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Research Article

Play and peril: Displacement drivers and types across recreation motivations in crowding and wildfire-prone southern California national forests

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ABSTRACT

Many southern California residents use urban-proximate national forests to meet their recreation needs, but with climate change and increased forest popularity, displacement is of concern due to the potential for degraded conditions and/or closures. Displacement could result in recreationists completely foregoing the national forests for other forms of leisure activities. To guide would-be visitors to suitable alternative recreation experiences when they are unable to recreate as they want due to undesirable conditions (e.g., crowding, poor resource conditions), a better understanding of how recreationists are experiencing and reacting to displacement is needed. In a 2023 survey of 3585 southern California residents who had visited at least one of the four national forests in the study area (Los Padres, San Bernardino, Cleveland, and Angeles National Forests) since summer 2020, we asked about drivers and types of displacement for these recreationists. We found that road closures and extreme heat are the two most common drivers of displacement resulting in a change of plans. The USDA Forest Service may need to consider these group differences when suggesting alternative high-quality recreation opportunities for displaced recreationists.

Management implications

Displacement is difficult to quantify on-site. Our population study informs managers about reasons and types of displacement with recreationists who have previously visited national forests. This is important for managers who would like to attract a diversity of people as recreationists but whose sites are experiencing stresses from climate change and/or popularity. We examine drivers and types of displacement across and within four national forests across a region, providing avenues for messaging for these particular populations and overall to help recreationists select quality alternative experiences. Examining their responses to site conditions that displaced them identifies specific areas of insight on factors driving adjustments in experience, especially with extreme heat. Recreationists are willing to change the when (temporal) and what (activity) of their experience but are not as flexible in the where (spatial) or with whom (companion), suggesting deep place and group connections but relative flexibility in timing. This perhaps speaks to the urban proximity of these forests and the outdoor recreation character of these places and their visitors.

1. Introduction

Recreation areas serve as places for bonding with the natural environment, among other socio-economic benefits. As recreation at national forests continues increasing but unevenly across sites (USDA Forest Service, 2023a), some recreational trails, waterbodies, campgrounds, and other attractions receive higher levels of use. Overall, national forests and grasslands saw a 17.5 % increase in visitation (~25 million more visitors) and wilderness areas saw a 25 % increase from 2019 to 2020 (Avitt, 2021). Left unchecked, or inappropriately managed, high visitation can result in degraded natural resources and experiential conditions (White et al., 2008).

Expectancy theory suggests that we engage in recreation activities at particular locations to realize beneficial outcomes that are known,

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desired, and valued (Manning et al., 2022; Vroom, 1964). When people encounter barriers to this engagement, they often adjust their behavior to still reach their desired outcome (Johnson & Dawson, 2004; Manning & Valliere, 2001). Displacement is one such adjustment, or coping mechanism, that results when a recreationist encounters undesirable conditions – those that prevent or do not meet the recreationist's standards of a quality experience – such as the chosen spot being unavailable, not suitable for their activity, or harboring potential conflicts (Johnson & Dawson, 2004; Manning & Valliere, 2001). Coping mechanisms allow people, including recreationists, to reduce stress while dealing with a situation (Sutherland, 1989). Engaging in displacement as coping with undesirable conditions allows an opportunity for a recreationist to seek experiences that better align with their desired outcomes (Clark et al., 1971; Fefer et al., 2021; Johnson & Dawson, 2004; Manning & Valliere, 2001). Recreationists can be displaced for reasons including social, ecological, and situational factors that affect recreational and natural resources (Ferguson et al., 2022).

2. Study area

California is the most populous state in the United States and the second most ethnically and racially diverse, with no one ethnic or racial group defining the population (ACS, 2022). Southern California is more populated and diverse than other parts of the state (US Census Bureau, 2021) and stretches from the United States – Mexico border to just south of the San Francisco Bay Area. The region has a Mediterranean-type climate, with hot dry summers and mild wet winters. It is also ecologically diverse, with chapparal on the coast, "sky island" conifer forests at higher elevations, and the Mojave Desert in the interior (California Wildfire & Forest Resilience Task Force, 2022). Southern California's four national forests (Los Padres, Angeles, San Bernardino, and Cleveland) cover 3.5 million acres of land (Fig. 1) managed for multiple uses including conservation of important natural habitats and extractive uses of grazing and mining (there are no timber sales). They also provide valuable opportunities for outdoor recreation to the region's ~25 million residents who live a short drive from one or more of the national forests (USDA Forest Service, 2023b), with numerous opportunities for hiking, camping, picnicking, mountain biking, off-road driving, horseback riding, skiing, hunting and fishing, and simply enjoying being outdoors (Table 1).

These four national forests face numerous threats to their ecological integrity and ability to provide recreation opportunities. They are under intense development and recreation pressure due to their proximity to some of the country's most heavily populated areas (Center for Biological Diversity, n.d.). For example, there were 2 million more visits to the Angeles National Forest in FY 2021 compared to FY 2016 (USDA Forest Service, 2025). Crowding, unsafe vehicle parking from overflowing/informal parking lots, managerial strain on staff-time at these

