for (a) mountain biking, (b) cross-country skiing and snowshoeing, (c) motorized snow use, (d) floating, (e) swimming, and (f) day hiking.



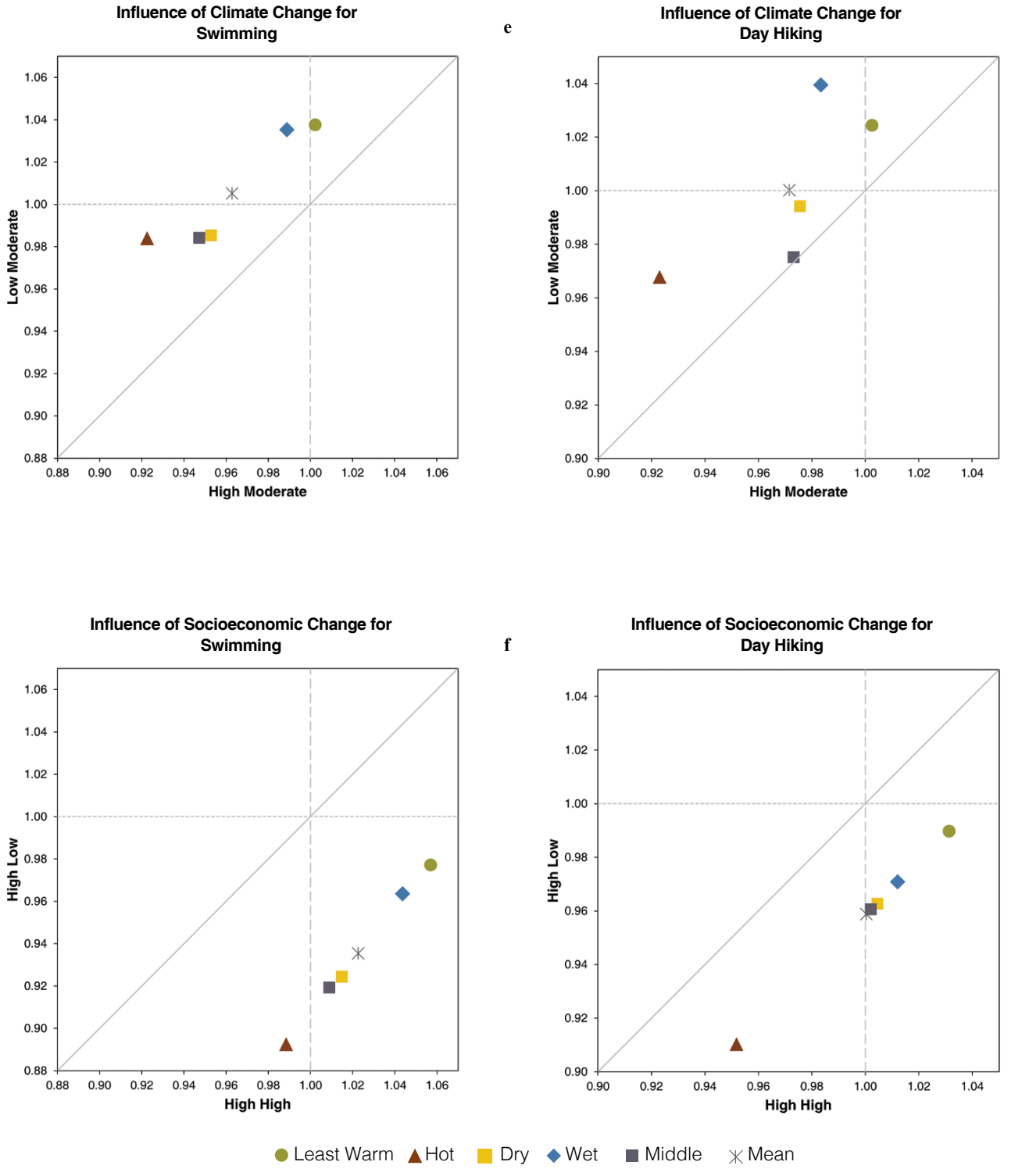

*LM = lower warming-moderate U.S. growth; HL = high warming-low U.S. growth; HM = high warming-moderate U.S. growth; HH = high warming-high U.S. growth.*

**Figure 11-11 continued**. Projected per capita participation in 2070 indexed to 2012 comparing RPA scenarios LM with HM (climate change, left) and HL with HH (socioeconomic change, right) for (a) mountain biking, (b) cross-country skiing and snowshoeing, (c) motorized snow use, (d) floating, (e) swimming, and (f) day hiking.




*LM = lower warming-moderate U.S. growth; HL = high warming-low U.S. growth; HM = high warming-moderate U.S. growth; HH = high warming-high U.S. growth.*

**Figure 11-11 continued**. Projected per capita participation in 2070 indexed to 2012 comparing RPA scenarios LM with HM (climate change, left) and HL with HH (socioeconomic change, right) for (a) mountain biking, (b) cross-country skiing and snowshoeing, (c) motorized snow use, (d) floating, (e) swimming, and (f) day hiking.

