# Whether they return

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# Whether They Return: Modeling Outdoor Recreation Behaviors, Decision Making, and Intention-to-Return in Congressionally Designated Wilderness

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**Abstract:** Visitation to parks and protected areas (PPAs) has become increasingly widespread in the United States. This increased visitation is especially concerning within congressionally designated wilderness areas where federal agencies are tasked with the dual mandate of preserving wilderness character while simultaneously providing high-quality outdoor recreation experiences. This study investigated the influence of social, situational, and ecological factors on outdoor recreation visitor behaviors and decision making within the Lye Brook Congressionally Designated Wilderness (LBW) area in Vermont, USA. An on-site intercept survey (n = 576) was employed to collect data from LBW visitors in the summer of 2021. Descriptive and multi-variate statistics (e.g., binary logistic regression, structural equation modeling) indicated that visitor behaviors (e.g., coping, substitution) and decision-making (e.g., intention-to-return) were significantly influenced by social (e.g., conflict), situational (e.g., litter, access), and ecological (e.g., trail conditions, weather) impacts. Moreover, the presence of various weather conditions was found to significantly influence the severity of perceived social, situational, and ecological impacts. Study results indicated that outdoor recreation experiences are multifaceted, necessitating a suite of social, situational, and ecological considerations, especially when examining the relationship between visitor coping behaviors and intention-to-return. This research advances the coping framework, provides empirical support for future examination of social–ecological system (SES) theory, and emphasizes the utility of employing an adaptive systems approach for sustainable PPA management.

**Keywords:** outdoor recreation; parks and protected areas; visitor behaviors and decision making; social–ecological systems; visitor use management; weather impacts

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## 1. Introduction

During the 21st century, outdoor recreation visitation within parks and protected areas (PPAs) in the United States has grown tremendously, with more than half the country participating annually as of 2018 [1]. In 2020–2021, outdoor recreation visitation to PPAs reached unprecedented levels due largely to the COVID-19 pandemic [1,2]. This surge in visitation has become increasingly difficult for PPA managers who are presented with the dual mandate of providing both high-quality outdoor recreation experiences while simultaneously protecting these important natural resources. As a result, resource managers are growing increasingly concerned regarding the impacts of social (e.g.,

crowding, conflict), situational (e.g., litter, access), and ecological (e.g., trail degradation, weather) factors upon visitor behaviors, decision making, experience quality, and intention-to-return. These impacts are particularly concerning in congressionally designated wilderness areas where the opportunity for solitude (i.e., minimal evidence of human habitation) is a core tenet of the visitor experience [3]. The coping framework suggests that in the presence of impacts, visitors may utilize a variety of behavioral coping mechanisms to preserve their desired outcome [4–6]. Yet, assessing and understanding the complex interplay between visitor behaviors, decision making, experience quality, and natural resource quality remains challenging.

A common critique of traditional outdoor recreation research has been a narrow methodological focus upon both scope and scale [7,8]. For instance, a majority of PPA studies focus solely on *social* issues at *one* specific location [7–9]. This one-dimensional approach often fails to consider both spatial and contextual variations, thus potentially oversimplifying the multifaceted nature of outdoor recreation experiences [7–10]. However, the social–ecological system (SES) conceptual framework suggests the integration and assessment of both social *and* ecological factors, across a broader system-wide spatial scale (e.g., multiple sites, multiple site types), may provide a more comprehensive and accurate representation of the numerous complex and interconnected systems present within PPAs [7,9,11,12]. This study examined the influence of social (e.g., crowding, conflict), situational (e.g., litter, access), *and* ecological factors (e.g., trail degradation, weather) upon visitor coping behaviors, and intention-to-return in the Lye Brook Wilderness (LBW) area of the Green Mountain and Finger Lakes National Forests (GMNF). Further, this study integrated various components of both the SES and coping conceptual frameworks in an effort to extend both the scale and applicability of PPA research. Study findings lend themselves to further integration between SES, coping, and visitor use management conceptual frameworks to provide a more comprehensive understanding of the complex human–nature relationship.