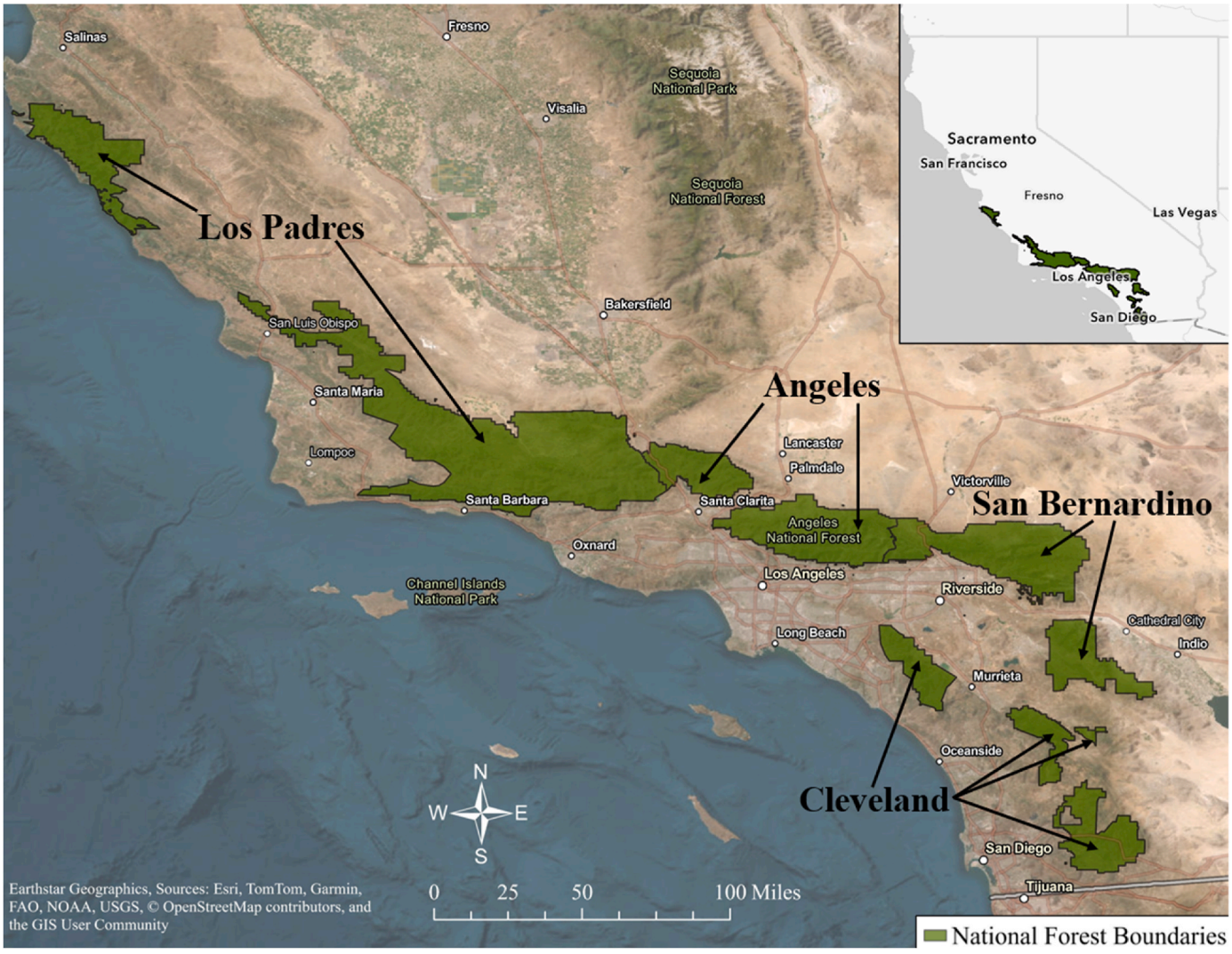

Fig. 1. Map of national forests in southern California included in this study.

Table 1
Characteristics of the four southern California national forests included in the study. Socio-demographic and visitation data are from the National Visitor Use Monitoring (NVUM) Program (https://www.fs.usda.gov/about-agency/nvum) and represent the most recent data available. The Angeles National Forest data are from the FY 2016 report, and the three others are from the FY 2019 reports.

	Angeles	Cleveland	Los Padres	San Bernardino
Size	700,176 acres	460,000 acres	1,950,000 acres	811,571 acres
Annual Visits	3,313,000	955,000	1,398,000	3,317,000
Race				
-White	70.7 %	88.7 %	90.4 %	88.5 %
-Asian	24.5 %	9.8 %	8.0 %	4.9 %
-Black/African American	7.7 %	1.6 %	1.3 %	3.6 %
-American Indian/ Alaskan	4.9 %	3.2 %	4.6 %	3.7 %
-Native Hawaiian/Pacific Islander	3.3 %	1.3 %	1.4 %	1.9 %
Hispanic/Latino Ethnicity	33.3 %	21.6 %	15.8 %	31.3 %
Household Income				
-Under $25,000	14.9 %	1.4 %	6.0 %	6.2 %
-$25,000-$49,999	25.6 %	9.3 %	16.3 %	15.4 %
-$50,000-$74,999	22.6 %	17.0 %	20.4 %	16.8 %
-$75,000-$99,999	14.1 %	17.6 %	11.0 %	17.2 %
-$100,000-$149,999	13.3 %	17.7 %	24.4 %	19 %
-$150,000 and over	8.4 %	36.9 %	21.9 %	25.5 %
Top 5 recreation activities (by percent participation)	Hiking/Walking, Viewing Natural Features, Relaxing, Viewing Wildlife, Picnicking	Hiking/Walking, Viewing Natural Features, Viewing Wildlife, Relaxing, Bicycling	Hiking/Walking, Viewing Natural Features, Relaxing, Viewing Wildlife, Driving for Pleasure	Hiking/Walking, Relaxing, Viewing Natural Features, Viewing Wildlife, Driving for Pleasure
Trail miles				
Non-motorized	619 miles	280 miles	1020 miles	595 miles
Motorized	62 miles	40 miles	407 miles	69 miles

highly visited locations (Hannon, 2021; Thomas & Reed, 2019), and damage to fragile habitats/species have occurred in national forests nationwide, including those in southern California. Environmental changes are also threatening the provision of recreation opportunities (e.g., limited access, diminished resource quality) (Hand et al., 2018; Wilkins & Horne, 2024). California has the most variable precipitation in the country, marked by sudden transitions between very dry and very wet conditions (USGS, 2017). Extreme precipitation, in the form of atmospheric rivers, can lead to widespread flooding and site/forest closures. Outside of such events, off-highway vehicle trails are commonly closed during wet weather events to prevent damage. At the other extreme, droughts can lead to temporary site closures due to low water levels at lakes and reservoirs, or result in a water feature (e.g., waterfall, river) becoming too low for use or non-existent. In response, many recreationists will turn to other sites and/or activities (Hand et al., 2018). Heat is also a pressing issue, especially during the summer and early fall when extreme heat waves are most common. Although most sites stay open, there is an increased public safety risk for recreationists. These recreationists might choose to correspondingly alter their plans, recreating earlier in the day under cooler weather or engaging in a different activity that is less strenuous/more appropriate for the heat, such as water-based activities or picnicking by a river.

Warnings are also issued during times of heightened wildfire risk, which are arguably the biggest threat to the national forests. In recent decades, the frequency, size, severity, and socio-economic effects of wildfires have rapidly risen (Dong et al., 2022; Safford et al., 2022). In the short-term, portions (or even the entirety) of national forests will temporarily close during active wildfires and for a period of time post-fire for assessment of conditions and necessary repairs. In some cases, these temporary closures can last years due to the severity and/or extent of the damage. These closures act as drivers of spatial and activity displacement, with recreationists forced to other places on the same or different national forest. Notably, in fall 2020 and fall 2021, all national forests in California were closed for several weeks due to "unprecedented and historic fire conditions".