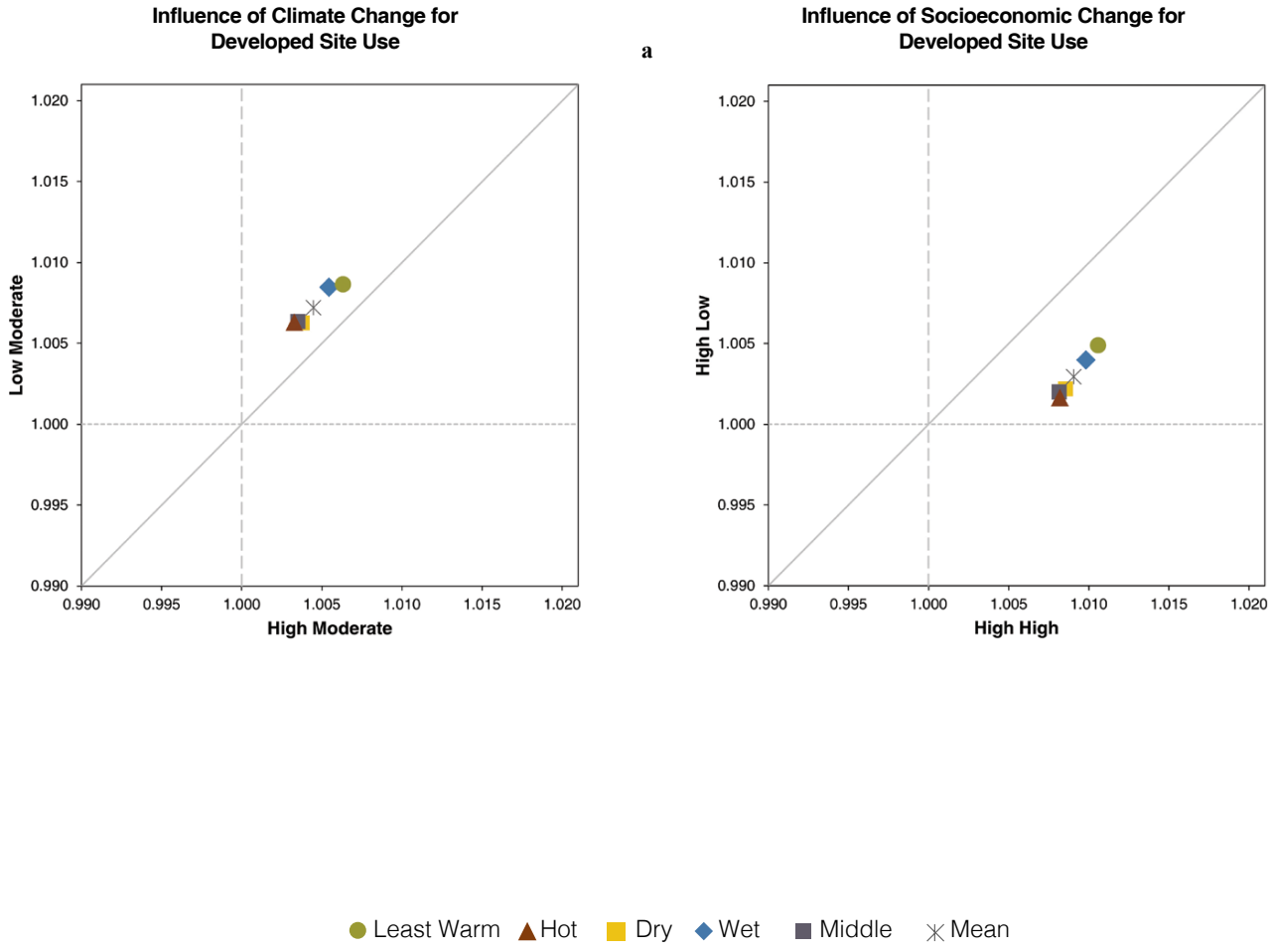



*LM = lower warming-moderate U.S. growth; HL = high warming-low U.S. growth; HM = high warming-moderate U.S. growth; HH = high warming-high U.S. growth.*

**No Evidence of Clear Driver**—Developed site use, viewing nature, fishing, primitive area recreation, and birding exhibit minimal response to alternate levels of atmospheric warming or economic development and population growth (figure 11-12). However, for fishing and birding there are some larger differences in indexed participation rates between the LM and HM scenarios for a few individual climate projections. Under the hot and wet climate projections, participation in birding is projected to be distinctly higher in the LM compared to the HM scenario. Conversely, under the middle climate projection, birding participation is highest under the HM scenario, counter to the pattern for that activity in any other climate projection. For fishing, the HM scenario produces slightly higher participation over the LM scenario in all climate projections, but this difference is more pronounced under the middle climate projection.

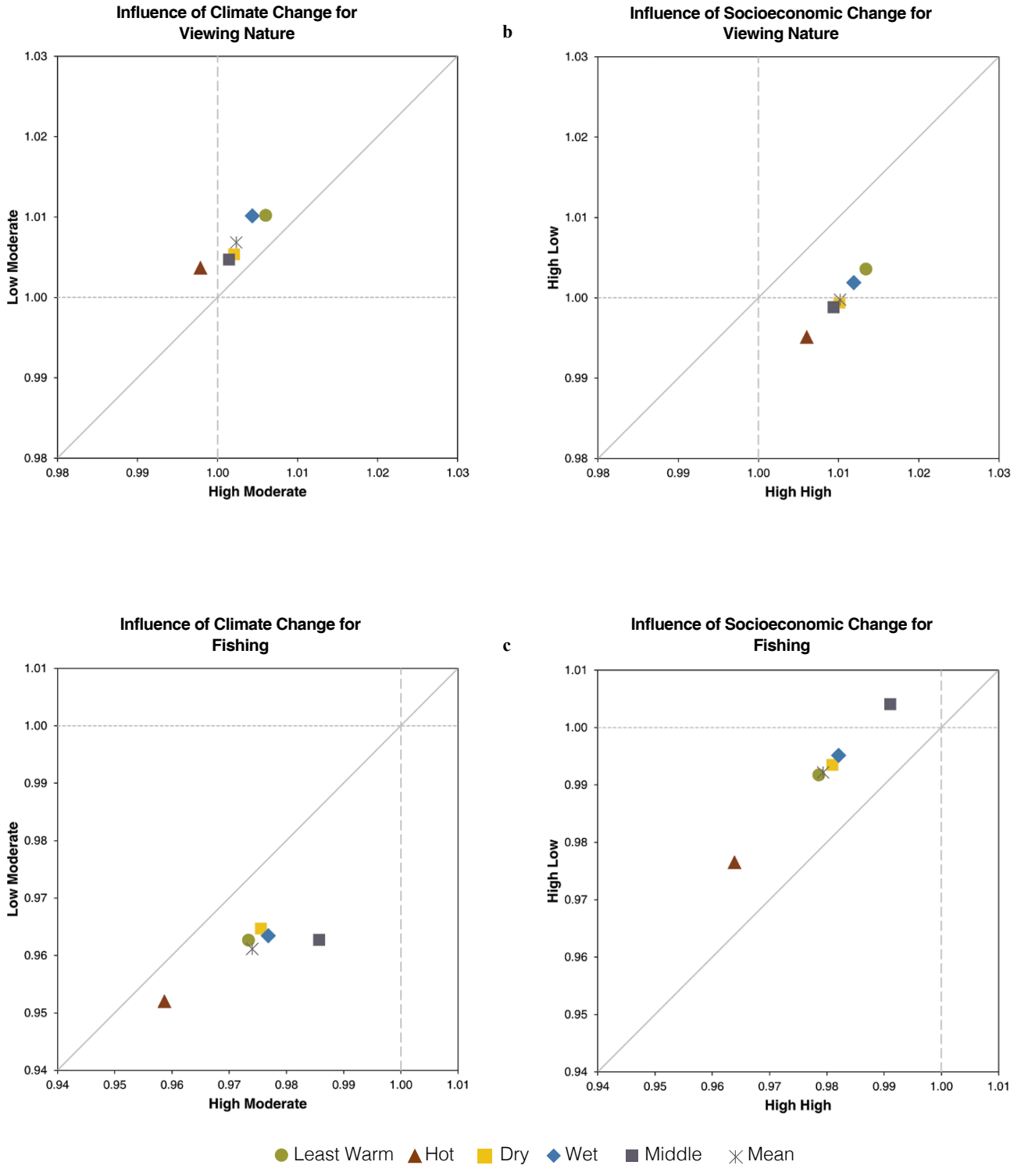
***Per Capita Participation Relative to 2012***—Projected participation in 2070 in developed site use and viewing nature are largely unchanged from observed 2012 participation. Slight declines in fishing participation are projected for all scenario-climate futures except HL-middle. Fishing participation declines are projected to be greatest under the hot climate projection. Similarly, the hot and middle climate projections lead to the largest declines in participation in primitive area recreation. Projected declines for that activity are smallest under the least warm climate projection. Participation in birding is projected to range from largely unchanged from 2012 in LM-wet to up to a 9-point loss under the hot climate projection.

**Figure 11-12**. Projected per capita participation in 2070 indexed to 2012 comparing RPA scenarios LM with HM (climate change, left) and HL with HH (socioeconomic change, right) for (a) developed site use, (b) viewing nature, and (c) fishing, (d) primitive area use, and (e) birding.



