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Seeing the forest for the trees: A social-ecological systems approach to managing outdoor recreation visitation in parks and protected areas

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ABSTRACT

Parks and protected areas visitation in the United States has increased substantially over the past several decades, and dramatically within the past few years. This expansion in visitation raises concerns regarding the influence of social, situational, and ecological factors upon visitor behaviors, decision-making, and overall experiences. This study investigated the relationship between three influencing factors and visitors' coping behaviors and overall satisfaction on the White Mountain National Forest (WMNF) of New Hampshire. A mail-back and online survey method was used to collect data from WMNF visitors from June to September of 2020 (n = 642). Structural equation modeling and binary logistic regression analyses suggest social factors (e.g., crowding and conflict), situational factors (e.g., litter and access), and ecological factors (e.g., weather and seasonality) were significant predictors of visitor decision-making and overall satisfaction on the WMNF. Moreover, a majority of the sample consistently employed behavioral adaptations such as resource and temporal substitution, and in some instances, permanently abandoned their recreation experiences altogether, all in an effort to maintain satisfaction. This study demonstrates that in addition to social factors, situational and ecological factors should also be integrated when assessing the broader human-nature relationship. This research advances the social-ecological systems framework and suggests the importance of considering the interconnectivity between recreation visitor experiences and natural resources when sustainably managing parks and protected areas.

Management implications: This study found that social, situational, and ecological factors are driving the need for visitor substitution behaviors on the WMNF. Resource and temporal substitution were most common, with an approximate 95% probability of visitor engagement. Results indicate visitors are able to effectively cope with situational and ecological impacts, partially cope with crowding impacts, and unable to cope with conflict related impacts. These findings suggest visitor conflict, followed by crowding, should be prioritized by resource managers. Additionally, resource managers should work with adjacent communities and stakeholders on communication and engagement strategies, especially in areas proximate to recreation sites prone to crowding and conflict.

1. Introduction

Outdoor recreation has become an increasingly popular in the United States with more than 153 million Americans participating annually (Outdoor Foundation, 2020). Between 2008 and 2019, this number grew by more than 16 million (Outdoor Foundation, 2020). This trend has been especially pronounced in the White Mountain National Forest (WMNF) of New Hampshire. Between 2005 and 2015, visitation to the

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WMNF has more than doubled, from 1.5 million annual visits to 3.4 million annual visits (United States Department of Agriculture Forest Service, 2005; 2015). As more and more visitors recreate in the same finite number of parks and protected areas, resource managers are growing concerned regarding various impacts upon natural resources and visitor experiences. These impacts may be social (e.g., crowding and conflict), situational (e.g., access, litter, parking), and/or ecological (e.g., ticks, weather, seasonality). In response to these impacts, visitors may alter their recreation behaviors in an effort to maintain their desired recreation experience and satisfaction, a process referred to as coping (Ferguson et al., 2018a, 2021; Hall & Shelby, 2000; Miller & McCool, 2003). These adaptations are concerning for resource managers as the employment of coping behaviors are often indicative of larger systemic issues; namely, a decline in the overall quality of the outdoor recreation experience (Hall & Shelby, 2000; Manning, 2011; Miller & McCool, 2003). Moreover, coping behaviors themselves may cause unintended impacts upon visitor experiences, the natural resources, and surrounding communities or regions (Cole, 1992; Starbuck et al., 2006). Thus, empirical examination of these issues, from a social-ecological systems perspective, is required to understand the interlinked impacts between visitors and natural resources.

A social-ecological systems (SES) approach provides an ideal framework for the sustainable management of parks and protected areas. The SES framework offers an interdisciplinary system-wide approach to resource management, considering the interaction of not only social factors, but also situational and ecological factors, upon recreation, culture, community, and natural resources (Morse, 2020). This ensures outcomes related to resource management decisions are not short-term and individualized but are long-term and system wide (Morse, 2020). This study examined the influence of social, situational, and ecological factors upon visitor coping behaviors, decision-making, and overall satisfaction on the WMNF. Study results demonstrate perceived social, situational, and ecological factors significantly influenced visitor behaviors and decision-making. Moreover, study respondents perceived resource and temporal substitution strategies to be the most effective behavioral adaptations for maintaining satisfaction. From a SES perspective, study findings indicate that resource managers must account for the potential impacts of visitor coping behaviors, in order to ensure the best outcomes for not only recreation visitors, but also the social and ecological system as a whole. This study is one of the first to integrate and apply the SES and stress-coping frameworks to examine social, situational, and ecological factors within a parks and protected areas setting. Study findings highlight the importance of a systems approach to sustainably managing recreation resources.

2. Literature review

2.1. Social-ecological systems

The social-ecological systems (SES) framework is an approach which seeks to consider outdoor recreation research more broadly. It combines both social and ecological systems and considers multiple levels of interaction (Morse, 2020). Parks and protected areas have historically been managed within a narrow focus, mainly concerned with single siloed issues within a specific location (Morse, 2020). However, it is now understood that outdoor recreation often influences social, situational, ecological, economic, and policy decisions at local, regional, and national levels (Cole, 1992; Marion & Cole, 1996; Outdoor Foundation, 2020). Approaching the management of outdoor recreation resources from a SES perspective allows for a unique systems approach that models the ripple of interlinked interactions between visitors, resources, and communities.

Coping mechanisms, specifically substitution behaviors, are critical considerations within a SES framework as these behaviors affect not only recreation visitors, but also surrounding communities, natural resources, economies, states, and regions (Cole, 1992; Hall & Cole, 2000; Starbuck et al., 2006). For example, sub-optimal recreation experiences in parks and protected areas often lead to the pervasive employment of substitution behaviors (Ferguson et al., 2018a, 2021; Miller & McCool, 2003). Behaviors such as resource substitution and displacement have been demonstrated to significantly damage the ecological, social, and economic integrity of not only the resources themselves, but also the surrounding communities and regions as well (Marion & Cole, 1996; Starbuck et al., 2006). It is therefore critical to understand the ramifications of visitor decision-making from a systems level. Accordingly, a SES framework has been applied to this study as it broadens the applicability of recreation research and establishes a framework to facilitate the long-term sustainable management of outdoor recreation.