Many of the largest and most destructive wildfires in California's history have been during Santa Ana wind events. Santa Ana winds are hot, dry, and fast winds (40–60 km/h with gusts of over 100 km/h) that blow in from deserts to the east, mainly in the winter and spring and peaking in December (Westerling et al., 2004). Aside from the heightened wildfire risk, the winds can also fell branches and trees. Finally, although southern California already has some of the country's worst air quality (American Lung Association, 2024), smoke from wildfires exacerbates this issue and represents a public health risk (Reid et al., 2016), as do summer heatwaves (Kalisa et al., 2018). These risks and degraded conditions (i.e., dust/dirt blowing in the air) could cause some recreationists to modify their plans.

The dynamic intersection of recreation uses and types, managerial approaches, and natural and cultural resources create site-specific impacts. This is the longstanding three-fold framework (Manning et al., 2022), recently extended to a more spatially, temporally, and topically comprehensive Integrated Recreation Amenities Framework (Perry et al., 2020). All the drivers mentioned above can cause individuals to adopt displacement coping strategies to attempt an alternate enjoyable recreational experience (Johnson & Dawson, 2004). However, the socio-ecological diversity of the four national forests suggests that the effects of the drivers and subsequent displacements are likely to vary between users and forests. McCreary et al. (2019) found significant differences in the use and type of displacement strategies by visitors' socio-economic characteristics and season of visitation. Despite the importance of these urban-proximate national forests as recreation destinations for the diverse southern California population, previous research has largely focused on national parks and in New England (Wilkins & Horne, 2024). Jenkins et al. (2023) examined how drought influenced visitation to national parks, finding significant differences across regions (i.e., mountain, arid, and coastal). Garnache et al. (2018) found that overuse, drought, and wildfire affect visitation to southern California national forests. However, to date, there has been no research focused on visitors to the four southern California national forests for the type(s) of displacement coping mechanisms they use. This is critical to forest managers as they consider provisioning recreation opportunities across a spectrum of environmental conditions and in a time of social, resource, and managerial changes and challenges.

In this study, our goal was to identify and assess the drivers and types of displacement experienced by local recreationists in these four highly visited national forests. To gain further insight into drivers and types of displacement, we asked research participants to focus on which of the four national forests they visited the most. In the context of recreation in

southern California national forests, we ask:

RQ$_1$: What drivers are displacing recreationists?
RQ2: How, if at all, do these drivers vary by recreationists' most visited forest?
RQ3: What types of displacement are being used by recreationists?
RQ4: How, if at all, do these types of displacement vary by recreationists' most visited forest?

3. Displacement

Displacement is a behavioral strategy to cope with undesirable site conditions and still have a quality experience, where someone changes the place (spatial), time (temporal), or activity of the experience, and whether they recreate at all (total) (Manning et al., 2022; Needham & Vaske, 2013). The role of group structure (companion) in displacement appears not to have been previously studied but may be an additional displacement type when considering adjustments to with whom someone is recreating in their experience. Certain recreation groups such as first-time visitors, those less invested in or attached to the experience, and individuals with less knowledge about recreation are more prone to total displacement (Needham & Vaske, 2013; Perry et al., 2021). Displacement is usually seen in recreationists who are more sensitive to factors like conflict, crowding, facility problems, environmental impacts, management conditions, and climate change effects (Hall & Shelby, 2000; Needham & Vaske, 2013; Perry, Manning, Xiao, & Valliere, 2018). In the context of this study's four national forests, their urban proximity may also influence displacement. Many popular trails begin on city/county land adjacent to a residential neighborhood before entering national forest land (e.g., Los Padres National Forest's Jesusita Trail begins in a Santa Barbara neighborhood). Thus, closures or other site conditions may negatively impact what may be easily accessible regular recreation experiences for nearby residents (not just destination visitors) and force displacement impacting daily recreation patterns.

Spatial displacement occurs when recreationists change the site at which they are recreating and is a common adaptation (Manning & Valliere, 2001; Perry et al., 2021). Common push factors for spatial displacement are crowding, conflict, or site closures (e.g., extreme weather, road hazards). For example, visitors to the Adirondak wilderness of upstate New York (U.S.) stated they would change their location or not visit at all, if their motivations were not met (Johnson & Dawson, 2004). Spatial displacement has been found to be less stressful than temporal displacement (Fefer et al., 2021) and lead to a higher quality recreation experience, potentially as choosing an alternative site at the same time is more likely to ensure similar physical site conditions (e.g., good weather) (Hall & Shelby, 2000).

Temporal displacement occurs when recreationists change the timing of their visit (Manning & Valliere, 2001). For example, recreationists may try to avoid weekend crowds on the trail by hiking on a weekday instead. Temporal adaptations are more likely employed by those who live closer to a recreation area (i.e., have more site knowledge and opportunities to visit across the year) (Hall & Shelby, 2000; Manning & Valliere, 2001) or have more flexible schedules for accommodating alternate recreation times (Johnson & Dawson, 2004). Temporal displacement can be used for ephemeral changes (e.g., crowding, drought) but not for permanent changes (e.g., site development/modifications). This may have implications for changing weather patterns and increased patterns of weather disturbances (Perry, Manning, Xiao, & Valliere, 2018, 2021).

Spatial and temporal displacement are often co-reported (e.g., Johnson & Dawson, 2004; Manning & Valliere, 2001; Perry, Manning, Xiao, & Valliere, 2018, Perry, Manning, Xiao, Valliere, et al., 2018, 2021), suggesting recreationists are trying to maintain satisfaction by using multiple coping strategies. Research suggests those who simultaneously use spatial and temporal coping strategies are more sensitive to crowding, conflict, environmental conditions, and facility issues (Hall & Shelby, 2000), and their sensitivities may increase with changes in weather patterns that influence modifications in the location or season of visit (Perry, Manning, Xiao, & Valliere, 2018).