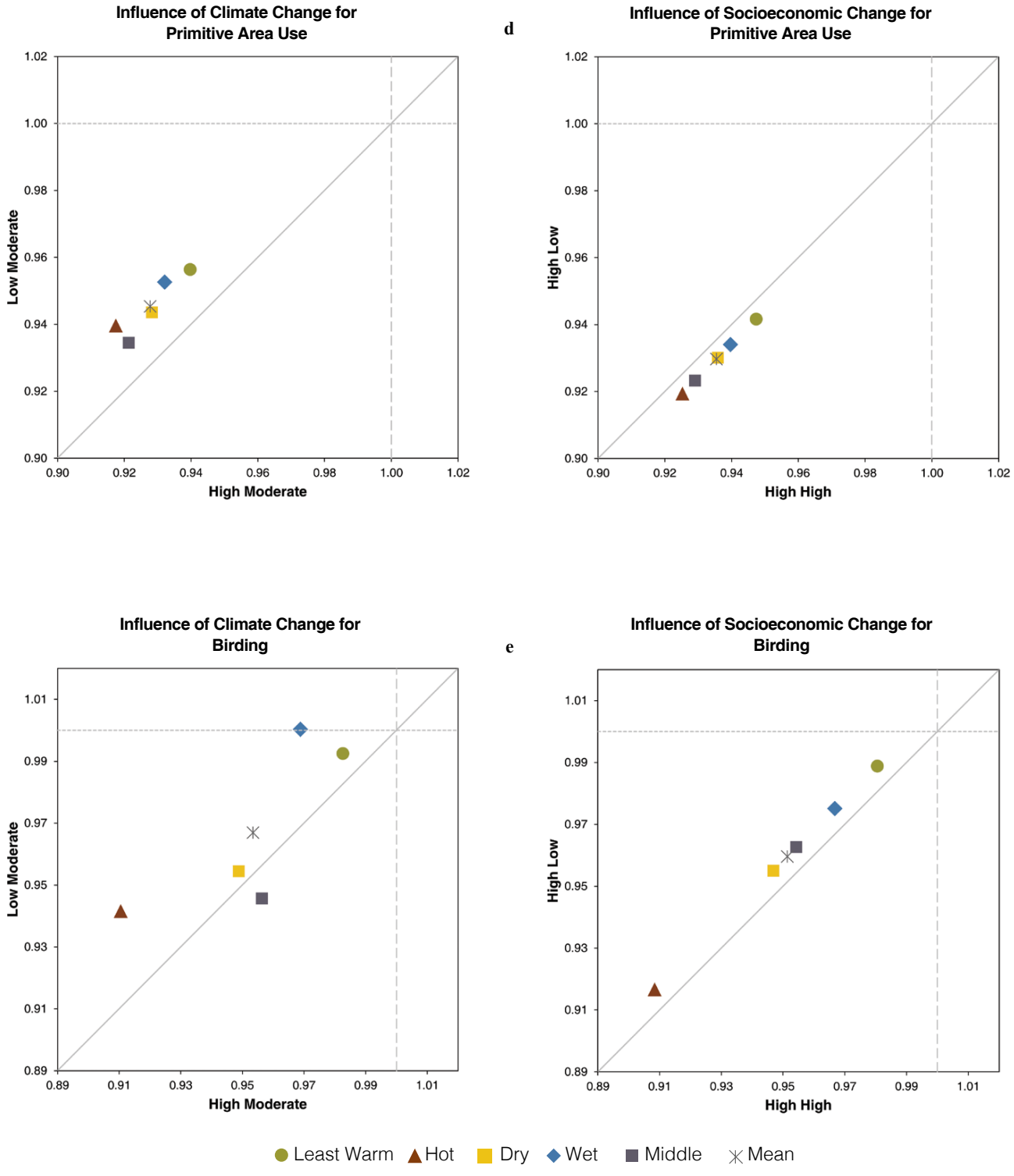

*LM = lower warming-moderate U.S. growth; HL = high warming-low U.S. growth; HM = high warming-moderate U.S. growth; HH = high warming-high U.S. growth.*

**Figure 11-12 continued**. Projected per capita participation in 2070 indexed to 2012 comparing RPA scenarios LM with HM (climate change, left) and HL with HH (socioeconomic change, right) for (a) developed site use, (b) viewing nature, and (c) fishing, (d) primitive area use, and (e) birding.




*LM = lower warming-moderate U.S. growth; HL = high warming-low U.S. growth; HM = high warming-moderate U.S. growth; HH = high warming-high U.S. growth.*

**Figure 11-12 continued**. Projected per capita participation in 2070 indexed to 2012 comparing RPA scenarios LM with HM (climate change, left) and HL with HH (socioeconomic change, right) for (a) developed site use, (b) viewing nature, and (c) fishing, (d) primitive area use, and (e) birding.




*LM = lower warming-moderate U.S. growth; HL = high warming-low U.S. growth; HM = high warming-moderate U.S. growth; HH = high warming-high U.S. growth.*

## Participants and Consumption

Population growth, because of its magnitude, is often the determining factor in long-term trends in the number of recreation participants and the collective total days of recreation. The number of participants engaging in a recreation activity in the future reflects both changes in per capita participation over time and the size of the future population. Similarly, the total days of recreation (consumption) in the future is a combination of the number of people participating in the activity and the mean days annually that participants engage in the activity. Although there may be meaningful changes (increases or decreases) in per capita participation and average number of days of engagement for individual activities (the per capita consumption measure), population growth typically magnifies (for increases) or offsets (for decreases) those changes.

**Participants**—The large gross domestic product (GDP) growth and substantial population increases of the HH scenario result in the greatest projected numbers of recreation participants for almost all activities (table 11-12). Three exceptions to this pattern are motorized snow use, cross-country skiing and snowshoeing, and hunting. For motorized snow use, there is overlap between the HH and HM scenarios in the projected numbers of participants nationally and in the North Region for 2040 and 2070. This overlap reflects the substantial projected decline in per capita participation in motorized snow use—to an extent that even high population growth under the HH scenario cannot offset—for some future climates, particularly the hot climate projection. Additionally, the absence of motorized snow use engagement in the South Region translates to a reduced national total, especially since large population increases are projected for that region in 2040 and 2070.

**Table 11-12**. Projected numbers of outdoor recreation participants (millions) for conterminous United States and RPA regions in 2040 and 2070, averaged across five climate projections within each RPA scenario.