2.2. Social factors

Social factors refer to human interactions that may influence visitor perceptions, behaviors, or experiences (Hall & Shelby, 2000; Manning et al., 2000; Miller & McCool, 2003). There are numerous social factors in parks and protected areas that may influence visitor behaviors and experiences, such as crowding and conflict (Ferguson, Burns, & Smaldone, 2018; Kim et al., 2019). Crowding is defined as a negative evaluation of the volume of visitors within a defined area (Manning et al., 2000). Conflict is defined as an interference in a visitor's goal caused by another's behaviors (Jacob & Schreyer, 1980). The social factors of crowding and conflict are prolific in the parks and protected areas literature and influence both visitor coping behaviors as well as overall satisfaction (Cole & Hall, 2005; Ferguson, Burns, & Smaldone, 2018; Hall & Cole, 2007; Johnson & Dawson, 2004; Schroeder et al., 2020). For instance, Hall and Shelby (2000) found just about half (48%) of visitors to Lake Billy Chinook had utilized various coping behaviors in response to crowding. Hall and Cole (2007) found wilderness visitors who were less satisfied also reported significantly higher levels of overall crowding than visitors who were more satisfied. Johnson and Dawson (2004) found coping behaviors such as resource and temporal substitution helped Adirondack Wilderness visitors maintain satisfaction when encountering crowding. Similarly, Schroeder et al. (2020) found coping behaviors amongst hunters helped maintain satisfaction when encountering crowding or conflict.

2.3. Situational factors

Situational factors refer to interactions with the built environment that may influence visitor perceptions, behaviors, or experiences (Gartner & Lime, 2000; Miller & McCool, 2003). There are numerous situational factors in park and protected areas that may influence visitor behaviors and experiences such as site degradation (e.g., litter and garbage), public access (e.g., facilities, roads, and recreation sites), and energy development (e.g., offshore wind energy development, natural gas development energy development, and anthropogenic sounds) (Ferguson et al., 2019a, 2019b, 2020; Miller et al., 2020). Site degradation is defined as a negative modification of a resource due to human use (Buckley, 2004). Access is commonly described as the ease that services or areas can be obtained or reached (Kim & Nicholls, 2016). Situational factors such as site degradation and access have been well studied in the parks and protected areas literature and have been demonstrated to influence both visitor coping behaviors as well as visitor satisfaction (Blenderman et al., 2018; Cole & Hall, 2005; Hall & Cole, 2007; Johnson & Dawson, 2004). For instance, Miller and McCool (2003) found over one-third of visitors to Glacier National Park reported situational factors as a detractor to their experience. While Johnson and Dawson (2004) and Hall and Cole (2007) found visitors often employed coping behaviors when encountering litter trash, and/or waste.

2.4. Ecological factors

Ecological factors refer to interactions with the natural environment

that may influence visitor perceptions, behaviors, or experiences (Buckley, 2004; Ferguson, Mueller, et al., 2018; Gartner & Lime, 2000). There are numerous ecological factors in parks and protected areas that may influence visitor behaviors and experiences, known as biophysical features (e.g., snowpack, water levels, and tick populations). Biophysical features refer to both living things (e.g., plants and animals) as well as non-living things (e.g., soil and water) (Gartner & Lime, 2000; Whittaker & Shelby, 2002). Yet, the influence of ecological factors upon the visitor experience is a burgeoning area within the parks and protected areas literature which requires further investigation (Ferguson, Mueller, et al., 2018). The limited available research has demonstrated various biophysical features can indeed influence both visitors coping behaviors as well as visitor satisfaction (Boyer et al., 2017; Ferguson, Mueller, et al., 2018; Verbos & Brownlee, 2017). For instance, Lam-González et al. (2019) determined that biophysical climate change factors can play a role in both visitor decision-making and satisfaction. As visitor satisfaction with the climate increased, visitor engagement in recreation increased, and when engagement increased, overall satisfaction increased. Likewise, Boyer et al. (2017) found that both water levels and air temperature impacted recreation visitation numbers.

2.5. Satisfaction

Historically, a primary objective of parks and protected area managers has been providing visitors with high-quality recreation experiences (Manning, 2011). Accordingly, satisfaction has emerged as the principal metric of overall experience quality (Bultena & Klessig, 1969; Williams, 1988). Satisfaction has been broadly defined as the congruence between expectations and outcomes (Ferguson, Burns, & Smaldone, 2018; Manning, 2011). Satisfaction has been widely assessed in myriad research (Hall & Cole, 2007; Johnson & Dawson, 2004; Manning, 2011). In many studies, however, visitor satisfaction has been shown to remain high, even in the presence of significant sub-optimal conditions (Manning, 2011; Manning & Valliere, 2001; Miller & McCool; 2003). A plausible explanation for this phenomenon lies in the stress-coping framework, where satisfaction may be preserved due to the employment of coping behaviors, which serve to mediate any negative influence upon satisfaction. Various research has explored the influence of social factors upon coping behaviors and satisfaction (Cole & Hall, 2005; Hall & Cole, 2007; Johnson & Dawson, 2004; Schroeder et al., 2020). However, limited research has investigated the effects of situational and ecological factors upon coping and overall satisfaction (Blenderman et al., 2018; Boyer et al., 2017; Ferguson, Mueller, et al., 2018; Hall & Cole, 2007; Johnson & Dawson, 2004; Verbos & Brownlee, 2017).

2.6. Stress-coping and substitution theories

Social, situational, and ecological factors have the potential to diminish visitor satisfaction in parks and protected areas settings. In an effort to preserve satisfaction, visitors may employ various coping behaviors to maintain their overall experience (Ferguson et al., 2018a, 2021; Manning & Valliere, 2001; Miller & McCool, 2003). Coping is a social-psychological concept commonly defined as any behavior meant to reduce stress or allow an individual to manage sub-optimal conditions (Sutherland, 1996). The stress-coping framework consists of three primary components: 1) influencing factors, 2) coping mechanisms, and 3) outcomes (Lazarus & Folkman, 1984). Recreation researchers have modified the stress-coping framework to also include behavioral adaptations germane within outdoor recreation settings, such as substitution behaviors (Ferguson et al., 2018a, 2021; Miller & McCool, 2003; Schneider & Hammitt, 1995). In a modified stress-coping framework, influencing factors may consist of social, situational, and ecological impacts a visitor may encounter in a recreation setting. If a visitor appraises said factors negatively, their overall outcome of visitor satisfaction may decline. As such, visitors may employ various coping mechanisms, such as substitution behaviors, in an effort to mitigate impacts and maintain overall satisfaction (Ferguson et al., 2018a, 2021).