Activity substitution occurs when recreationists change their planned pursuit for one providing comparable benefits and satisfaction (Needham & Vaske, 2013). This has been widely examined for hiking and consumptive uses (e.g., Needham & Vaske, 2013) but in fewer studies for water-based recreation or switches within or between land and water-based activities. Studying these switches is necessary, especially as temperatures and other weather variables continue to become more volatile and some land and water activities may be less available (Perry, Manning, Xiao, & Valliere, 2018, Perry, Manning, Xiao, Valliere, et al., 2018). Factors influencing the employment of activity substitution include a recreationist's activity skill and specialization, place attachments to activities' locations, finances, and amount of leisure time available (Hall & Shelby, 2000; Needham & Vaske, 2013; Parry & Gollob, 2018; Perry et al., 2021). Understanding substitutions employed, if at all, can assist managers in creating accommodations needed to keep recreationists recreating and having quality experiences (Needham & Vaske, 2013).

Recreation often has social components, and thus we consider it worthwhile to explore companion displacement in this study. We define companion displacement, informed by previous work (Perry, Manning, Xiao, Valliere, et al., 2018; Powers et al., 2022; Xiao et al., 2016), as recreationists' change in group structure due to conditions that they consider unsuitable for their current group structure (e.g., changing from solo to group or vice versa, not including more sensitive participants). Groups of recreationists with varying degrees of physical health and stamina may encounter this frequently, as recreation decisions may be made about the most sensitive within the group (e.g., wildfire smoke and asthma, parking areas farther from the experience and those with limited mobility) (Burns & Graefe, 2007; Mactavish & Schleien, 2004). Companion displacement could be co-employed with other types of displacement, as conditions shaping group composition might also shape the where, when, and how of the experience.

Displacement as a coping mechanism is part of a recreationist's larger decision-making process (Johnson & Dawson, 2004). Most research is concerned with the increase in use levels and assumes that recreationists are goal-oriented and seek experiences that advance toward those goals (Manning et al., 2022). This research can be expanded by looking at factors other than increased use, such as environmental and managerial conditions.

4. Methods

4.1. Data collection

We defined "local recreationist" as southern California adults (18 years or older) who 1) reside in one of the ten counties proximate to one or more of the four national forests of interest; and 2) have visited one or more of these four forests at least once since summer 2020 (a common inflection point due to the impact of the COVID-19 pandemic on people's lives). The ten local counties sampled are: Monterey, San Luis Obispo, Kern, Santa Barbara, Ventura, Los Angeles, San Bernardino, Orange, Riverside, and San Diego.

To reach these local visitors, we used a zip code-based Qualtrics panel sample. Qualtrics is a web-based survey tool that allows surveys to be created, distributed, and analyzed (Duong, 2023). Panel surveys allow for responses from visitors beyond those who would be intercepted in on-site sampling, and at a lower cost (Perry et al., 2015). The survey instrument was constructed and disseminated in both English and Spanish to acknowledge/include the substantial Spanish-speaking population of the area. Qualtrics administered the panel recruitment using our invitation prompts and compensated those who completed a quality survey. The survey was available from August 15 – November 8, 2023.

Surveying resulted in 3585 high quality responses (i.e., those that met Qualtrics' and our standards of inclusion) and an additional (culled) 327 low quality responses. Beyond Qualtrics' standards for exclusion (e.g., not meeting minimum expected length of time in the survey, incomplete responses), we removed additional responses with suspicious or incongruent straight-line answers through question batteries, invalid dates of birth, invalid or non-California zip codes, and invalid open response answers (e.g., off-topic, gibberish). We conducted two rounds of cleaning to identify low quality and automated responses, removing those that did not meet our standards for inclusion. Data validation measures in the survey also promoted data integrity (i.e., questions designed to detect spurious or automated responses) and served as reference points for identifying suspicious responses. Although some low quality and automated responses were expected during data cleaning, we identified many survey responses, especially in the Spanish version, as potentially spurious and requested replacement of these (i.e., Qualtrics seeking additional, quality responses) This resulted in the survey being open longer than expected, but ultimately with a response dataset of higher quality confidence.

The survey contained questions related to visitor use preferences, use patterns, displacement experience(s), messaging and fatigue, fire risk, and demographics. Respondents were asked which of the four study national forests they had visited, and which one they visited most frequently. For the section on displacement, they were first asked "Which of the following site conditions, if any, have you experienced in any of these four national forests?" followed by "Have you subsequently changed your recreation plans?" A list of 15 potential drivers of displacement (e.g., extreme heat, crowding, lack of parking) was provided, and for each one the respondent chose one of three options: did not experience, experienced but did not affect my plans, or experienced and affected my plans. Survey respondents were then asked to identify which drivers were most recently encountered, and which forms of displacement were used in response to those drivers.

4.2. Data analysis

Data analysis was done via IBM SPSS statistical software version 30.0. Respondents noted which of the four national forests they had visited since summer 2020, and which of those was their most visited forest. For comparing forest-level responses, we grouped respondents by their "most visited" national forest. Descriptive statistics identified the drivers of displacement: those that were experienced but did not affect respondents' plans, experienced and affected plans, not experienced ever, and most recently experienced (Fig. 2). We conducted chi-square analyses to compare percentages of respondents by national forest for 1) which drivers they had ever experienced that had affected their plans (Table 2), 2) which driver that had most recently affected their plans (Table 3), and 3) which type(s) of displacement they had experienced in this most recent occurrence of affected plans (Table 4). For these comparative analyses, we examined the Cramer's V effect size for significant results ($p < .05$) and the standardized residuals of the chi-square to determine if respondents in a particular forest were responding at a higher or lower frequency than expected.

5. Results

Of the 3585 responses, 50.4 % of respondents identified as male; 47.9 % as female; and 1.7 % as non-binary ($n = 36$), prefer not to say ($n = 23$), or other ($n = 2$). Respondents chose non-exclusive racial and ethnic categories in the following frequencies: white (66.5 %); other (11.0 %); Black or African American (10.4 %); Asian (8.4 %); and American Indian or Alaskan Native, prefer not to say, and Hawaiian or Pacific Islander totaling 9.8 %. One-third (32.5 %) of respondents identified as Hispanic, Latino/a, or Spanish origin.