| | | Baseline | LM | | HL | | HM | | HH | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Activity** | **Geography** | **2012** | **2040** | **2070** | **2040** | **2070** | **2040** | **2070** | **2040** | **2070** |
| Developed site use (visiting natural prehistoric, and/or historic sites; family gatherings; picnicking) | | | | | | | | | | |
| | Conterminous United States | 93.0 | 122.4 | 141.6 | 104.6 | 98.6 | 119.4 | 134.9 | 137.4 | 186.8 |
| | North | 38.0 | 45.1 | 49.0 | 38.6 | 34.2 | 44.0 | 46.7 | 50.6 | 64.5 |
| | South | 31.8 | 44.8 | 54.2 | 38.3 | 37.5 | 43.8 | 51.5 | 50.4 | 71.6 |
| | Rocky Mountain | 8.7 | 12.7 | 15.7 | 10.9 | 10.9 | 12.4 | 14.9 | 14.3 | 20.8 |
| | Pacific Coast | 14.5 | 19.7 | 22.8 | 16.9 | 16.0 | 19.2 | 21.7 | 22.1 | 29.9 |
| Developed camping | | | | | | | | | | |
| | Conterminous United States | 25.3 | 30.7 | 33.8 | 26.8 | 24.6 | 30.2 | 32.6 | 34.3 | 43.6 |
| | North | 9.1 | 10.0 | 10.3 | 8.8 | 7.6 | 9.9 | 10.1 | 11.2 | 13.3 |
| | South | 7.3 | 9.2 | 10.3 | 8.1 | 7.6 | 9.1 | 10.0 | 10.3 | 13.2 |
| | Rocky Mountain | 3.5 | 4.8 | 5.7 | 4.1 | 4.0 | 4.7 | 5.4 | 5.3 | 7.4 |
| | Pacific Coast | 5.3 | 6.7 | 7.5 | 5.8 | 5.4 | 6.6 | 7.1 | 7.5 | 9.6 |
| Nature viewing (viewing or photographing birds, other wildlife, natural scenery, gathering, other) | | | | | | | | | | |
| | Conterminous United States | 19.1 | 25.2 | 29.1 | 21.5 | 20.2 | 24.5 | 27.6 | 28.3 | 38.4 |
| | North | 7.8 | 9.3 | 10.0 | 7.9 | 7.0 | 9.1 | 9.6 | 10.4 | 13.3 |
| | South | 6.5 | 9.2 | 11.2 | 7.9 | 7.7 | 9.0 | 10.6 | 10.4 | 14.8 |
| | Rocky Mountain | 1.8 | 2.6 | 3.2 | 2.2 | 2.2 | 2.6 | 3.1 | 3.0 | 4.3 |
| | Pacific Coast | 3.0 | 4.0 | 4.6 | 3.4 | 3.2 | 3.9 | 4.4 | 4.5 | 6.0 |
| Birding (viewing or photographing) | | | | | | | | | | |
| | Conterminous United States | 12.0 | 15.9 | 17.6 | 13.6 | 12.2 | 15.5 | 16.6 | 17.8 | 22.8 |
| | North | 5.1 | 6.2 | 6.4 | 5.3 | 4.5 | 6.1 | 6.1 | 7.0 | 8.4 |
| | South | 4.0 | 5.8 | 6.7 | 4.9 | 4.5 | 5.6 | 6.2 | 6.4 | 8.6 |
| | Rocky Mountain | 1.0 | 1.6 | 1.8 | 1.3 | 1.3 | 1.5 | 1.7 | 1.7 | 2.4 |
| | Pacific Coast | 1.8 | 2.4 | 2.7 | 2.1 | 1.9 | 2.4 | 2.5 | 2.7 | 3.4 |
| Day hiking | | | | | | | | | | |
| | Conterminous United States | 31.0 | 40.3 | 46.9 | 34.2 | 31.4 | 39.2 | 43.5 | 45.3 | 61.7 |
| | North | 12.3 | 14.2 | 15.0 | 12.2 | 10.5 | 14.0 | 14.4 | 16.1 | 20.1 |
| | South | 8.4 | 11.8 | 14.6 | 9.8 | 9.1 | 11.3 | 12.9 | 13.2 | 18.7 |
| | Rocky Mountain | 3.9 | 5.8 | 7.6 | 5.0 | 5.1 | 5.7 | 7.1 | 6.7 | 10.3 |
| | Pacific Coast | 6.3 | 8.4 | 9.7 | 7.2 | 6.7 | 8.2 | 9.0 | 9.4 | 12.5 |
| Primitive-area use (visiting wilderness, primitive camping, backpacking) | | | | | | | | | | |
| | Conterminous United States | 6.8 | 8.6 | 9.8 | 7.3 | 6.7 | 8.4 | 9.2 | 9.6 | 12.7 |
| | North | 2.7 | 3.0 | 3.2 | 2.6 | 2.2 | 2.9 | 3.0 | 3.3 | 4.1 |
| | South | 2.1 | 2.8 | 3.4 | 2.4 | 2.2 | 2.7 | 3.1 | 3.2 | 4.3 |
| | Rocky Mountain | 0.8 | 1.2 | 1.5 | 1.0 | 1.0 | 1.2 | 1.4 | 1.3 | 1.9 |
| | Pacific Coast | 1.2 | 1.6 | 1.8 | 1.4 | 1.3 | 1.6 | 1.7 | 1.8 | 2.4 |

Continued ...

**Table 11-12 continued**. Projected numbers of outdoor recreation participants (millions) for conterminous United States and RPA regions in 2040 and 2070, averaged across five climate projections within each RPA scenario.