A considerable amount of research has applied various forms of the empirically validated recreation substitution typology (Ferguson, Mueller, et al., 2018; Manning & Valliere, 2001; Miller & McCool, 2003; Shelby & Vaske, 1991). The substitution typology consists of several substitutive behavioral adaptations (Manning & Valliere, 2001; Miller & McCool, 2003; Shelby & Vaske, 1991). There are four primary types of substitution behaviors: 1) resource substitution, 2) temporal substitution, 3) activity substitution, and 4) displacement (Anderson & Brown, 1984; Manning, 2011; Miller & McCool, 2003; Shelby & Vaske, 1991). Research suggests temporal substitution is often the most frequently applied substitution behavior, followed by resource substitution, and activity substitution (Greenaway et al., 2007; Hall & Cole, 2007; Hall & Shelby, 2000; Manning & Valliere, 2001). Moreover, studies suggest displacement is often the least frequently applied substitution behavior, as it is typically employed as a last resort when no other options to maintain satisfaction are available (Hall & Cole, 2007; Manning & Valliere, 2001).

Resource substitution refers to a visitor maintaining their preferred activity, but visiting a different location (Ferguson, Mueller, et al., 2018; Greenaway et al., 2007; Miller & McCool, 2003). Temporal substitution refers to a visitor maintaining their preferred activity but visiting the location during a different time (Ferguson, Mueller, et al., 2018; Hall & Cole, 2007; Hall & Shelby, 2000). Activity substitution refers to a visitor maintaining their preferred location, but changing their activity (Ferguson, Mueller, et al., 2018; Greenaway et al., 2007; Miller & McCool, 2003). Finally, displacement refers to a visitor permanently ceasing participation in both the recreation setting and the activity altogether (Ferguson, Mueller, et al., 2018; Hall & Cole, 2007; Miller & McCool, 2003). Thus, the employment of substitution behaviors within a recreation setting are often indicative of significant systemic issues requiring further examination.

2.7. Summary and research questions

A substantial body of recreation literature has focused on the influence of *social* factors upon outdoor recreation behaviors and experiences (Manning, 2011; Manning & Valliere, 2001; Miller & McCool; 2003). However, outdoor recreation inherently takes place within both natural and built environments; thus, situational and ecological factors likely also influence visitor decision-making and overall satisfaction. While this premise has been suggested in the literature, to our knowledge, this is one of the first studies to use a stress-coping model to explore these combined influences within a SES framework. This study addressed these gaps by applying a modified stress-coping framework to explore the extent to which social, situational, and ecological factors relate to visitor coping behaviors and overall satisfaction at the WMNF. A better understanding of these relationships may help shape sustainable policies and strategies to facilitate long-term change. To that end, this study sought to answer the following research questions:

R[1]: To what extent are visitors impacted by social, situational, and ecological factors on the WMNF?

R[2]: To what extent are visitors employing coping behaviors on the WMNF?

R[3]: What is the relationship between influencing factors, coping behaviors, and overall satisfaction on the WMNF?

R[4]: What is the influence of social, situational, and ecological factors upon individual substitution behaviors on the WMNF?

3. Methods

3.1. Study context- the White Mountain National Forest

The White Mountain National Forest (WMNF) is a popular recreation destination that attracts more than 6 million annual visitors (United

States Department of Agriculture Forest Service, 2020). The WMNF is a vital recreation resource for the state of New Hampshire and the New England region. It is an essential part of New Hampshire's economy, supporting more than 5000 jobs and generating more than $193 million in labor income (USDA FS, 2016). The national forest spans more than 800,000 acres in New Hampshire and Western Maine and is located within one day's drive of more than 70 million people (National Forest Foundation, 2020). The WMNF offers more than 1200 miles of hiking trails, 400 miles of snowmobile trails, 160 miles of the Appalachian Trail, 23 developed campgrounds, 6 ski touring areas, and 4 alpine ski areas (United States Department of Agriculture Forest Service, 2020). Broadly speaking, the WMNF management plans aims to sustain a healthy forest, restore the land, provide recreation opportunities, and support local economies, all while protecting the natural landscape (USDA FS,2005). This combination of ecological diversity and high-quality natural resource management, in addition to an abundance of public access, has made the WMNF extremely popular amongst a variety of local, regional, and international visitors.

3.2. Data collection

A modified drop-off/pick-up survey method (Allred & Ross-Davis, 2011; Jackson-Smith et al., 2016; Steele et al., 2001; Trentelman et al., 2016), referred to in this study as a *knock-and-drop* method, was applied to gather data from WMNF visitors from June to August of 2020. A zip code analysis of National Visitor Use Monitoring data was used to identify communities with significant percentages of WMNF visitors (Table 1) (United States Department of Agriculture Forest Service, 2005; 2015). This methodology was created and selected for multiple reasons. First, to comprehensibly assess local, state, and regional visitor perceptions from a systems level. Next, the COVID-19 pandemic necessitated the need to veer away from traditional on-site face-to-face intercept surveys in favor of a more socially distanced survey approach. Finally, this technique allowed for sampling of potentially displaced visitors who are not captured with traditional on-site survey modalities.

This knock-and-drop technique entailed trained researchers canvasing and approaching residential homes, hanging survey kits on doorknobs, knocking, briefly speaking to homeowners (if available), and then proceeding to more homes. Survey kits consisted of a clear plastic bag containing a cover letter, a paper survey, and a return envelope. Two options for returning the survey were provided: 1) a link to an online survey utilizing Qualtrics software, or 2) a printed survey and a postage-paid return envelope. Approximately two weeks after the first round of survey distribution, researchers returned to non-respondent homes and left a reminder postcard. Only consenting adults (18 years of age or older) were eligible to participate in the study.

As a prerequisite screen-out question, all respondents were asked to indicate if they had visited the WMNF in the past two years. If respondents answered 'yes' to this question, they commenced the survey. If respondents answered 'no' to this question, they were asked to complete a separate non-respondent socio-demographic survey. Upon completion of the survey, respondents were thanked for their time and provided an opportunity to voluntarily enter into a prize drawing. In total, 3000 surveys were distributed, yielding 642 completed surveys and a 21% response rate (Table 1). 65% of surveys were completed via the online modality and 35% were completed via the mail-back modality. This survey method response rate was consistent with similar research methods (Stedman et al., 2019; Wallen et al., 2016; Westphal et al., 2014, pp. 1–116).

Finally, non-response bias was assessed using socio-demographic data relating to gender, race, income, and education as well as survey modality from individuals who declined to participate in the survey or who were screened out early in the survey process. Socio-demographics were then compared between both respondents and non-respondents. A chi-square analysis found no significant differences ($p < .05$) for any variables between respondents and non-respondents. Therefore, a lack of non-response bias was assumed.

Table 1
WMNF visitation and survey response information.