## 2. Literature Review

### 2.1. Social–Ecological Systems

A SES refers to a complex system of interdependent social *and* ecological subsystems [7]. The SES conceptual framework was originally applied in local ecological contexts, aiding resource managers in assessing complex and adaptive ecological systems and improving their long-term management [7,12]. Although growing recreation visitation has placed unprecedented stress on both social and ecological systems, outdoor recreation research is often criticized for lacking considerations beyond simply the *social* aspects of the visitor experience [7–9]. By incorporating interconnected social and ecological components on a broadened spatial scale, SES serves to more thoroughly address complex visitor use management issues [11,12]. Moreover, SES and visitor use management frameworks (e.g., IVUMC-VUM) have natural synergies which serve to capitalize on these critical relationships, all in an effort to more comprehensively understand complex human–nature relationships [1,13–15].

### 2.2. Social Factors

Social factors entail interactions among humans and the influence of said interactions upon visitor behaviors, experiences, and outcomes [16,17]. Within the PPA literature, crowding and conflict have emerged as the predominant social factors of study [16]. Crowding is typically experienced when visitors perceive too many people in a specific location [18]. Conflict often occurs when the actions or behaviors of certain visitors interfere with the goals of other visitors [17]. The relationship between social factors and outdoor recreation experiences has been well documented in the outdoor recreation literature, with crowding and conflict demonstrated to influence visitor coping behaviors, intention-to-return, and opportunities for solitude [16,17,19]. For instance, research suggests

five group encounters per day is the normative standard amongst wilderness visitors before social conditions become unacceptable [16]. Li [20] found a significant negative relationship between levels of perceived crowding and the likelihood of repeat visitation. Tynon and Gómez [21] found that for coastal recreationists in Hawaii, a majority of visitors experiencing conflict would return, but would do so while avoiding weekends and holidays or recreating earlier or later in the day. Arnberger and Brandenburg [19] found PPA visitors employed temporal, resource, and activity coping behaviors and intended to visit less in the future in response to crowding. Likewise, Schuster et al. [22] reported 50% of visitors to the Great Gulf Wilderness employed coping behaviors largely due to crowding. In other words, perceptions of crowding and conflict often increase visitor coping behaviors, yet the combined influence of social factors and coping mechanisms upon intention-to-return remains understudied.

### 2.3. Situational Factors

Situational factors refer to the influence of broad contextual interactions, often with the built environment, upon visitor behaviors, experiences, and outcomes [9,23,24]. Within the outdoor recreation literature, access (e.g., roads, parking, traffic) and litter (e.g., waste, garbage) are commonly studied situational factors. Access can be defined as how easily a resource, destination, or opportunity can be reached [25]. Litter is commonly defined as waste products that have been improperly discarded [26]. The existing literature has found that situational factors have significant influences upon visitor coping behaviors and intention-to-return [27,28]. For example, Taher et al. [29] found that mountaineers expressed a greater intention-to-return when an area was perceived as more accessible. Arnberger and Eder [30] found that visitors within European PPAs were most impacted by litter and vandalism, often requiring the employment of coping mechanisms, resulting in high levels of intention-to-return. Schuster et al. [28] also found litter to be the most frequently reported undesirable condition when evaluating coping responses in outdoor recreation settings. Similarly, Miller and McCool [6] found access to facilities to be one of the most frequently reported experiential impacts related to the employment of coping behaviors.

### 2.4. Ecological Factors

Ecological factors, commonly referred to as biophysical indicators, consider the influence of the natural environment upon visitor behaviors, experiences, and outcomes [9,31,32]. Site degradation (e.g., trail conditions) is a commonly studied ecological factor within the outdoor recreation literature and is broadly defined as recreation use impacts that degrade the quality of a natural resource [32,33]. Site degradation has been found to significantly influence visitor coping behaviors and intention-to-return. For instance, Hall and Cole [27] found that 20% of visitors to wilderness areas in Washington and Oregon employed coping behaviors when encountering heavily impacted trails. Further, 25% of respondents listed trail maintenance and site impacts as the main factors preventing their return.

### 2.5. Weather

Weather is another important, yet understudied and often overlooked, ecological factor within the outdoor recreation literature [34,35]. Weather refers to day-to-day variations in meteorological conditions within an area [36]. The weather typology primarily used to examine the effect of weather upon outdoor recreation includes thermal components (e.g., temperature, humidity), physical components (e.g., precipitation, wind), and aesthetic components (e.g., sky conditions) [35,37]. While the importance of weather upon the recreation experience has been established, limited research has explored the relationship between weather and visitor experiences and behaviors within PPAs [35,38,39]. This burgeoning area of research suggests weather may significantly influence visitor coping

behaviors and intention-to-return. For example, Hübner and Gössling [40] found that nearly 20% of visitors would not return to their recreation destination due to perceived weather conditions. While McCreary et al. [41] found that nature-based recreationists often employ various coping behaviors when dealing with weather-related experiential impacts. Thus, a central component of this study aims at examining the influence of weather upon social, situational, and ecological factors as well as coping behaviors and experience outcomes.