... Continued

| Activity | Geography | Baseline | LM | | HL | | HM | | HH | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 2012 | 2040 | 2070 | 2040 | 2070 | 2040 | 2070 | 2040 | 2070 |
| Mountain biking | | | | | | | | | | |
| | Conterminous United States | 6.2 | 7.9 | 9.9 | 6.7 | 6.6 | 7.7 | 9.3 | 9.0 | 13.6 |
| | North | 2.8 | 3.3 | 4.0 | 2.8 | 2.7 | 3.3 | 3.8 | 3.8 | 5.5 |
| | South | 1.7 | 2.2 | 2.8 | 1.8 | 1.8 | 2.1 | 2.5 | 2.5 | 3.7 |
| | Rocky Mountain | 0.7 | 1.1 | 1.5 | 0.9 | 1.0 | 1.0 | 1.4 | 1.2 | 2.2 |
| | Pacific Coast | 1.0 | 1.3 | 1.6 | 1.1 | 1.1 | 1.3 | 1.5 | 1.5 | 2.1 |
| Equestrian (horseback riding on trails) | | | | | | | | | | |
| | Conterminous United States | 3.4 | 4.7 | 6.2 | 3.9 | 4.1 | 4.6 | 5.9 | 5.4 | 9.0 |
| | North | 1.2 | 1.6 | 2.0 | 1.4 | 1.5 | 1.6 | 2.1 | 1.9 | 3.2 |
| | South | 1.2 | 1.7 | 2.3 | 1.4 | 1.4 | 1.6 | 2.1 | 1.9 | 3.4 |
| | Rocky Mountain | 0.4 | 0.6 | 0.9 | 0.5 | 0.5 | 0.6 | 0.7 | 0.7 | 1.2 |
| | Pacific Coast | 0.6 | 0.8 | 1.0 | 0.6 | 0.6 | 0.7 | 0.9 | 0.9 | 1.3 |
| Motorized water (motor boating, water skiing, personal watercraft use) | | | | | | | | | | |
| | Conterminous United States | 27.5 | 37.4 | 47.7 | 31.2 | 32.3 | 36.2 | 45.5 | 42.1 | 68.8 |
| | North | 11.4 | 14.1 | 16.8 | 12.0 | 11.8 | 13.8 | 16.4 | 16.0 | 24.2 |
| | South | 9.5 | 13.8 | 18.6 | 11.4 | 12.4 | 13.2 | 17.5 | 15.4 | 26.9 |
| | Rocky Mountain | 2.7 | 4.1 | 5.6 | 3.4 | 3.6 | 4.0 | 5.3 | 4.7 | 8.3 |
| | Pacific Coast | 3.9 | 5.4 | 6.7 | 4.5 | 4.5 | 5.2 | 6.3 | 6.0 | 9.4 |
| Off-road driving | | | | | | | | | | |
| | Conterminous United States | 21.3 | 25.3 | 28.8 | 21.9 | 20.8 | 24.7 | 27.6 | 28.0 | 37.6 |
| | North | 8.0 | 8.9 | 9.6 | 7.7 | 7.1 | 8.7 | 9.6 | 9.9 | 13.3 |
| | South | 7.2 | 8.6 | 9.7 | 7.5 | 7.0 | 8.4 | 9.1 | 9.4 | 12.0 |
| | Rocky Mountain | 2.7 | 3.8 | 5.0 | 3.3 | 3.4 | 3.8 | 4.7 | 4.4 | 6.8 |
| | Pacific Coast | 3.4 | 4.0 | 4.5 | 3.5 | 3.2 | 3.9 | 4.2 | 4.4 | 5.5 |
| Motorized snow (snowmobiling) | | | | | | | | | | |
| | Conterminous United States | 4.1 | 4.2 | 4.3 | 3.3 | 2.4 | 3.8 | 3.2 | 4.4 | 4.7 |
| | North | 2.9 | 2.6 | 2.3 | 2.1 | 1.2 | 2.4 | 1.6 | 2.8 | 2.4 |
| | Rocky Mountain | 0.7 | 1.0 | 1.2 | 0.7 | 0.6 | 0.8 | 0.8 | 0.9 | 1.3 |
| | Pacific Coast | 0.5 | 0.6 | 0.8 | 0.5 | 0.6 | 0.6 | 0.7 | 0.7 | 1.0 |
| Fishing (warm water, cold water, saltwater, anadromous) | | | | | | | | | | |
| | Conterminous United States | 31.0 | 39.3 | 45.1 | 33.9 | 32.5 | 38.5 | 43.6 | 43.9 | 60.4 |
| | North | 12.2 | 13.9 | 14.9 | 11.9 | 10.4 | 13.6 | 14.2 | 15.6 | 20.0 |
| | South | 12.0 | 16.2 | 19.3 | 14.2 | 14.5 | 16.0 | 19.2 | 18.1 | 26.1 |
| | Rocky Mountain | 3.0 | 4.2 | 5.1 | 3.6 | 3.6 | 4.1 | 4.8 | 4.7 | 6.7 |
| | Pacific Coast | 3.8 | 5.0 | 5.8 | 4.2 | 4.1 | 4.8 | 5.4 | 5.5 | 7.7 |
| Hunting (all types of legal hunting) | | | | | | | | | | |
| | Conterminous United States | 12.7 | 13.6 | 13.6 | 12.2 | 10.5 | 13.3 | 12.8 | 14.5 | 15.5 |
| | North | 5.0 | 4.5 | 3.7 | 4.0 | 2.8 | 4.3 | 3.3 | 4.6 | 3.8 |
| | South | 5.0 | 5.8 | 6.2 | 5.3 | 5.1 | 5.7 | 6.1 | 6.2 | 7.3 |
| | Rocky Mountain | 1.7 | 2.2 | 2.5 | 1.8 | 1.7 | 2.0 | 2.2 | 2.3 | 2.9 |
| | Pacific Coast | 1.0 | 1.2 | 1.2 | 1.1 | 1.0 | 1.2 | 1.2 | 1.4 | 1.6 |
| Developed skiing (downhill skiing, snowboarding) | | | | | | | | | | |
| | Conterminous United States | 11.0 | 14.4 | 20.0 | 11.7 | 12.6 | 13.8 | 18.5 | 16.4 | 30.5 |
| | North | 6.6 | 8.0 | 10.7 | 6.5 | 6.9 | 7.7 | 10.1 | 9.1 | 16.5 |
| | Rocky Mountain | 1.6 | 2.5 | 3.9 | 2.0 | 2.4 | 2.4 | 3.6 | 2.9 | 6.1 |
| | Pacific Coast | 2.8 | 3.9 | 5.4 | 3.1 | 3.3 | 3.7 | 4.8 | 4.4 | 8.0 |
| Undeveloped skiing (cross-country skiing, snowshoeing) | | | | | | | | | | |
| | Conterminous United States | 6.2 | 7.1 | 8.0 | 6.0 | 5.0 | 6.8 | 7.0 | 7.9 | 10.3 |
| | North | 4.1 | 4.3 | 4.4 | 3.5 | 2.6 | 4.0 | 3.5 | 4.6 | 5.1 |
| | Rocky Mountain | 1.0 | 1.4 | 1.7 | 1.2 | 1.2 | 1.3 | 1.6 | 1.5 | 2.4 |
| | Pacific Coast | 1.1 | 1.5 | 1.9 | 1.3 | 1.3 | 1.5 | 1.8 | 1.8 | 2.8 |
| Swimming (swimming in streams, lakes, ponds, or ocean; snorkeling; scuba diving) | | | | | | | | | | |
| | Conterminous United States | 48.4 | 61.7 | 73.6 | 51.6 | 47.8 | 59.7 | 67.3 | 69.4 | 98.5 |
| | North | 20.2 | 22.9 | 25.1 | 19.2 | 16.1 | 22.1 | 22.5 | 25.7 | 32.8 |
| | South | 16.1 | 22.3 | 28.2 | 18.6 | 18.0 | 21.6 | 25.7 | 25.2 | 38.2 |
| | Rocky Mountain | 3.8 | 5.3 | 6.7 | 4.5 | 4.5 | 5.1 | 6.2 | 6.0 | 9.0 |
| | Pacific Coast | 8.3 | 11.2 | 13.6 | 9.4 | 9.3 | 10.9 | 12.9 | 12.6 | 18.5 |
| Floating (canoeing, kayaking, rafting) | | | | | | | | | | |
| | Conterminous United States | 10.0 | 12.1 | 14.7 | 10.2 | 10.0 | 11.6 | 13.6 | 13.4 | 20.0 |
| | North | 4.4 | 4.6 | 5.0 | 3.9 | 3.2 | 4.4 | 4.4 | 5.2 | 6.5 |
| | South | 3.2 | 4.2 | 5.5 | 3.6 | 4.0 | 4.0 | 5.2 | 4.6 | 7.7 |
| | Rocky Mountain | 1.0 | 1.4 | 1.9 | 1.2 | 1.3 | 1.3 | 1.8 | 1.5 | 2.7 |
| | Pacific Coast | 1.5 | 1.9 | 2.3 | 1.6 | 1.5 | 1.8 | 2.1 | 2.1 | 3.1 |

*Activities are individual or activity composites derived from the NSRE. Initial participants are determined from the scenario adult (16 years or older) population estimates for the conterminous United States during 2012 and initial estimates by activity based on Outdoor Foundation estimates and/or NSRE responses from 2006 to 2012.*

*NSRE = National Survey on Recreation and the Environment; LM = lower warming-moderate U.S. growth; HL = high warming-low U.S. growth; HM = high warming-moderate U.S. growth; HH = high warming-high U.S. growth.*

For hunting, the projected number of participants in the RPA North Region under the HH scenario overlaps with projections for the HM scenario in 2040 and 2070, reflecting the large decline in per capita participation in hunting under the HH scenario and the relatively low population increase projected in the North Region, even under the HH scenario. The cross-country skiing and snowshoeing aggregate exhibits a similar response, with overlap between the HH and HM scenario in the North Region in 2070.

Comparing projections under the LM and HM scenarios, with their relatively equivalent population and GDP trends, lower atmospheric warming (LM) tends to favor increased numbers of participants and recreation consumption. For most activities, the projected number of participants in 2040 and 2070 is slightly greater under the LM scenario compared to the HM scenario. These general differences between the LM and HM scenarios are more pronounced in some regions. Meaningful regional differences tend to occur for the RPA North Region (for many activities) and, beyond the North Region, for activities where future climatic change more strongly influenced per capita participation (e.g., motorized snow use, day hiking, and floating). The LM scenario has slightly higher GDP and population projections by 2070 than the HM scenario. Those slightly higher trends also promote slightly greater participant projections for many activities.