Community Name	% of WMNF Visitation[1]	Distributed Surveys	Completed Surveys	Response Rate
Conway	5.8%	277	56	20.2%
Concord	5.4%	271	66	24.4%
Littleton	5.4%	278	69	24.8%
North Conway	4.5%	274	63	22.9%
Berlin	3.7%	275	36	13.1%
Gorham	3.7%	277	59	21.3%
Franconia	3.7%	271	53	19.6%
Portsmouth	3.7%	248	62	25.0%
Campton	2.9%	275	70	25.5%
Plymouth	2.5%	279	72	25.8%
Groveton	0.4%	275	36	13.1%
TOTAL	**41.7%**	**3000**	**642**	**21.4%**

*Note. Percentages may not equal 100 because of rounding.
Note[1]: 2015 National Visitor Use Monitoring data - White Mountain National Forest.

3.3. Survey instrumentation

For each subsequent survey question, respondents were prompted to think about their "most recent trip to the WMNF". The topics within the first portion of the survey included trip visitation patterns and socio-demographic characteristics. Next, respondents assessed items related to perceptions of social, situational, and ecological impacts. Respondents were asked, "To what extent have the following impacted your recreation experience at the WMNF". The fourteen individual impact items were evaluated on a seven-point Likert scale of 1–7; 1 = no impact and 7 = major impact (Table 2). This multi-item scale represented four previously validated domains: 1) social factors-crowding (two items), 2) social factors-conflict (two items), 3) situational factors (six items), and 4) ecological factors (four items) (Ferguson, Burns, & Smaldone, 2018; Manning, 2011; White et al., 2008).

Next, respondents were asked to assess items related to coping behaviors. Respondents were asked, "Please indicate whether you have done any of the following in response to impacts at the WMNF". The eleven individual coping items were evaluated on a seven-point Likert scale of 1–7; 1 = never and 7 = always (Table 3). This multi-item scale represented four previously validated domains: 1) resource substitution (two items), 2) temporal substitution (four items), 3) activity substitution (two items), and 4) displacement (three items) (Ferguson et al., 2018a, 2021; Manning & Valliere, 2001; Miller & McCool, 2003; Schneider & Hammitt, 1995).

Finally, respondents were asked to assess items related to overall satisfaction. Respondents were asked, "Please indicate the extent to which you agree or disagree with each of the following statements." The three individual satisfaction items were evaluated on a seven-point Likert scale of 1–7; 1 = completely disagree and 7 = completely agree (Table 4). This multi-item scale represented the previously validated domain of overall satisfaction (Burns et al., 2003; Ferguson et al., 2018a, 2018b; Lee et al., 2004).

3.4. Data analyses

All data were analyzed using Statistical Package for the Social Sciences (SPSS) version 24.0 and Mplus version 7.11. To address research questions R1 and R2, frequencies, percentages, and measure of central tendency were used. To address research question R3, structural equation modeling (SEM) was employed. Structural equation modeling allows for confirmatory factor analyses, which generate latent variables that can then be linked via structural regression pathways with other measured or latent variables in a single model. This approach was used as several of the constructs central to R3 were multi-item measures that

Table 2
WMNF influencing factors and confirmatory factor analyses for structural equation model.

Code[a]	Item	Loading[b]	Item M (SD)	Domain M (SD)
Social Factors- Crowding[c] (α = 0.96)				
V1	Crowding	.96	4.17 (1.92)	4.15 (1.94)
V2	Too many other visitors	.98	4.13 (1.96)	
Social Factors- Conflict[c] (α = 0.76)				
V1	Conflict with other visitors	.71	2.02 (1.52)	2.57 (1.72)
V2	The actions or behaviors of other visitors	.90	3.13 (1.92)	
Situational Factors[c] (α = 0.85)				
V1	Trail degradation (mud, social trails, erosion)	.75	2.95 (1.71)	3.14 (1.79)
V2	Visible litter, garbage, or vandalism	.82	3.15 (1.94)	
V3	Overall sanitation and cleanliness	.80	2.86 (1.80)	
V4	Availability of restroom facilities	.56	3.04 (1.79)	
V5	Parking or traffic	.63	4.22 (1.90)	
V6	Site access (road conditions/ closures, site closures)	.57	2.62 (1.65)	
Ecological Factors[c] (α = 0.80)				
V1	Diminished natural snowpack	.63	2.72 (1.93)	2.90 (1.88)
V2	Increased tick population	.64	3.46 (2.00)	
V3	Changing seasonality	.69	2.77 (1.87)	
V4	Changing water levels (streams, rivers, lakes)	.73	2.65 (1.75)	

[a] Note: Variable code refers to SEM model, see Fig. 1.
[b] Note: Standardized factor loadings. All loadings were significant at $p < .001$.
[c] Note: Crowding, conflict, situational, and ecological latent variable items (1 = no impact, 7 = major impact).

formed latent variables (see Fig. 1 below). To assess model fit for the structural equation model, a robust selection of fit indices were assessed: RMSEA, CFI, and SRMR (Hooper et al. 2008). Finally, to address research question R4, binary logistic regression was applied, due to the outcome variable being a dichotomous measure.

4. Results

4.1. Descriptive statistics

Of the 642 survey respondents, 47% identified as male and 46% as female (see Appendix A- Table 1). The mean age of respondents was 56 years. A large majority of respondents (89%) reported their race/ethnicity as White. Other ethnicities included Spanish/Hispanic/Latino, African American, and Asian. Over two-thirds (71%) of the sample reported earning a four-year or graduate/professional degree. The political ideology distribution within the sample was moderate, but slightly liberal leaning (M = 3.62) (1 = extreme liberal, 4 = moderate, 7 = extreme conservative). Respondents noted hiking and walking were by far their most common recreation activities, representing approximately 50% of the sample (see Appendix A- Table 2). Downhill skiing or snowboarding (9%) was the next most popular, followed by sightseeing or viewing scenery (8%). Regarding trip visitation characteristics, the vast majority of respondents were New Hampshire residents (91%) who noted traveling a median distance of approximately 60 miles from their homes to the WMNF. These largely local and highly experienced recreationists noted visiting the WMNF an average of five days per month, 36 days per year, and for 30 total years.

Table 3
WMNF coping factors and confirmatory factor analyses for structural equation model.