### 2.6. Intention-to-Return

While satisfaction has remained a common standard when evaluating experience quality outcomes in PPA settings, recent research suggests other various outcome indicators may be more comprehensive [42,43]. Consequently, post-visit behavioral intentions such as intention-to-return have become an increasingly common outcome measure of experience quality within PPAs [42,44]. Intention-to-return can be defined as a visitor's intention to revisit a PPA where they have previously recreated [42,43]. Within this growing area of research, findings have been mixed. For example, some studies found that undesirable impacts may significantly influence intention-to-return, while others have reported higher levels of intention-to-return despite encounters with various impacts [37,43]. These mixed findings may be explained through the integration of the coping framework which suggests coping behaviors may be employed in the presence of undesirable impacts in an effort to maintain outcomes such as intention-to-return. While various studies have investigated how social factors influence coping behaviors and intention-to-return, limited research has examined the extent to which social, situational, *and* ecological factors collectively influence coping behaviors and intention-to-return in PPA settings [9].

### 2.7. Stress-Coping and Substitution Theories

Visitors to PPAs often employ various coping strategies to minimize the impact presented by social, situational, and/or ecological factors upon their overall recreation experiences [5,6]. Coping can be defined as behavioral adaptations used to mitigate stressful situations [45]. The three main components of the stress-coping framework are influencing factors, coping mechanisms, and outcomes [46]. The framework postulates that when an individual assesses a situation as stressful, they may employ various behavioral adaptations (i.e., coping mechanisms) to mediate sub-optimal encounters and ultimately achieve a desired outcome [4,46]. In PPA settings, research suggests first-time visitors are less likely to perceive impacts and employ coping behaviors [19,47]. Likewise, studies also suggest repeat PPA visitors, with past on-site experiences, are more likely to perceive impacts and employ coping behaviors [19]. Moreover, several studies have also modified the coping framework to include various coping behaviors (e.g., substitution) germane to outdoor recreation settings [4,6,41].

The four main substitution behaviors are temporal substitution, activity substitution, resource substitution, and displacement [6,48,49]. Temporal, activity, and resource substitution refer to a visitor altering the time, activity, and/or place in which they recreate, respectively [48]. Displacement refers to a visitor permanently abandoning their recreation experience altogether [50]. Moreover, strategic substitution is an understudied substitution behavior that incorporates alterations to recreation gear and/or equipment [41,51]. Despite receiving less attention in the literature, recent studies have integrated strategic substitution for its unique application to natural resource management [41,51]. Assessing the presence of substitution behaviors in PPAs is an important consideration when developing sustainable visitor use policies as their presence can be indicative of larger systemic issues.

### 2.8. Summary and Research Questions

Historically, PPA research has largely assessed issues within a limited scope, often examining a single issue at a specific location, with a primary focus on *social* factors [7,8,16]. Yet, recent research suggests recreation resources and visitor use management frameworks are complex and adaptive systems, requiring a broader and more comprehensive approach [7–9]. Limited research, however, has integrated SES concepts within outdoor recreation settings, and even fewer studies have integrated this concept within the coping framework. Similarly, the relationship between weather conditions and visitor decision making and experiences remains understudied [35]. This study addresses these gaps by assessing the influence of social, situational, and ecological factors upon coping behaviors and intention-to-return. From a theoretical perspective, parallels are drawn between the SES and coping conceptual frameworks. Further clarity amongst these relationships will assist in developing policies and practices that encourage sustainable PPA management, especially in Congressionally Designated Wilderness Areas where opportunities for solitude are central. To that end, the current study examines the following research questions:

$R^1$: To what extent are visitors impacted by social, situational, and ecological factors at the LBW?

$R^2$: To what extent are visitors employing coping behaviors and exhibiting intention-to-return at the LBW?

$R^3$: What is the influence of weather upon social, situational, ecological factors and coping behaviors at the LBW?