Projected losses in the numbers of participants engaging in activities in 2040 and 2070 relative to 2012 were primarily confined to the HL scenario, nationally and regionally. Relatively small projected population growth and economic development gains in the HL scenario are insufficient to overcome the declines in per capita participation projected for many activities. Potential declines in the numbers of participants in 2040 and 2070 extend into the HM scenario for several regions and nationally for hunting, motorized snow use, cross-country skiing and snowshoeing, and floating. Projected declines in participation for hunting extend into the HH scenario in the RPA North Region. The hunting results reflect the steep projected decline in per capita hunting participation in the face of both high atmospheric warming and strong population and economic growth. Although most activities have projected declines in at least one scenario-climate future, downhill skiing and snowboarding, equestrian riding on trails, and motorized water use activities have increasing numbers of projected participants across all regions, scenarios, and climate projections.

The presently most-popular activities remain the most-popular in projections of future recreation for 2040 and 2070. Developed site use (i.e., visiting natural, historic, or prehistoric sites, picnicking, outdoor family gatherings) is projected to have the greatest number of participants of the activity aggregates by far, with between 104 and 137 million participants in 2040. Swimming is projected to be the next most-popular activity—with about half the participants of developed site use—followed by day hiking, fishing, and motorized water use. Developed site camping rounds out the greatest-participant activity aggregates with projections of between 27 and 34 million participants by 2040. Each of the most-popular activities has projected percentage increases in participants that are around 30 percent by 2040 and 45 percent or more by 2070, relative to 2012. Downhill skiing and snowboarding, floating, mountain biking, and equestrian riding on trails—activities that currently have moderate numbers of participants—exhibit some of the largest percentage increases in participants between 2012 and 2070. Despite the large percentage increases, the numbers of participants in floating, mountain biking, and equestrian riding on trails remain modest in 2040 and 2070 relative to those seen in more general and broadly accessible activities such as day hiking and viewing nature.

**Days of Engagement—**In general, our projections show continued modest declines in the average number of days each year that participants engage in a recreation activity. This pattern is consistent with recent trends over the last decade or more. Ultimately, those engaging in outdoor recreation are doing so with less frequency, and that trend is projected to continue. Projected declines in the average number of days of engagement are common across activities, regions, scenarios, and climate projections. Three activities are exceptions to this general pattern—motorized water use, mountain biking, and hunting—although each activity still has projected engagement declines in at least one region/scenario combination. For hunting, the lack of a uniform decline across regions and scenarios in projected average days of engagement is noteworthy given the projected marked declines in per capita participation in hunting.

Despite general declines in the mean days of recreation per participant, the total days of recreation in each activity is typically projected to increase (table 11-13). This pattern results because the total number of participants in each activity is typically projected to increase in the future. When present, projected declines in the total days of recreation for individual activities are most common under the HL scenario. In some cases, those projected declines are substantial, as they reflect both projected declines in participant numbers and engagement frequency. For example, national-level days of recreation in 2070 are projected to decline by 40 percent for cross-country skiing and snowshoeing, 50 percent for snowmobile use, and 9 percent for primitive area activities under the HL scenario. When projected declines occur, they are often especially pronounced in the RPA North Region, with its low projected population growth in the future. As with projected participation, projected declines in total days of recreation extend through the HH scenario in some regions

for snowmobile use, cross-country skiing and snowshoeing, and hunting. Declines in snowmobile use and cross-country skiing and snowshoeing in the North Region result from the compounded influence of atmospheric warming and declining population. Per capita consumption in hunting for the North Region is projected to be mostly stable except for under the hot climate projection. Factoring in substantially declining per capita participation alongside population outlooks, the number of days of hunting in the North Region is projected to decline substantially by 2070.

Projected patterns of increase (or decrease) in engagement generally continue in linear fashion over the projection period. Discrepancies between 2040 and 2070 projections are most common under the HL scenario. For example, the projected number of birding days in 2040 under the HL scenario is 7 percent higher than 2012 observations, but the 2070 projection is a reduction of 13 percent from 2012 levels. Similarly, projections of day hiking under the HL scenario show a slight gain in total days for 2040 (6 percent), which turns into a slight loss of 5 percent from

**Table 11-13**. Projected numbers of days (millions) of recreation engagement for conterminous United States and RPA regions in 2040 and 2070, averaged across five climate projections within each RPA scenario.

| | | Baseline | LM | | HL | | HM | | HH | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Activity** | **Geography** | **2012** | **2040** | **2070** | **2040** | **2070** | **2040** | **2070** | **2040** | **2070** |
| Developed site use (visiting natural prehistoric, and/or historic sites; family gatherings; picnicking) | | | | | | | | | | |
| | Conterminous United States | 1,119 | 1,474 | 1,746 | 1,247 | 1,197 | 1,422 | 1,630 | 1,635 | 2,284 |
| | North | 446 | 522 | 572 | 441 | 378 | 506 | 524 | 586 | 750 |
| | South | 366 | 520 | 655 | 445 | 472 | 501 | 626 | 569 | 846 |
| | Rocky Mountain | 120 | 173 | 211 | 145 | 143 | 166 | 196 | 191 | 273 |
| | Pacific Coast | 187 | 259 | 308 | 216 | 204 | 249 | 284 | 289 | 415 |
| Developed camping | | | | | | | | | | |
| | Conterminous United States | 198 | 237 | 257 | 206 | 189 | 232 | 249 | 262 | 330 |
| | North | 65 | 72 | 72 | 63 | 55 | 71 | 73 | 80 | 97 |
| | South | 58 | 68 | 76 | 59 | 54 | 66 | 72 | 75 | 94 |
| | Rocky Mountain | 31 | 42 | 50 | 37 | 38 | 42 | 49 | 47 | 66 |
| | Pacific Coast | 44 | 55 | 59 | 47 | 42 | 53 | 55 | 60 | 73 |
| Nature viewing (viewing or photographing birds, other wildlife, natural scenery, gathering, other) | | | | | | | | | | |
| | Conterminous United States | 296 | 372 | 407 | 319 | 282 | 361 | 375 | 410 | 504 |
| | North | 125 | 140 | 140 | 120 | 96 | 136 | 128 | 155 | 173 |
| | South | 103 | 142 | 170 | 122 | 116 | 138 | 157 | 157 | 210 |
| | Rocky Mountain | 26 | 36 | 41 | 31 | 28 | 35 | 38 | 39 | 50 |
| | Pacific Coast | 43 | 54 | 57 | 47 | 41 | 52 | 53 | 59 | 70 |
| Birding (viewing or photographing) | | | | | | | | | | |
| | Conterminous United States | 172 | 217 | 221 | 185 | 149 | 209 | 198 | 237 | 263 |
| | North | 74 | 82 | 75 | 71 | 51 | 80 | 68 | 91 | 91 |
| | South | 63 | 86 | 97 | 73 | 63 | 83 | 85 | 94 | 113 |
| | Rocky Mountain | 12 | 18 | 18 | 15 | 13 | 17 | 17 | 19 | 20 |
| | Pacific Coast | 22 | 30 | 31 | 26 | 21 | 29 | 28 | 33 | 38 |
| Day hiking | | | | | | | | | | |
| | Conterminous United States | 473 | 581 | 650 | 500 | 451 | 563 | 597 | 638 | 806 |
| | North | 182 | 194 | 188 | 169 | 133 | 190 | 176 | 216 | 230 |
| | South | 130 | 165 | 199 | 141 | 132 | 158 | 173 | 179 | 236 |
| | Rocky Mountain | 53 | 76 | 96 | 67 | 69 | 76 | 94 | 88 | 134 |
| | Pacific Coast | 110 | 146 | 167 | 122 | 117 | 138 | 154 | 156 | 206 |
| Primitive-area use (visiting wilderness, primitive camping, backpacking) | | | | | | | | | | |
| | Conterminous United States | 11 | 13 | 15 | 11 | 10 | 13 | 13 | 14 | 19 |
| | North | 4 | 4 | 4 | 3 | 3 | 4 | 4 | 4 | 5 |
| | South | 3 | 4 | 5 | 4 | 3 | 4 | 5 | 5 | 6 |
| | Rocky Mountain | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 |
| | Pacific Coast | 2 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 4 |
| Mountain biking | | | | | | | | | | |
| | Conterminous United States | 125 | 161 | 206 | 136 | 138 | 157 | 193 | 182 | 281 |
| | North | 54 | 62 | 73 | 53 | 48 | 61 | 67 | 70 | 97 |
| | South | 29 | 40 | 54 | 33 | 34 | 38 | 49 | 45 | 72 |
| | Rocky Mountain | 22 | 33 | 46 | 28 | 31 | 32 | 43 | 37 | 64 |
| | Pacific Coast | 20 | 26 | 33 | 23 | 24 | 26 | 34 | 30 | 48 |
| Equestrian (horseback riding on trails) | | | | | | | | | | |
| | Conterminous United States | 46 | 61 | 83 | 50 | 49 | 58 | 69 | 67 | 110 |
| | North | 11 | 18 | 28 | 16 | 17 | 18 | 24 | 21 | 36 |
| | South | 17 | 24 | 36 | 18 | 19 | 22 | 29 | 27 | 53 |
| | Rocky Mountain | 14 | 14 | 13 | 12 | 9 | 14 | 12 | 15 | 15 |
| | Pacific Coast | 4 | 5 | 5 | 4 | 3 | 4 | 4 | 5 | 6 |