Code[a]	Item	Loading[b]	Item M (SD)	Domain M (SD)
Resource Substitution[c] (α = 0.96; R^2 = 0.61)				
V1	Visited different areas of the WMNF	.95	4.40 (1.91)	4.35 (1.90)
V2	Visited a different location within the WMNF	.97	4.31 (1.89)	
Temporal Substitution[c] (α = 0.80; R^2 = 0.71)				
V1	Visited WMNF during a different season	.65	3.27 (2.09)	4.13 (2.13)
V2	Visited WMNF during a different day of week	.87	4.20 (2.11)	
V3	Visited WMNF earlier or later in the day	.77	3.92 (2.12)	
V4	Avoided visiting the WMNF on holidays	.60	5.13 (2.21)	
Activity Substitution[c] (α = 0.79; R^2 = 0.35)				
V1	Began a new recreation activity at the WMNF	.75	2.18 (1.50)	2.23 (1.55)
V2	Changed my recreation activity at the WMNF	.88	2.29 (1.61)	
Displacement[c] (α = 0.77; R^2 = 0.05)				
V1	Stopped visiting the WMNF entirely	.73	1.47 (1.19)	1.31 (0.96)
V2	Never visited the WMNF again	.70	1.16 (0.72)	
V3	Abandoned my experience at the WMNF	.83	1.30 (0.98)	
Coping[d] (R^2 = 0.44[e])				
V1	Resource substitution	.78	–	4.35 (1.90)
V2	Temporal substitution	.84	–	4.13 (2.13)
V3	Activity substitution	.60	–	2.23 (1.55)
V4	Displacement	.23	–	1.31 (0.96)

[a] Note: Variable code refers to SEM model, see Fig. 1.
[b] Note: Standardized factor loadings. All loadings were significant at $p < .001$.
[c] Note: Resource, Temporal, and Activity substitution, and Displacement latent variable items (1 = never, 7 = always).
[d] Note: Coping is a second-order latent variable created from four first-order latent variables that capture different categories of coping behavior.
[e] Note: Alpha values cannot be calculated in MPlus for second order confirmatory factor analyses. Kline (2015) notes that factor loadings above 0.60 can be taken as evidence of adequate reliability in a CFA.

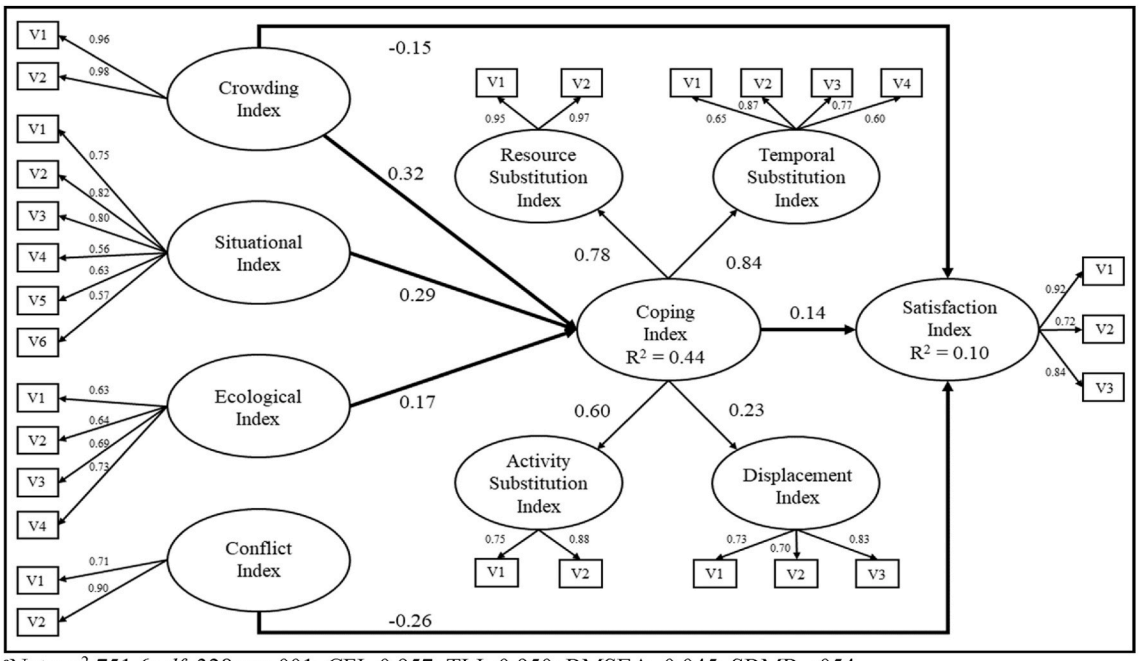
Table 4
WMNF satisfaction and confirmatory factor analyses for structural equation model.

Code[a]	Item	Loading[b]	Item M (SD)	Domain M (SD)
Satisfaction[c] (α = 0.85; R^2 = 0.10)				
V1	I have thoroughly enjoyed my trips to the WMNF	.92	6.38 (0.81)	6.20 (0.95)
V2	I cannot imagine better trips to the WMNF	.72	5.89 (1.14)	
V3	My trips have been well worth the money and time	.84	6.33 (0.91)	

[a] Note: Variable code refers to SEM model, see Fig. 1.
[b] Note: Standardized factor loadings. All loadings were significant at $p < .001$.
[c] Note: Satisfaction latent variable items (1 = completely disagree, 7 = completely agree).

4.2. Research question one

To assess the extent visitors were impacted by social, situational, and ecological factors on the WMNF, respondents evaluated a multi-item seven-point Likert scale (1 = no impact, 7 = major impact) (Table 2). Overall, respondents noted their recreation experiences had been



[a]Note: χ^2:751.6; *df*=328; p<.001; CFI=0.957; TLI=0.950; RMSEA=0.045; SRMR=.054
*Note: All relationships and error covariances were significant at p<.05
*Note[1]: SEM included several error covariances between latent variables based on theoretical constructs: Ecological index with situational index, crowding index, and conflict index; Situational index with crowding index and conflict index; Conflict index with crowding index; Displacement index with activity substitution index.
*Note[2]: SEM included several error covariances between latent and measured variables based on theoretical constructs: Crowding index with parking/traffic; Conflict index with litter/garbage/vandalism.
*Note[3]: SEM included several error covariances between measured variables based on theoretical constructs: Changing seasonality with diminished natural snowpack and changing water levels; Restroom facilities with sanitation and cleanliness.