$R^4$: What is the relationship between influencing factors, coping behaviors, and intention-to-return at the LBW?

## 3. Methods

### 3.1. Study Context—The Lye Brook Wilderness

The LBW is the third largest congressionally designated wilderness area within the GMNF [52]. As a congressionally designated wilderness, the LBW receives the highest level of resource protection from human impacts (e.g., development, mechanization) to preserve its most natural condition and prioritize opportunities for solitude and undisturbed experiences [3,53]. As a recreation resource, the LBW encompasses 20 miles of hiking trails, including 4.5 miles of the popular Appalachian/Long Trail, one historic camping shelter, multiple backcountry campsites, two major ponds, and the third largest waterfall in Vermont—the Lye Book Falls [52]. The LBW is also rich in historical, cultural, ecological, and biological value as a landscape recovering from heavy logging and mining [52]. Since recovering, it has become a popular recreation destination for a myriad of local, regional, and international visitors. The LBW is located within one day's drive of an estimated 74 million people and is surrounded by major roadways on three sides, making it an easily accessible recreation destination [52]. Accordingly, the goal of the GMNF Land and Resource Management Plan is to maintain the LBW for high-quality forest, recreation, community, and economic opportunities for current and future generations [54].

### 3.2. Data Collection

This study employed an on-site exit-use intercept survey of LBW visitors from June to August of 2021. To obtain a diverse and representative sample, researchers established a systematic sampling plan coinciding with peak recreation visitation periods [55]. To ensure data collection across a broad and diverse spatial scale, numerous survey locations within the LBW were selected for sampling based on conversations with natural resource managers [7,8]. These survey locations included front-country and back-country hiking trails, thru-hiking and/or long-distance hiking sites, undeveloped campgrounds, and water-based recreation sites. As potential respondents exited the LBW boundary, they were approached by a trained research assistant and asked if they would be willing to

participate in a brief 10 to 15-min survey regarding their experience *that day*, via a tablet computer using Qualtrics data collection software. Informed consent was obtained from each respondent prior to beginning of the survey.

To qualify for the study, potential respondents were shown a map of the LBW and asked a prerequisite screen-out question, "Did you specifically enter the LBW during this trip?" If respondents answered 'no' to this question, they were excluded from the survey. If respondents answered 'yes' to this question, but were unwilling to participate in the survey, they were asked to complete a separate non-respondent socio-demographic survey. Non-response bias was examined by comparing the socio-demographics between respondents and non-respondents. A lack of non-response bias was determined as a series of chi-square analyses found no significant differences between respondents and non-respondents within any study variables. Upon completion of the survey, respondents were thanked for their time. This process resulted in a 93% response rate, with 618 respondents being approached and 576 respondents completing the survey. This survey method response rate was consistent with similar research methods and settings [4,21].

### *3.3. Survey Instrumentation*

Study respondents were instructed to only consider "this trip to the LBW" while completing the survey. Section one of the survey asked questions regarding visitors' general recreation experience. The next section evaluated visitors' perceptions of various social, situational, and ecological impacts. Respondents were asked "to what extent have the following conditions impacted your recreation experience at the LBW?" Several multi-item survey batteries represented six constructs supported by previously validated literature: (1) crowding [16], (2) conflict [9,17], (3) litter [33], (4) accessibility [24,56], (5) weather [37], and (6) trail conditions [24,33]. All impacts were assessed on a seven-point Likert-type scale from one to seven; 1 = no impact and 7 = major impact.

The ensuing survey section evaluated how often visitors employed various coping/substitution behaviors as well as their intention-to-return to the LBW. Respondents were asked to "indicate whether you have done any of the following in response to various conditions at the LBW." The multi-item coping battery represented five previously validated constructs: (1) resource substitution, (2) activity substitution, (3) temporal substitution, (4) strategic substitution, and (5) absolute displacement [6,9,41,51]. Perceptions of substitution behaviors were evaluated on a seven-point Likert-type scale from one to seven; 1 = never and 7 = always. Finally, to evaluate visitors' intention-to-return, respondents were asked to, "Please indicate whether you intend to return to the LBW in the future." This empirically validated single-item construct was assessed on a seven-point Likert-type scale from one to seven; 1 = definitely not and 7 = without a doubt [40].