Overall, 51.0 % of respondents have visited Angeles National Forest, followed by 39.8 % Los Padres, 37.5 % San Bernardino, and 19.7 % Cleveland. Looking at multi-forest visitation, 66.0 % have visited only one of these national forests, 23.1 % have visited two of them, 7.6 % have visited three of them, and 3.2 % have visited all four. For each national forest, approximately 40–50 % of respondents who have visited that forest report visiting only that forest, and rates of visiting more forests decreased with each additional forest. Respondents indicated their most visited forest with the following frequency: 39.2 % ($n = 1401$) Angeles, 25.7 % ($n = 921$) Los Padres, 24.8 % ($n = 888$) San Bernardino,

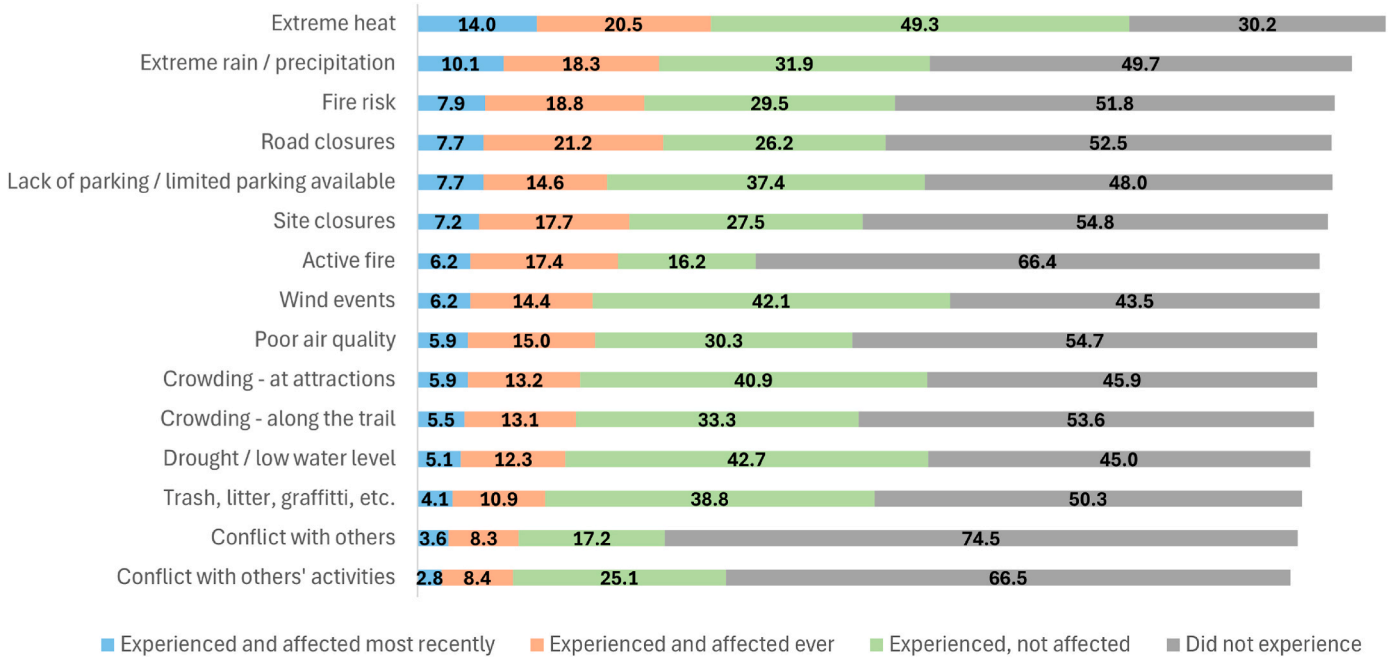

Fig. 2. Percentages (%) of respondents answering for each condition that they: have experienced and were affected by most recently (blue, far left) or ever (orange), have experienced but were not affected by (green), or have not experienced (gray, far right). (For interpretation of the references to color in this figure legend, the reader is referred to the Web version of this article.)

Table 2
Drivers displacing recreationists at any time, by most visited southern California national forest, and overall. Cells represent percentages (%) of respondents overall, and percentages (%) of the overall by forest. Significant differences between/among forests ($p < .05$) are noted by Cramer's V effect sizes and standardized residuals in parentheses following the percentage of respondents.

Driver	Most Visited National Forest				Overall	*p*-value	Cramer's V
	Los Padres	Angeles	San Bernardino	Cleveland			
ENVIRONMENTAL							
Extreme heat	27.0	39.0	23.3	10.8	20.5	.676	
Fire risk	25.0	39.2	24.7	11.1	18.8	.894	
Extreme rain/precipitation	29.3 (1.8)	39.4 (.1)	23.7 (−.5)	7.6 (−2.2)	18.3	.014	.054
Active fire	28.4	35.6	26.0	10.1	17.4	.165	
Poor air quality	28.1	40.5	22.1	9.3	15.0	.237	
Wind event	31.4 (2.6)	39.1 (.0)	21.5 (−1.5)	7.9 (−1.7)	14.4	.003	.062
Drought/low water levels	34.1 (3.5)	39.8 (.2)	19.8 (−2.1)	6.4 (−2.6)	12.3	<.001	.086
MANAGERIAL							
Road closure	28.7 (1.7)	38.2 (−.4)	24.8 (.0)	8.3 (−1.8)	21.2	.046	.047
Site closure	29.8	37.2	23.0	10.1	17.7	.077	
Lack of parking/limited available parking	27.7	40.3	22.0	9.9	14.6	.356	
SOCIAL							
Crowding – at attractions (e.g., waterfalls, picnic areas, vistas)	26.8	39.7	23.9	9.5	13.2	.821	
Crowding – along the trail	32.9 (3.1)	40.8 (.6)	17.6 (−3.1)	8.7 (−1.1)	13.1	<.001	.082
Trash, litter, graffiti, etc.	33.7 (3.1)	39.3 (.0)	19.4 (−2.1)	7.7 (−1.7)	10.9	<.001	.073
Conflict with others' activities (e.g., hiking and mountain biking on the same trail)	35.3 (3.3)	41.3 (.6)	14.3 (−3.6)	9.0 (−.8)	8.4	<.001	.087
Conflict with others (discrimination, harassment, etc.)	35.2 (3.3)	37.6 (.4)	17.8 (−2.4)	9.4 (−.5)	8.3	<.001	.072

Table 3
Driver most recently displacing recreationists, by most visited southern California national forest and overall. Cells represent percentages (%) of respondents overall, and percentages (%) of the overall by forest. Significant differences between/among forests ($p < .05$) are noted by Cramer's V effect sizes and standardized residuals in parentheses following the percentage of respondents.