Fig. 1. SEM Model[aa]Note: χ^2:751.6; *df* = 328; p < .001; CFI = 0.957; TLI = 0.950; RMSEA = 0.045; SRMR = 0.054
Note: All relationships and error covariances were significant at p < .05
Note[1]: SEM included several error covariances between latent variables based on theoretical constructs: Ecological index with situational index, crowding index, and conflict index; Situational index with crowding index and conflict index; Conflict index with crowding index; Displacement index with activity substitution index.
*Note[2]: SEM included several error covariances between latent and measured variables based on theoretical constructs: Crowding index with parking/traffic; Conflict index with litter/garbage/vandalism.
*Note[3]: SEM included several error covariances between measured variables based on theoretical constructs: Changing seasonality with diminished natural snowpack and changing water levels; Restroom facilities with sanitation and cleanliness.

significantly impacted by crowding (M = 4.15), moderately impacted by situational factors (M = 3.14), and slightly impacted by ecological factors (M = 2.90) and conflict (M = 2.57). Moreover, the individual items with the highest perceived impacts were related to parking or traffic (M = 4.22) and crowding (M = 4.17).

4.3. Research question two

To assess the extent visitors employed coping behaviors on the WMNF, respondents evaluated a multi-item seven-point Likert scale (1 = never, 7 = always) (Table 3). Respondents largely agreed the presence of various impacts on the WMNF caused them to employ coping behaviors, with mean scores ranging from 4.35 to 1.31. The highest rated coping behavior was resource substitution (M = 4.35), followed closely by temporal substitution (M = 4.13), and activity substitution (M = 2.23). The coping domain which received the lowest mean rating was displacement (M = 1.31).

4.4. Research question three

To assess overall satisfaction on the WMNF, respondents evaluated a multi-item seven-point Likert scale (1 = completely disagree, 7 = completely agree) (Table 4). Overall, respondents noted they were highly satisfied with their experience on the WMNF (M = 6.20). Overall satisfaction played an important role as an *outcome* variable in the stress-coping framework examined in this study. Outcome variables refer to both short-term and/or long-term outcomes with either immediate and/or gradual consequences (Ferguson et al., 2021; Miller & McCool, 2003). Thus, this overall satisfaction domain is necessary to properly assess the relationship between influencing factors, coping mechanisms, and outcomes in this study.

Structural equation modeling (SEM) was then used to examine the relationships between influencing factors, coping behaviors, and satisfaction amongst WMNF visitors. A measurement model for crowding, conflict, situational, and ecological factors was created via a confirmatory factor analysis (CFA) (Table 2). Next, measurement models for satisfaction and the second order factor of coping were created via CFA (Tables 3 and 4). The researchers then specified theoretically justified structural regression pathways (see section 2.0) to link these latent variables. This process determined significant relationships between influencing factors, coping behaviors, and overall satisfaction, all with sufficient factor loadings. It should be noted that while the displacement R^2 was quite low and does not contribute strongly to the model, it was important to include displacement due to its theoretical importance within the coping model.

The final SEM, using maximum likelihood estimation, with all CFAs

and structural regression pathways, is displayed in Fig. 1. The SEM showed a good fit to the data (χ^2:751.6; $df = 328$; $p < .001$; CFI = 0.957; TLI = 0.950; RMSEA = 0.045; SRMR = 0.054). Results indicate influencing variables explained a significant amount of the variance in coping behavior among visitors ($R^2 = 43.7\%$). The latent variables for crowding, situational, and ecological factors had strong positive relationships with coping behaviors (standardized parameter estimates of 0.318, 0.285, and 0.167 respectively). The effects of situational and ecological factors on satisfaction were fully mediated by coping behaviors. The effects of crowding on satisfaction were only partially mediated by coping behaviors, and also had an indirect negative relationship with satisfaction (−0.148). Finally, conflict was unable to mediate via coping behaviors and instead had a direct and negative effect upon satisfaction (−0.261).

4.5. Research question four

Four separate binary logistic regression analyses were conducted as post-hoc analyses to further explore the relationship between crowding, situational, and ecological factors and WMNF visitor decisions to engage in specific substitution behaviors (Table 5). All of the hypothesized variables were included in the model based on results from the SEM. The latent factor variables are composed of the measured items listed in Tables 3 and 4 CFA were run for each latent variable in a measurement model, which allowed the latent factor variables to be regressed upon one another. It should be noted that conflict was dropped from subsequent models, as it demonstrated no direct effect upon coping in the SEM.

The seven-point substitution constructs (1 = never, 7 = always) were recoded into dichotomous dummy dependent variables: 1 was recoded as 0 (i.e., no a coping behavior was not initiated) and 2–7 were recoded as 1 (i.e., yes a coping behavior was initiated). The decision was made to include insignificant variables to better explore the nuanced relationship between influencing factors and substitution behaviors; a common occurrence in recreation research (Casola, Peterson, Pacifici, & Moorman, 2021; Lyon & Vaske, 2010). The resulting models were used to determine the likelihood of visitor engagement with each coping behavior. When determining the likelihood of engagement, mean scores for crowding, situational, and ecological factors were held constant to account for the average WMNF visitor.

Table 5
Logistic regression models predicting WMNF visitor substitution behaviors.

	Nagelkerke R Square	β	Wald	Odds Ratio
Resource Substitution Model[a]				
Situational factors	0.319	0.684	13.284***	1.982
Crowding factors		0.368	14.798***	1.444
Ecological factors		0.297	4.180*	1.346
Constant		*−1.649*	*17.548****	*0.192*
Temporal Substitution Model[b]				
Situational factors	0.272	0.611	8.933**	1.842
Crowding factors		0.405	13.775***	1.499
Ecological factors		0.176	1.266	1.193
Constant		*−1.042*	*6.393**	*0.353*
Activity Substitution Model[c]				
Situational factors	0.220	0.418	19.388***	1.519
Crowding factors		−0.013	0.047	0.987
Ecological factors		0.365	22.302***	1.440
Constant		*−1.947*	*51.102****	*0.143*
Displacement Model[d]				
Situational factors	0.095	0.241	4.433*	1.273
Crowding factors		0.125	2.258	1.133
Ecological factors		0.162	3.272	1.176
Constant		*−3.592*	*81.546****	*0.028*

*Note. Percentages may not equal 100 because of rounding.
*Significant at 0.05 level, **significant at 0.01 level, ***significant at 0.001 level.
*C = level of crowding factors, S = level of situational factors, and E = level of ecological factors.
[a] Ln(odds) = −1.649 + 0.368(C) + 0.684 (S) + 0.297(E).
[b] Ln(odds) = −1.042 + 0.405(C) + 0.611 (S) + 0.176(E).
[c] Ln(odds) = −1.947 + −0.013(C) + 0.418 (S) + 0.365(E).
[d] Ln(odds) = −3.592 + 0.125(C) + 0.241(S) + 0.162(E).