### *3.4. Data Analyses*

The data analyses in this study were conducted using the Statistical Package for the Social Sciences (SPSS) version 27.0 and Mplus version 7.11. Frequencies, valid percentages, and measures of central tendency were used to investigate R1 and R2. Binary logistic regression was used to investigate R3. To investigate R4, Structural Equation Modeling (SEM) was used; the model's fit to the data was then assessed via multiple fit indices [57].

## 4. Results

### *4.1. Descriptive Statistics*

Among the 576 study respondents, 51% identified as male and 47% as female. Nearly all respondents (91%) indicated their race/ethnicity to be White, while Asian, Spanish/Hispanic/Latino, and African American ethnicities were also reported. Respondents, on average, were 38 years old (median 36 years old). In terms of primary activity, respondents most commonly participated in hiking or walking (52%) with more than one-quarter of the sample (28%) indicating through and/or section hiking the Appalachian/Long trail.

Other activities reported included backpacking (10%), dog walking (2%), and nature/wildlife viewing (2%). Approximately 80% of respondents were first-time visitors to the LBW and three-quarters (77%) were day-users. Repeat visitors indicated recreating in the LBW an average of two days per month, 3 days per year, and for 6 total years. Regarding visitor origin, the vast majority of visitors (88%) were from out-of-state, with respondents traveling a median distance of 200 miles from home to access the LBW. The most common out-of-state origins were New York (17%), Massachusetts (11%), and Pennsylvania (7%).

### *4.2. Research Question One*

To investigate the extent to which visitors were impacted by social, situational, and ecological factors at the LBW, respondents assessed a series of multi-item Likert-type scales (1 = no impact, 7 = major impact) (Table 1). Overall, reported impacts and associated means amongst visitors to the LBW were quite low. The results indicated that visitors were most impacted by trail conditions (M = 2.49), weather conditions (M = 2.03), and crowding (M = 2.05). Factors such as access (M = 1.73), litter (M = 1.63), and conflict (M = 1.53) were the least impactful. The individual items that visitors perceived to be the most impactful to their experiences were trail muddiness (M = 4.18) and erosion (M = 2.79), followed by rain (M = 2.55), humidity (2.51), and temperature (M = 2.29).

**Table 1.** LBW Visitors' Perceived Social, Situational, and Ecological Impacts.

| Item | Item M (SD) | Domain M (SD) |
|---|---|---|
| [a] **Social Factors—Crowding ($\alpha$ = 0.94)** | | |
| Crowding | 2.10 (1.51) | 2.05 (1.47) |
| Too many other visitors | 2.00 (1.42) | |
| [a] **Social Factors—Conflict ($\alpha$ = 0.92)** | | |
| Conflict with other visitors | 1.40 (1.05) | |
| The way other visitors are behaving | 1.58 (1.30) | 1.53 (1.23) |
| The actions or behaviors of other visitors | 1.60 (1.33) | |
| [a] **Situational Factors—Litter ($\alpha$ = 0.77)** | | |
| Visible litter, garbage, or waste | 1.77 (1.43) | 1.63 (1.29) |
| Domestic animal waste | 1.48 (1.15) | |
| [a] **Situational Factors—Access ($\alpha$ = 0.78)** | | |
| Parking Accessibility | 1.74 (1.43) | 1.73 (1.43) |
| Trail Accessibility | 1.72 (1.42) | |
| [a] **Ecological Factors—Trail Conditions ($\alpha$ = 0.78)** | | |
| Trail widening | 2.11 (1.66) | |
| Informal trails | 1.87 (1.38) | |
| Trail erosion | 2.79 (1.87) | 2.49 (1.62) |
| Trail muddiness | 4.18 (2.07) | |
| Trail litter | 1.51 (1.11) | |
| [a] **Ecological Factors—Weather Conditions ($\alpha$ = 0.84)** | | |
| Temperature | 2.29 (1.65) | |
| Humidity | 2.51 (1.78) | |
| Rain | 2.55 (2.17) | 2.03 (1.58) |
| Strong Winds | 1.44 (1.11) | |
| Cloudiness | 1.75 (1.38) | |
| Visibility | 1.68 (1.41) | |

[a] Note: Social, situational, and ecological factor variable items (1 = no impact, 7 = major impact).