Driver	Most Visited National Forest				Overall	*p*-value	Cramer's V
	Los Padres	Angeles	San Bernardino	Cleveland			
ENVIRONMENTAL							
Extreme heat	26.9	37.6	23.7	11.8	14.0	.581	
Extreme rain/precipitation	31.6 (2.2)	35.2 (−1.2)	25.5 (.3)	7.8 (−1.6)	10.1	.020	.052
Fire risk	26.2	37.9	24.8	11.0	7.9	.968	
Active fire	29.5	37.5	22.8	10.3	6.2	.597	
Wind events	31.1	39.2	23.0	6.8	6.2	.111	
Poor air quality	26.4	43.4	23.1	7.1	5.9	.292	
Drought/low water levels	40.8 (4.0)	38.0 (−.2)	14.7 (−2.8)	6.5 (−1.6)	5.1	<.001	.088
MANAGERIAL							
Road closure	23.9	39.1	28.6	8.3	7.7	.335	
Lack of parking/limited available parking	36.4	39.5	24.8	9.3	7.2	.944	
Site closure	27.0	34.4	27.4	11.2	6.7	.474	
SOCIAL							
Crowding – at attractions (e.g., waterfalls, picnic areas, vistas)	29.5 (1.1)	44.3 (1.2)	19.0 (−1.7)	7.1 (−1.5)	5.9	.046	.047
Crowding – along the trail	37.7 (3.3)	38.2 (−.2)	14.6 (−2.9)	9.5 (−.4)	5.5	<.001	.076
Trash, litter, graffiti, etc.	27.9	44.2	20.4	7.5	4.1	.293	
Conflict with others' activities (e.g., hiking and mountain biking on the same trail)	35.2 (2.1)	39.8 (.1)	14.1 (−2.4)	10.9 (.2)	3.6	.013	.055
Conflict with others (discrimination, harassment, etc.)	36.0	34.0	18.0	12.0	2.8	.068	

and 10.4 % ($n = 373$) Cleveland.

5.1. Drivers of displacement

For any listed driver of displacement, a quarter to two-thirds of respondents (25.5–69.8 %) indicated that they had experienced this condition. Conflict with others was the least experienced, though still somewhat high, with 25.5 % having experienced this driver. For any given driver experienced, 16.2 %–49.3 % of respondents indicated that although they had experienced it, it did *not* affect their plans. Extreme heat was the most experienced driver not affecting plans (49.3 %). Finally, for any given driver experienced, 8.3 %–21.2 % of respondents indicated that it had *affected* their plans. Road closures was the most experienced displacement driver that affected plans (21.2 %). For the driver of displacement most recently experienced, frequencies ranged from 2.8 % (conflict with others) to 14.0 % (extreme heat) (Fig. 2).

Looking across drivers for each displacement type, the most common driver is extreme heat. This driver consistently has the highest percentage across all displacement types, ranging from 21.2 % to 39.0 %. An exception was "recreating with fewer people with limitations", for which wind events were the most common driver (26.9 %, Table 2). Significant differences among forests were found for extreme rain/precipitation, wind events, drought/low water levels, road closures, crowding along the trail, trash/litter/graffiti, conflict with others' activities, and conflict with others. Within these, the general pattern of significance was that Los Padres routinely noted higher frequencies of response than expected (around a third of respondents each), and San Bernardino noted fewer frequencies of response than expected (around 15–20 % of respondents each), with Cleveland also noting lower frequencies than expected for extreme rain/precipitation and drought/low water levels (7.6 % and 6.4 %, respectively). Concerning the most recent driver of displacement (Table 3), the pattern generally remained the

Table 4
Types of displacement being used by recreationists, by most visited southern California national forest and overall, for the site condition that they experienced most recently that affected their plans to visit the forest. The general response option per displacement type is bolded. Cells represent percentages (%) of respondents overall, and percentages (%) of the overall by forest. Significant differences between/among forests ($p < .05$) are noted by Cramer's V effect sizes and standardized residuals in parentheses following the percentage of respondents.

Type	Most Visited National Forest				Overall	p-value	Cramer's V
	Los Padres	Angeles	San Bernardino	Cleveland			
SPATIAL							
Changed the location I visited	**31.8 (3.1)**	**37.3 (-.8)**	**21.9 (-1.5)**	**9.0 (-1.2)**	**18.7**	**<.001**	**.069**
Different site, same forest	33.0 (3.0)	37.5 (−.6)	22.2 (−1.0)	7.3 (−2.0)	11.9	<.001	.068
Different national forest	39.4 (4.5)	36.6 (−.7)	17.2 (−2.5)	6.8 (−1.9)	7.8	<.001	.097
Different outdoor recreation location (city park, etc.)	30.8	38.0	21.1	10.1	6.6	.254	
TEMPORAL							
Changed the time/amount of time I visited	**27.8 (1.3)**	**40.7 (.8)**	**22.6 (-1.3)**	**8.8 (-1.5)**	**25.9**	**.041**	**.048**
Different day of the week	32.1 (2.5)	41.0 (.6)	21.1 (−1.5)	5.9 (−2.8)	11.0	<.001	.072
Different time of day	29.7	39.9	21.9	8.4	9.3	.172	
Different month	34.2 (2.8)	38.2 (−.2)	18.8 (−2.0)	8.8 (−.8)	7.6	.004	.061
Changed amount of time spent there	17.5 (−2.5)	44.2 (1.2)	27.5 (.9)	10.8 (.2)	6.7	.027	.051
Different season/time of year	32.5 (2.0)	39.8 (.2)	20.3 (−1.3)	7.4 (−1.4)	6.4	.035	.049
ACTIVITY							
Changed the recreation activity I participated in	**33.3 (4.0)**	**39.3 (.1)**	**18.9 (-3.1)**	**8.4 (-1.6)**	**19.5**	**<.001**	**.099**
Land-based to a different land-based activity	32.9 (2.8)	39.2 (.0)	20.6 (−1.6)	7.3 (−1.9)	10.7	.001	.066
Land-based to water-based activity	42.9 (5.5)	37.8 (−.3)	13.5 (−3.6)	5.8 (−2.3)	7.2	<.001	.121
Water-based to land-based activity	39.2 (4.1)	40.9 (.4)	11.4 (−4.1)	8.4 (−.9)	6.6	<.001	.102
Water-based to a different water-based activity	42.6 (4.6)	36.3 (−.6)	15.8 (−2.5)	5.3 (−2.2)	5.3	<.001	.098
Changed the level of challenge	25.6	40.2	20.1	14.0	4.6	.294	
COMPANION							
Changed the group I was with or whether or not I was solo	**37.9 (4.7)**	**38.1 (-.3)**	**16.7 (-3.2)**	**7.3 (-1.9)**	**10.7**	**<.001**	**.106**
Recreated with a smaller group	37.9 (3.4)	38.5 (−.2)	16.4 (−2.3)	7.2 (−1.4)	5.4	<.001	.075
Recreated with a group with more experience	43.8 (4.9)	36.2 (−.6)	14.6 (−2.8)	5.4 (−2.1)	5.2	<.001	.103
Decided to recreate with others	37.9 (3.1)	36.6 (−.5)	18.0 (−1.7)	7.5 (−1.2)	4.5	.002	.064
Recreated with a larger group	44.6 (4.5)	33.1 (−1.2)	16.2 (−2.1)	6.1 (−1.6)	4.1	<.001	.092
Decided to recreate alone	38.8 (2.9)	36.4 (−.5)	16.5 (−1.8)	8.3 (−.7)	3.4	.005	.059
Recreated with fewer children in the group	37.6 (2.5)	40.4 (.2)	14.7 (−2.1)	7.3 (−1.0)	3.0	.008	.058
Recreated with fewer people with limitations (mobility, health conditions)	36.5	36.5	15.4	11.5	1.5	.217	
TOTAL							
Chose a different experience	**30.1**	**35.0**	**25.5**	**9.5**	**12.0**	**.093**	
Canceled all plans	**17.7 (-2.8)**	**40.4 (.4)**	**29.4 (1.7)**	**12.5 (1.2)**	**9.1**	**.003**	**.062**