Continued ...

**Table 11-13 continued**. Projected numbers of days (millions) of recreation engagement for conterminous United States and RPA regions in 2040 and 2070, averaged across five climate projections within each RPA scenario.

| | | Baseline | LM | | HL | | HM | | HH | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Activity** | **Geography** | **2012** | **2040** | **2070** | **2040** | **2070** | **2040** | **2070** | **2040** | **2070** |
| ... Continued | | Baseline | LM | | HL | | HM | | HH | |
| **Activity** | **Geography** | **2012** | **2040** | **2070** | **2040** | **2070** | **2040** | **2070** | **2040** | **2070** |
| Motorized water (motor boating, water skiing, personal watercraft use) | | | | | | | | | | |
| | Conterminous United States | 366 | 518 | 715 | 429 | 470 | 503 | 678 | 592 | 1,109 |
| | North | 126 | 162 | 197 | 139 | 145 | 160 | 200 | 185 | 304 |
| | South | 169 | 254 | 380 | 208 | 241 | 246 | 355 | 292 | 606 |
| | Rocky Mountain | 28 | 41 | 56 | 34 | 37 | 40 | 53 | 47 | 83 |
| | Pacific Coast | 43 | 61 | 82 | 48 | 48 | 57 | 69 | 68 | 116 |
| Off-road driving | | | | | | | | | | |
| | Conterminous United States | 350 | 414 | 467 | 360 | 355 | 402 | 457 | 450 | 600 |
| | North | 109 | 121 | 128 | 102 | 96 | 116 | 129 | 132 | 177 |
| | South | 152 | 181 | 209 | 163 | 171 | 180 | 211 | 196 | 258 |
| | Rocky Mountain | 45 | 63 | 79 | 52 | 52 | 60 | 71 | 69 | 104 |
| | Pacific Coast | 44 | 49 | 51 | 42 | 36 | 47 | 46 | 52 | 61 |
| Motorized snow (snowmobiling) | | | | | | | | | | |
| | Conterminous United States | 28 | 26 | 24 | 20 | 12 | 23 | 16 | 26 | 24 |
| | North | 23 | 18 | 15 | 14 | 7 | 16 | 10 | 19 | 14 |
| | Rocky Mountain | 3 | 4 | 5 | 3 | 2 | 4 | 4 | 4 | 5 |
| | Pacific Coast | 3 | 3 | 4 | 3 | 2 | 3 | 3 | 3 | 4 |
| Fishing (warm water, cold water, saltwater, anadromous) | | | | | | | | | | |
| | Conterminous United States | 501 | 614 | 694 | 537 | 518 | 603 | 676 | 679 | 902 |
| | North | 188 | 204 | 209 | 175 | 143 | 199 | 193 | 227 | 269 |
| | South | 217 | 288 | 345 | 258 | 279 | 287 | 355 | 319 | 458 |
| | Rocky Mountain | 37 | 49 | 57 | 41 | 39 | 47 | 52 | 53 | 72 |
| | Pacific Coast | 58 | 74 | 83 | 63 | 57 | 71 | 75 | 80 | 103 |
| Hunting (all types of legal hunting) | | | | | | | | | | |
| | Conterminous United States | 238 | 257 | 259 | 235 | 217 | 255 | 260 | 275 | 308 |
| | North | 90 | 80 | 65 | 71 | 49 | 77 | 58 | 83 | 67 |
| | South | 106 | 129 | 145 | 120 | 130 | 130 | 154 | 140 | 184 |
| | Rocky Mountain | 23 | 26 | 27 | 22 | 18 | 24 | 23 | 27 | 30 |
| | Pacific Coast | 19 | 22 | 22 | 22 | 21 | 24 | 24 | 25 | 27 |
| Developed skiing (downhill skiing, snowboarding) | | | | | | | | | | |
| | Conterminous United States | 70 | 92 | 132 | 72 | 73 | 87 | 113 | 106 | 208 |
| | North | 37 | 40 | 50 | 32 | 26 | 38 | 40 | 46 | 70 |
| | Rocky Mountain | 10 | 17 | 31 | 13 | 16 | 16 | 26 | 20 | 52 |
| | Pacific Coast | 23 | 34 | 51 | 27 | 31 | 33 | 47 | 40 | 85 |
| Undeveloped skiing (cross-country skiing, snowshoeing) | | | | | | | | | | |
| | Conterminous United States | 33 | 36 | 37 | 29 | 20 | 33 | 29 | 39 | 44 |
| | North | 22 | 20 | 18 | 16 | 8 | 18 | 12 | 21 | 17 |
| | Rocky Mountain | 5 | 7 | 9 | 6 | 5 | 7 | 8 | 8 | 11 |
| | Pacific Coast | 6 | 8 | 10 | 7 | 7 | 8 | 10 | 10 | 15 |
| Swimming (swimming in streams, lakes, ponds, or ocean; snorkeling; scuba diving) | | | | | | | | | | |
| | Conterminous United States | 582 | 709 | 860 | 585 | 529 | 678 | 747 | 791 | 1,125 |
| | North | 211 | 231 | 257 | 189 | 151 | 219 | 215 | 257 | 328 |
| | South | 221 | 284 | 368 | 233 | 217 | 271 | 312 | 319 | 482 |
| | Rocky Mountain | 37 | 50 | 61 | 42 | 41 | 48 | 57 | 56 | 83 |
| | Pacific Coast | 113 | 145 | 174 | 121 | 120 | 139 | 163 | 160 | 231 |
| Floating (canoeing, kayaking, rafting) | | | | | | | | | | |
| | Conterminous United States | 60 | 71 | 86 | 60 | 58 | 68 | 78 | 78 | 115 |
| | North | 26 | 28 | 30 | 23 | 19 | 27 | 27 | 31 | 39 |
| | South | 21 | 26 | 35 | 22 | 25 | 25 | 32 | 28 | 47 |
| | Rocky Mountain | 5 | 6 | 8 | 5 | 5 | 6 | 7 | 7 | 11 |
| | Pacific Coast | 9 | 11 | 13 | 9 | 9 | 11 | 12 | 12 | 18 |