### *4.3. Research Question Two*

To investigate the extent to which visitors employed coping behaviors at the LBW, respondents assessed a fourteen-item seven-point Likert-type scale of coping behaviors (1 = never, 7 = always) (Table 2). Overall, visitors indicated rarely employing coping behaviors (M = 1.66) in response to the conditions they encountered within the LBW. However, when coping behaviors *were* utilized, visitors most often employed strategic substitution (M = 1.79), temporal substitution (M = 1.77), and resource substitution (M = 1.71). The coping behavior employed least often was activity substitution (M = 1.38).

**Table 2.** LBW Visitors' Employment of Coping Mechanisms and Intention-to-return to the LBW.

| Item | Item M (SD) | Domain M (SD) |
|---|---|---|
| [a] **Resource Substitution ($\alpha$ = 0.85)** | | |
| Avoided certain areas of the LBW | 1.63 (1.37) | |
| Visited different areas of the LBW | 1.78 (1.54) | 1.71 (1.47) |
| Visited a different location within the LBW | 1.73 (1.49) | |
| [a] **Activity substitution ($\alpha$ = 0.83)** | | |
| Stopped engaging in my main recreation activity at the LBW | 1.33 (0.93) | |
| Began a new recreation activity at the LBW | 1.46 (1.18) | 1.38 (1.04) |
| Changed my Recreation activity at the LBW | 1.36 (1.00) | |
| [a] **Temporal Substitution ($\alpha$ = 0.88)** | | |
| Visited the LBW during a different season | 1.62 (1.46) | |
| Visited the LBW on a different day of the week | 1.76 (1.61) | 1.77 (1.62) |
| Visited the LBW earlier or later in the day | 1.87 (1.72) | |
| Avoided visiting the LBW on holidays | 1.81 (1.72) | |
| [a] **Strategic Substitution ($\alpha$ = 0.73)** | | |
| Changed the gear I use while recreating in the LBW | 1.66 (1.39) | 1.79 (1.53) |
| Considered purchasing new gear for future trips to the LBW | 1.92 (1.67) | |
| [a] **Absolute Displacement ($\alpha$ = 0.51)** | | |
| Considered visiting a different location outside of the LBW | 1.90 (1.72) | 1.61 (1.39) |
| Considered abandoning my recreation experience entirely | 1.37 (1.05) | |

[a] Note: Resource, Activity, Temporal, and Strategic Substitution, and Absolute Displacement variable items (1 = never, 7 = always).

To determine the extent to which LBW visitors exhibited intention-to-return at the LBW, respondents evaluated a single-item Likert-type scale of intention-to-return (1 = Definitely not, 7 = Without a doubt) (Table 3). On average, visitors had high intentions to return to the LBW (M = 5.17). Valid percentages indicated that 65% of respondents were likely to return to the LBW and 14% of respondents were unlikely to return. Within that, 31% of respondents indicated they would return to the LBW "without a doubt" and 3% indicated they would "definitely not" return (Table 3).

**Table 3.** LBW Visitors' Intention-to-return Rating.

| Mean (SD) | Valid Percentages | | | | | | |
|---|---|---|---|---|---|---|---|
| 5.17 (1.65) | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| | 3.1% | 4.9% | 5.9% | 20.7% | 19.2% | 15.6% | 30.6% |

Note: Intention-to-return single item (1 = definitely not, 7 = without a doubt). Note: Percentages may not equal 100 because of rounding.

### *4.4. Research Question 3*

Multiple binary logistic regression (BLR) analyses were conducted to investigate the relationship between LBW visitors' perceptions of weather conditions and social, situational, and ecological impacts as well as coping behaviors. Variable selection for the models was based upon prominent social, situational, and ecological impacts and coping behaviors identified throughout the literature (see Section 2.). Exploratory factor analysis was then used to create latent factor variables for each of the multi-item impact factors and coping behaviors based on the measured items in Tables 1 and 2. Next, the seven-point latent impact and coping constructs (1 = no impact, 7 = major impact; 1 = never, 7 = always) were recoded into dichotomous dummy dependent variables: 1 was recoded as 0 (i.e., no impact perceived) and 2–7 were recoded as 1 (i.e., an impact was perceived). Although coping behaviors were initially hypothesized as an outcome variable within the regression analyses, the decision was made to exclude them from the final models due to a lack of direct effect and associated variance. The subsequent models determined the likelihood of visitors perceiving social, situational, and/or ecological impacts at the currently reported mean levels for perceived weather impacts (Table 4). When determining the likelihood of perceiving impacts, the mean score for weather factors was held constant to represent the average LBW visitor response.