same, but with fewer significant differences overall and by forest.

5.2. Types of displacement

Overall, the most employed type of displacement was temporal (25.9 %), followed by activity (19.5 %), spatial (18.7 %), total – choosing a different experience (12.0 %), companion (10.7 %), and total – canceling all plans (9.1 %) (Table 4). Within these percentages, rates of employment by forest varied substantially for almost all the overall types of displacement and specific items within each. However, the pattern for significant differences among forests generally followed that seen with drivers, in that respondents in Los Padres National Forest generally selected displacement types with a higher frequency than expected, with exceptions being lower rates than expected for changing the amount of time spent in the forest and canceling all plans, and respondents in San Bernardino National Forest and sometimes Cleveland National Forest responded to types of displacement with lower rates than expected. Though responses concerning Angeles National Forest tended to have the highest or second highest percentages of each displacement type, they were not significantly higher or lower than expected for this group.

6. Discussion

With 80 % of U.S.-Americans living in urban areas (US Census Bureau, 2023), urban proximate green spaces provide important areas of refuge for human health and well-being, especially with urban expansion projected to continue. In southern California, the four national forests serve as easily accessible recreation areas for over 25 million people. However, their increased popularity coupled with environmental changes has led to many visitors experiencing recreation displacement after encountering undesirable and/or degraded conditions. Notably, displacement is not an isolated behavior but is part of the larger socio-ecological system of the national forest where visitors interact with the environment (Ferguson et al., 2022). However, to date, there is relatively sparse research on the frequency of different displacement types and the underlying drivers of this behavior (Monz et al., 2021), which is necessary for managers to provide alternate high-quality experiences. The purpose of our study was therefore to examine drivers and types of displacement experienced by recreationists across and within the four national forests in southern California. From these data, we find areas of discussion in the most pronounced drivers, most used types of displacement, and the importance of place in understanding forest-level patterns. As our work surfaced significant differences among forests, but often with small effect sizes, we discuss both the general and forest-specific patterns seen for greater utility.

Three of the four most common drivers of displacement were environmental (extreme heat, fire risk, and extreme precipitation). About a fifth of respondents had experienced each of these drivers to the extent that it affected their plans. This is not entirely surprising, as environmental drivers such as these usually lead to degraded conditions across large geographic areas, affecting numerous visitors who are potentially displaced from the larger landscape (e.g., all four national forests) (Seekamp et al., 2019). However, most of the literature around environmental drivers of displacement is on temperature (Monz et al., 2021), and the literature on precipitation and recreation is often focused on the impact of drought to recreation (e.g., Hand et al., 2018; Jenkins et al., 2023), especially in southern California (Garnache et al., 2018). Although overall slightly more visitors had experienced drought conditions (55.0 % vs. 50.2 %), extreme precipitation resulted in more visitors changing their plans (18.3 % vs. 12.3 %). This could be because drought conditions do not automatically force displacement, as

activities such as hiking (the most common activity in the study area) do not require a water feature, or the water feature is alongside other activities available at that site. For example, on the San Bernardino National Forest, Big Falls is one of the tallest waterfalls in southern California, but the trail starts by a picnic area meaning people can still enjoy picnicking or the hike even if there is no waterfall.

However, people cannot safely recreate during extreme precipitation events, which can also extensively damage roads, trails, and other recreational infrastructure, leading to prolonged site closures. For example, on January 13, 2023, a 60-day closure order was issued for the four of the five districts on the Los Padres National Forest due to a series of atmospheric rivers that brought 17–18 inches of rain over three days, breaking a multi-year drought with widespread flooding. Given that future climatic projections for California involve extreme precipitation events becoming less frequent but more intense (Swain et al., 2025), this subject merits increased attention. Furthermore, given the frequency of this driver in a Mediterranean climate and across a large region, further research in other geographic areas would be advisable. However, addressing environmental drivers is out of the control of forest managers, so addressing social and managerial drivers could instead be prioritized.

Positively, social drivers that affected plans were experienced much less often across the study region. Notably, none of these five drivers were significantly more common for the highly visited Angeles National Forest. As social drivers such as crowding and litter/trash are subjective (Manning et al., 2022; Shelby et al., 1996) and based on individual perceptions and norms (Ferguson et al., 2022), it could be that visitors to this national forest had previously experienced these conditions and/or were expecting to, and had found behaviors and other adaptations (e.g., rationalization, product shift) to still have a quality experience. The visitors to the Angeles National Forest are also the most diverse socio-demographically (Table 1), which could also influence the acceptance of these social drivers. For example, some previous research around crowding has found a significant influence of culture (e.g., Lee et al., 2019; Sayan et al., 2013). Additionally, research has shown that local visitors (which are most visitors to national forests) are more tolerant of crowding (Buta & Bustam, 2024).