*Activities are individual or activity composites derived from the NSRE. Initial participants are determined from the scenario adult (16 years and older) population estimates for the conterminous United States during 2012 and initial estimates by activity based on Outdoor Foundation estimates and/or NSRE responses from 2006 to 2012.*

*NSRE = National Survey on Recreation and the Environment; LM = lower warming-moderate U.S. growth; HL = high warming-low U.S. growth; HM = high warming-moderate U.S. growth; HH = high warming-high U.S. growth.*

baseline by 2070. These patterns are likewise projected for participant totals from 2040 to 2070 for both activities, albeit to a less pronounced extent. Furthermore, for both activities, projections under HL diverge from the other scenarios, indicating relatively more meaningful changes in number of annual days of engagement.

## Management Implications

Our projections of annual days of recreation activities show increases across most activities and under most scenarios. Projected numbers of recreation days are greatest for general activities, such as day hiking, viewing nature, developed site use, and developed site camping. Our projections of days

of engagement are likely the most meaningful for recreation managers because that metric is most closely related to visitation. Recreation-related natural resource management and policy decisions are often made in the context of patterns in current and expected future recreation visitation. For example, changes in occupancy rates at a campground, the number of visits annually to a trail, or the number of permits requested by river kayakers might recommend changes in management of, and policies for, recreation resources.

Developed sites and recreation infrastructure are likely to continue facing pressure to meet recreation demand. Developed site use—a compilation of activities including visiting historic sites and picnicking—and developed site camping continue to be among the leading activities in terms of participants and days of recreation and are also projected to experience some of the greatest expansion in both metrics. Developed facilities providing for these recreation activities will likely continue to see substantial and increasing use in future decades. In addition to developed site recreation, other activities that frequently require developed infrastructure are also projected to see large gains in recreation consumption in future decades, under most scenarios. For example, motorized boating typically requires boat ramps, developed skiing requires ski area infrastructure, and day hiking, one of the most-popular recreation activities, requires trail systems.

Our projections show little indication of significant changes in the types of outdoor recreation activities likely to be desired in the coming decades, especially at the national level. Those activities that are most-popular now are projected to remain most-popular. The activities with the highest projected rates of participation in future decades remain visiting developed sites, swimming, day hiking, fishing, and motorized water use. Those activities that presently have relatively small but enthusiastic participant populations remain popular among a relatively small contingent of outdoor recreationists. We do project steep reductions in per capita participation for several activities under most scenarios: hunting, motorized snow use, and cross-country skiing and snowshoeing.

Our projections of recreation demand include general supply factors (e.g., Federal forest land per capita within 200 miles) but do not consider factors related to how increased or more-severe natural disturbance may influence recreation resource availability. For example, our models do not consider the effects of frequent recreation resource closures because of wildfire or reduced desirability of recreation resources from presence of wildfire smoke. Researchers do not yet have a very rich understanding of how natural disturbance influences recreation behavior. In the short term, if disturbance does not alter recreation demand, it may influence recreationist decisions about where or when to recreate. Recreation managers may see recreationists opting to recreate in different seasons of the year (e.g., to avoid potential wildfire closures) or in different regions (e.g., avoiding places prone to hurricane or wind disturbance). Over the long term, increased frequency or severity of natural disturbance may influence recreation demand in ways not accounted for in our models.

## Conclusions

A future that includes continuing population growth and conversion of open space to developed land is projected to result in increasing pressure on the remaining natural resources to provide for nature-based outdoor recreation. Although there have been some increases in areas of State park systems and lands managed by land conservancy organizations, the area of land accessible for recreation has not kept pace with recent population growth. Looking forward, the per capita area of forest and land accessible for recreation is projected to continue to decline if population growth occurs at the pace of our high- or moderate-growth scenarios—HH, LM, and HM. Projected losses in per capita recreation opportunities differ across regions in the United States, with declines being slower in regions with less population growth and less conversion of lands to developed land uses.

Looking ahead to the coming decades, our projections of future recreation demand generally indicate only modest changes (both increases and decreases) in the share of the population participating in specific recreation activities. This is consistent with patterns found in recent decades. Hunting participation is an exception to the otherwise mostly modest changes in projected participation. Moderate to steep declines in hunting participation are projected across all scenarios. The most-popular outdoor recreation activities today (viewing nature, day hiking, and visiting developed recreation areas) are projected to remain the most-popular in the coming decades. Although our projections of participation yield a mix of increases and decreases across activities, our projections of engagement frequency indicate declines across almost all recreation activities. Increases in engagement frequency in the coming decades are projected only for motorized water use, mountain biking, and hunting. Our projected declines in engagement are consistent with patterns observed in recent decades.

Future levels of atmospheric warming and economic development and population growth can have diverse influences on recreation demand. Participation and engagement in individual activities exhibit a range of responsiveness to changes in climate and economic development and population growth. Most activities are responsive to either socioeconomic change only or atmospheric warming and socioeconomic change jointly. Two activities most responsive to climate change are motorized snow use and the cross-country skiing and

snowshoeing aggregate, with both exhibiting steep projected declines in participation as atmospheric warming levels increase. In addition, high levels of atmospheric warming have the largest negative impacts on recreation in the RPA North Region. Downhill skiing and snowboarding and hunting are both very responsive to increases in economic development and population growth: the former exhibits steep increases in projected participation rates while the latter exhibits steep declines. Our projections do not include residents of Alaska, Hawaii, or the U.S. territories. It is possible that future climate change will yield different outcomes for recreation participation and engagement in those locales.

In the presence of continued population growth, the number of individuals participating in recreation activities is generally projected to increase in the coming decades. However, if future population growth and economic development are instead more similar to our low-growth scenario (HL), we project some declines in the numbers of participants as the modest population increases under that scenario are insufficient to overcome projected declining per capita participation. Within RPA regions, the North Region is most likely to have projected declines in numbers of participants because of smaller population increases relative to other regions. The greatest numbers of participants are projected under the HH scenario because it projects a higher population than the other scenarios. In scenarios of moderate population growth and economic development (the LM and HM scenarios), participant numbers are frequently greater under lower levels of atmospheric warming. In a world with high levels of atmospheric warming, however, the greatest levels of population growth and economic expansion (the HH scenario) lead to the greatest number of participants.

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