In the first model, crowding, situational, and ecological factors were associated with a higher likelihood of engagement in resource substitution. Situational factors were the strongest predictor, with an odds ratio of 1.98:1. Crowding factors were a moderate predictor, with an odds ratio of 1.44:1. Ecological factors were the weakest predictor, with an odds ratio of 1.34:1. This model suggests that at the reported mean levels for all three factors, there is 95% likelihood of visitor engagement in resource substitution. This model correctly classified 88.4% of visitors into the "had not initiated coping behavior" or "had initiated coping behavior" categories.

The second model determined crowding and situational factors were associated with a higher likelihood of engagement in temporal substitution. Situational factors were the strongest predictor, with an odds ratio of 1.84:1. Crowding factors were a moderate predictor, with an odds ratio of 1.49:1. This model indicates that at the reported mean levels for all three factors, there is 96% likelihood of visitor engagement in temporal substitution. This model correctly classified 90.6% of visitors into the "had not initiated coping behavior" or "had initiated coping behavior" categories.

In the third model, situational and ecological factors were associated with a higher likelihood of engagement in activity substitution. Situational factors were the strongest predictor, with an odds ratio of 1.52:1. Ecological factors were a moderate predictor, with an odds ratio of 1.44:1. This model suggests that at the reported mean levels for all three factors, there is 60% likelihood of visitor engagement in temporal substitution. This model correctly classified 68.3% of visitors into the "had not initiated coping behavior" or "had initiated coping behavior" categories.

In the final model, only situational factors were associated with a higher likelihood of engagement in displacement. Situational factors had an odds ratio of 1.27:1. This model indicates that at the reported mean levels for all three factors, there is 13% likelihood of visitor engagement in displacement. This model correctly classified 85.1% of visitors into the "had not initiated coping behavior" or "had initiated coping behavior" categories.

5. Discussion

Outdoor recreation has established itself as a powerful industry and sector in the United States. The recent explosion in visitation to parks and protected areas creates both opportunities and challenges for the social and ecological systems that provide and depend upon outdoor recreation. SES provides an ideal framework for sustainably managing visitation and providing high-quality outdoor recreation opportunities. This approach considers the multiple scales of visitors, ecosystems, and communities which rely upon the outdoors for their social, cultural, ecological, and economic wellbeing (Morse, 2020). The overarching purpose of this study was to examine the extent to which social, situational, and ecological factors relate to visitor coping behaviors and overall satisfaction on the WMNF, from both a SES and stress-coping perspective. Results indicate social, situational, and ecological impacts significantly influenced both visitor decision-making and overall experience quality. This study advances the SES and stress-coping frameworks and suggests the importance of integrating recreation and ecological considerations when sustainably managing parks and protected areas.

5.1. Theoretical implications

From a theoretical perspective, this study and specifically research question three, offer insights into the theory of stress-coping. While the outdoor recreation literature has largely focused on the influence of *social* factors upon the recreation experience (Manning & Valliere, 2001; Miller & McCool; 2003), to our knowledge, this is one of the first studies to explore the combined influence of social, situational, and ecological factors upon coping behaviors and satisfaction within a combined SES and stress-coping framework. Study findings indicate both crowding and situational factors were robust predictors of coping behaviors, while ecological factors were a moderate predictor of coping behavior. Crowding had an additional, indirect negative influence on satisfaction. Moreover, conflict had a direct negative influence on satisfaction, bypassing coping behaviors altogether. Study findings corroborate the literature and suggest coping behaviors partially and/or fully mediated the relationship between influencing factors and outcomes (Ferguson et al., 2018a, 2021; Miller & McCool, 2003). Findings also extend the literature, indicating factors beyond crowding have strong effects on visitor coping behaviors (Ferguson et al., 2018a, 2021). Thus, the effect sizes within the SEM in this study suggest both situational and crowding factors may significantly and equally influence visitor coping behaviors.

A series of binary logistic regression models were applied in research question four to explore the more nuanced effects of various influencing factors upon individual substitution behaviors. Results determined crowding, situational, and ecological factors are robust predictors of visitor decision-making for both resource and temporal substitution. These findings validate the exiting substitution literature (McCreary et al., 2019; Miller & Vaske, 2003) and serve to further extend the literature by suggesting not only social, but also situational and ecological impacts may be driving the need for both resource and temporal substitution on the WMNF. The application of activity substitution and displacement are less pervasive. Moreover, within all four models, situational factors were consistently the strongest predictors of substitution behaviors. This further suggests situational factors (e.g., litter, parking, restrooms) rival social factors (e.g., crowding and conflict) in their influence upon coping behaviors. When integrating SEM and binary logistic regression results (research questions three and four), crowding, conflict, and situational factors have the most robust influence upon visitor decision-making and overall experience quality on the WMNF.

A SES framework was applied in this study as an approach to more broadly understand the visitor decision-making process and the impacts of those decisions downstream. This research explored the premise that visitor behaviors do not exist in isolation. In other words, this study investigated the concept of interlinked interactions between visitor decision-making and ecosystems (Morse, 2020). Study findings suggest the presence of a positive feedback loop which may serve to increase the magnitude of impacts and further destabilize the overall system (Fig. 2) (Miller et al., 2012). For example, visitors may encounter sub-optimal conditions which force them to employ coping strategies to preserve their overall recreation experience. As a result of coping strategies, visitors may choose to recreate within lower-use areas (e.g., resource substitution) or during different days of the week, month, or season (e.g., temporal substitution); both of which increase the potential for significant social, situational, and ecological impacts (Cole, 1992; Starbuck et al., 2006).

Fig. 2. Social-ecological systems model of interconnectivity.

In other words, as visitors change their behaviors in response to influencing factors, they are not simply maintaining their own satisfaction. Rather, recreation behavioral adaptations also significantly influences both social systems (e.g., other visitors and stakeholders) and ecological systems (e.g., site biodiversity and resource quality) (Cole, 1992; Morse, 2020; Starbuck et al., 2006). These impacts may serve to further intensify sub-optimal conditions, with the cycle repeating itself with increased intensity each time. Thus, the applications of a SES framework in parks and protected areas management provides a broad and interconnected understanding of human-nature relationships. Moreover, SES provides resource managers, communities, and stakeholders the opportunity to reduce impacts, stabilize the cycle, and facilitate long-term proactive planning.