Although crowding and litter/trash is not currently one of the top drivers in the study region, it could still be a problem at high-use sites or for some visitors. For example, there is now so much graffiti and trash along the East Fork of the San Gabriel River in the Angeles National Forest that the site made Fodor's 2024 "no-list", a list of places to avoid visiting (Fodor's, 2023). Furthermore, large scale or extended closures can lead to increased crowding at sites that remain open (e.g., Venter et al., 2020). The Forest Service's National Visitor Use Monitoring has a question on crowding across site types but does not currently have a question around trash/litter or conflicts between users and/or activities. Given visitation is likely to continue to increase alongside the more frequent occurrence of environmental drivers, formal monitoring of these other social drivers could be worthwhile for forest managers to undertake.

Displacement is a behavioral adaptation, coping with undesirable site conditions through changing recreation's where, when, how, with whom, or if all. Our results indicate that potentially different displacement types require different levels of effort and perhaps have correspondingly different rates of employment. For example, temporal displacement was the most employed, used by more than a quarter of respondents. This may imply that, when planning forest recreation, the "when" to recreate is the easiest or smallest adjustment needed in plans, which is contradictory to Fefer and colleagues' findings that spatial displacement is the easiest to employ (2021). That our data suggest temporal adaptations as the most common may imply that the urbanity of these forests is a unique factor promoting more local adaptations of time and is worth exploring further in terms of place attachments. It is also surprising that activity displacement was pronounced (about a fifth of respondents), as activity is often tied to recreation identity and is a less flexible component of the experience (Parry & Gollob, 2018). This implies that our population is more flexible in their selected pursuits, especially those at Los Padres National Forest and their movement between water and land-based activities. Spatial displacement was at a similar rate to activity displacement, indicating that about a fifth of respondents also found the place of their recreation to be malleable or adjustable depending on the driver, though often staying within the same forest.

So, although flexibility can be found in the ways recreationists are coping with site conditions, that flexibility is not even across displacement types. People are generally tied to where they are recreating, as expectancy theory suggests, as we know the desired outcomes and value of the location (Manning et al., 2022; Parry & Gollob, 2018). Overall, recreationists in our study are willing to change the what (activity) and when (temporal) of the experience, with less employment of changes to the where (spatial) and who (companion), suggesting deep place and companion ties but more adaptive mindsets (and abilities) to change when and what comprises the recreation experience in these places with the desired group structure. For managers, this means understanding the important nature of place and companions to the experience and correspondingly advertising what activities could be done at different times under various site conditions to recognize that recreationists are more flexible in these adaptations to maintain a quality experience.

Though our results show support for total and companion displacement, these are at lower rates, indicating that respondents were less willing to change their companions or totally abandon their plans. Together, these results imply that while the timing of the recreation experience is perhaps the element that can be changed with least effort by the greatest proportion of respondents, changing the composition of the experience (the activity and the place) is also fairly commonly changed and thus each may require only moderately more effort. This may speak to the known diversity of recreation activities and locations available within each forest and across the region, especially in the northern region with the Los Padres National Forest, which is the largest and most diverse in resources. It is further suggested with the lower-than-expected response rates across displacement types for the San Bernardino and Cleveland National Forests, which are the smallest of the four and perhaps containing the least landscape diversity.

Understanding drivers and types of displacement and how they are varied across their intersections could help in better predicting visitor behavior when site conditions change and would be a useful next step. We also note that by asking for their most recent experience, we are unable to know what frame "recent" was or if respondents were considering one or multiple "recent" visits. Future studies may expand on these investigations of displacement and perhaps only allow one driver to be selected and/or defined as "recent," as fits the intention of that inquiry. Furthermore, drivers are not necessarily independent of each other. For example, extreme heat is often associated with drought, poor air quality, and heightened wildfire risk. The survey question did reflect this, allowing respondents to choose multiple "most recent" drivers, but future research might look to explore which driver(s) have the greatest effect on plans in situations like these. Finally, there is likely to be heterogeneity in how different groups respond to the same driver: if they change their plans or not, and then what type(s) of displacement they employ. Further research might wish to explore this subject, across the landscape or within the same landscape, and the inherent overlaps among drivers (e.g., heat waves co-occurring with active fires, droughts, fire risk, poor air quality, and site closures).

7. Conclusion

The results of this survey show that most visitors to southern California national forests are experiencing a range of environmental, managerial, and social conditions that are often affecting their recreation plans. In turn, these visitors are using all three previously identified types of displacement as coping mechanisms to still have a quality

experience, while also lending support to considering companion displacement as a fourth type of displacement. However, the drivers encountered and displacement strategies employed were unevenly distributed across the study area and among visitors, making it more challenging for forest managers to sustainably balance the provision of recreational opportunities, environmental preservation, and public safety. For example, messages promoting alternative sites and activities will need to be varied (e.g., different framing, targeting specific groups) to effectively reach different groups of users who are employing different coping strategies in response to the same driver. The promotion of less visited sites also risks displacing current visitors who may choose that location wholly or in part to avoid crowds. Managers must also consider the potential impacts on the environment and wildlife that could result from increased use overall and/or at a different time. For example, not all sites are capable of handling a surge in visitation, due to inadequate infrastructure, leading to an increase in litter with negative effects on the environment. Wildlife may also respond negatively to increased disturbances, and such disturbances during breeding season can have especially severe consequences. Finally, public safety concerns associated with some of the environmental drivers (e.g., extreme heat, fire risk, extreme precipitation) mean that managers will need to decide when to promote alternative sites/activities on the forest (or a nearby forest), and when to encourage people to stay home. Although displacement may not be life or death – play or peril – keeping recreationists sustainably and safely engaged in forest visits is crucial to keeping these national forests open, available, and relevant for our recreation pursuits, as these areas are only as important and stewarded as the public considers them to be.

CRediT authorship contribution statement

Alyssa S. Thomas: Writing – review & editing, Project administration, Methodology, Funding acquisition, Conceptualization. **Erin E. Budzyn:** Writing – review & editing, Writing – original draft, Validation, Methodology, Formal analysis, Data curation, Conceptualization. **Elizabeth E. Perry:** Writing – review & editing, Writing – original draft, Validation, Supervision, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Brian A. Peterson:** Writing – review & editing, Methodology, Funding acquisition, Conceptualization. **José J. Sánchez:** Writing – review & editing, Methodology, Funding acquisition, Conceptualization.

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Data availability

The authors do not have permission to share data.

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