5.2. Management implications

From a management perspective, study findings suggest a series of unique challenges and opportunities that may be of interest to natural resource managers. As examined in research question one, the most pervasive impacts upon WMNF visitor experiences are related to crowding (e.g., too many other visitors), situational (e.g., litter, parking, restrooms), and ecological (e.g., diminished snowpack, tick populations) factors. Yet, as examined in research question two, findings demonstrate visitors are able to effectively cope with both situational and ecological factors. This is helpful for resource managers as ecological and situational impacts can be particularly difficult to manage and control. However, results also indicate visitors are largely *unable* to cope with conflict related impacts, and only partially cope with crowding related impacts; both of which lead to significant decreases in satisfaction. In other words, WMNF visitors are fully capable of handling situational and ecological impacts, but less capable of managing conflict and crowding related impacts. These findings suggest visitor conflict, followed closely by crowding, should be a top priority for resource managers. This implication is even more pronounced when considering the dramatic increases in visitation to parks and protected areas due to the COVID-19 pandemic as well as management trends towards multiple use recreation areas and diversifying recreation opportunities (Manning et al., 2000; Marcouiller et al., 2005; Rice et al., 2020).

Resource managers might consider implementing policies to further manage increasing visitation and specifically combat the prevalence of crowding, conflict, and situational impacts. These policies may manifest as direct management actions (e.g., law enforcement presence, citations/fines, area restrictions, activity prohibition) or indirect management actions (e.g., visitor education, interpretive programming, entrance fees, limiting parking infrastructure). Direct management actions may enhance recreation quality and be supported by visitors when implemented in order to specifically control the impacts of increasing recreation visitation. However, indirect management actions have been demonstrated to be preferred by visitors over direct management, especially in dispersed recreation settings (Manning, 2011). Moreover, various direct and indirect visitor management approaches may have distinct downstream influences upon the broader social-ecological system. Thus, resource managers must consider and account for the potential impacts of behavioral adaptations from a SES perspective to facilitate the ideal outcomes for recreation visitors, natural resources, and surrounding communities, states, and regions.

Furthermore, this study suggests that in the presence of various sub-optimal conditions, WMNF visitors are most likely to employ resource and temporal substitution strategies in an effort to preserve and/or

increase overall experience quality. For instance, at the current reported levels of social, situational, and ecological impacts on the WMNF, there is an approximate 95% likelihood of visitor engagement in both resource or temporal substitution. The pervasive application of both resource and temporal substitution behaviors is likely to impact the visitors, ecosystems, and communities surrounding the WMNF. As a result of resource substitution, visitation often spreads from high-to low-use areas, leading to significant social and ecological impacts. With temporal substitution, visitation may shift to different times of the day, week, month, or year; potentially alleviating conventional high-use periods (e.g., summers, holiday weekends), while increasing overall visitation, especially during off-peak periods (e.g., shoulder seasons, weekdays).

These scenarios create unique visitation management challenges, especially for ecosystems and surrounding communities. For example, increased visitation in low use areas may lead to increased trail degradation or impacts to wildlife. Additionally, increased visitation during off-peak periods may stress resource managers in terms of staff and resource allocations as well as local communities who may not have the assets or workforce to accommodate off-season visitation. Further, this study also demonstrated that both crowding and situational factors are significant drivers of coping behaviors. Therefore, resource managers should proactivity and systematically work with local communities and stakeholders to minimize the presence of sub-optimal conditions and prioritize communication and engagement strategies through information signage and messaging, especially in areas known for crowding, conflict, and situational impacts. For example, in the context of parking and traffic, messaging could focus on the impacts of parking and traffic on both the recreation experience and the natural resources, communities, states, and regions. Then, information campaigns could covey specific times and locations where traffic and a lack of parking is prevalent, encourage and incentivize programs for utilizing alternative transportation systems, and work with communities to develop action plans to curb overflow parking, especially on private property.

5.3. Implications for future research

This study has several implications for future research including segmenting recreation visitors, further investigating the influence of various exogenous and endogenous factors, broadening the study sample, and applying a mixed-methods study approach. This study focused on WMNF visitors as a whole, but there may be merit in examining the influence of individual outdoor recreation activities upon the stress-coping process. Future studies might consider segmenting visitors by primary activity, focusing on those activities more susceptible to sub-optimal conditions (e.g., downhill skiing). These segmentations could help identify and rank order recreation activities in terms of their vulnerability. Next, there may be other exogenous factors outside of social, situational, and ecological factors that may influence coping behaviors. For example, displacement was the weakest of the four BLR models and did not contribute strongly to the SEM, implying there remains a need to further identify which variables may influence visitor decisions to completely abandon their recreation experiences. Future research might consider examining the influence of factors such as motivations, experience use history, and specialization upon coping behaviors. Further, there may be other endogenous factors, aside from satisfaction, that can serve as an outcome variable in the stress-coping model. Future research might consider utilizing endogenous factors such as intention to return, health outcomes, or management preferences.

This study used an online/mail-back survey modality and focused on a rather homogenous subset of in-state outdoor recreationists as study methods were somewhat restricted due to funding limitations as well as COVID-19 related safety protocols and travel restrictions. Future research might consider enhancing the study modality (e.g., incorporating more follow-ups) in an effort to increase dwindling mail-back response rates (Stedman et al., 2019) as well as broadening and diversifying the study sample (e.g., including out-of-state and/or regional respondents) to allow for further generalization and applicability of findings. The overall sample in this study was relatively homogenous. While this is common in outdoor recreation research, it is worth noting the lack of diversity in the sample. Finally, future studies should consider the application of a mixed-methods and multi-discipline approach to SES. Applying mixed methodologies and multi-disciplinary approaches to assess social, situational, and ecological impacts upon visitors, ecosystem health of the landscape, communities, and entire regions may aid in a further assessing the operation of the entire system.

6. Conclusion

The results of this study suggest social, situational, and ecological factors significantly influenced visitor decision-making and overall experience quality on the WMNF. Findings indicate visitors were able to effectively cope with situational and ecological impacts but were largely unable to cope with crowding and conflict related impacts. Study results suggest a positive feedback loop may be ongoing; one which continues to increase the magnitude of impacts and further destabilize the overall system. When visitors employ coping behaviors in response to influencing factors, these behavioral adaptations may introduce new impacts, or exacerbate existing ones. As visitors continue to encounter these magnifying impacts, they often employ additional coping behaviors. If left unchecked, these impacts may increase the prevalence and severity of substitution behaviors, leading to significant downstream effects upon the visitors, resources, communities, and regions who rely upon the WMNF. Recognizing that parks and protected areas serve as vital ecological, social, cultural, and economic hubs, resource managers and policymakers should consider a SES approach towards the sustainable management of these priceless resources. This research advances the social-ecological systems framework and suggests the importance of considering the interconnectivity between recreation visitor experiences and natural resources when sustainably managing parks and protected areas.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jort.2021.100473.

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