**Table 4.** Binary Logistic Regression Models—Predicting LBW Visitor Perceptions of Impacts.

| | Nagelkerke R Square | β | Wald | Odds Ratio |
|---|---|---|---|---|
| **Social factors—Crowding Model** [a] | | | | |
| Weather factors | 0.078 | 0.438 | 29.463 *** | 1.550 |
| *Constant* | | −0.896 | 24.873 *** | 0.408 |
| **Social factors—Conflict Model** [b] | | | | |
| Weather factors | 0.082 | 0.431 | 31.398 *** | 1.539 |
| *Constant* | | −1.747 | 82.227 *** | 0.174 |
| **Situational factors—Litter Model** [c] | | | | |
| Weather factors | 0.034 | 0.271 | 13.902 *** | 1.311 |
| *Constant* | | −1.011 | 33.545 *** | 0.364 |
| **Situational factors—Access Model** [d] | | | | |
| Weather factors | 0.028 | 0.246 | 11.564 *** | 1.279 |
| *Constant* | | −1.025 | 34.382 *** | 0.359 |
| **Ecological factors—Trail Conditions Model** [e] | | | | |
| Weather factors | 0.135 | 1.235 | 21.056 *** | 3.437 |
| *Constant* | | 0.158 | 0.168 | 1.172 |

* Significant at 0.05 level, ** significant at 0.01 level, *** significant at 0.001 level * Note. W = reported mean for latent weather factor. [a] Ln(odds)= −0.896 + 0.438 (W). [b] Ln (odds) = −1.747 + 0.431 (W). [c] Ln (odds) = −1.011 + 0.271 (W). [d] Ln (odds) = −1.025 + 0.246 (W). [e] Ln (odds) = 0.158 + 1.235 (W).

The first model determined that weather impacts were associated with a higher likelihood that visitors would perceive crowding impacts. Weather impacts significantly predicted crowding impacts, with an odds ratio of 1.55:1 (Table 4). This model suggests that at the reported mean levels for weather impacts, there is a 50% likelihood that visitors will perceive crowding impacts. Yet, if the mean values for weather impacts increased by 1-point, the likelihood that visitors will perceive crowding impacts increased to 61% (Table 5). This model correctly classified 60% of respondents into appropriate categories.

**Table 5.** Binary Logistic Regression Models—Extrapolations Predicting LBW Visitor Perceptions of Impacts.

| | Likelihood of Visitor Impact (%) | | |
|---|---|---|---|
| | **Reported Mean −1** | **Reported Mean** | **Reported Mean +1** |
| Social factors—Crowding Model [a] | 39.1% | 50.0% | 60.7% |
| Social factors—Conflict Model [b] | 21.4% | 29.6% | 39.2% |
| Situational factors—Litter Model [c] | 32.5% | 38.7% | 45.3% |
| Situational factors—Access Model [d] | 31.6% | 37.2% | 43.1% |
| Ecological factors—Trail Conditions Model [e] | 80.8% | 93.6% | 98.0% |

[a–e] Note: Variable model refers to the Binary Logistic Regression models in Table 4.

In the second model, weather impacts were associated with a higher likelihood that visitors would perceive conflict impacts. Weather impacts significantly predicted conflict impacts, with an odds ratio of 1.54:1 (Table 4). This model suggests that at the reported mean levels for weather impacts, there is a 30% likelihood that visitors will perceive conflict impacts. Further, if the mean values for weather impacts increased by 1-point, the likelihood that visitors will perceive conflict impacts increased to 39% (Table 5). This model correctly classified 60% of respondents into appropriate categories.

The third model determined that weather impacts were associated with a higher likelihood that visitors would perceive litter impacts. Weather impacts significantly predicted litter impacts, with an odds ratio of 1.31:1 (Table 4). This model suggests that at the reported mean levels for weather impacts, there is a 39% likelihood that visitors will perceive litter impacts. Moreover, if the mean values for weather impacts increased by 1-point, the likelihood that visitors will perceive litter impacts increased to 45% (Table 5). This model correctly classified 63% of respondents into appropriate categories.

The fourth model indicated weather impacts were associated with a higher likelihood that visitors would perceive access impacts. Weather impacts significantly predicted access impacts, with an odds ratio of 1.27:1 (Table 4). This model suggests that at the reported mean levels for weather impacts, there is a 33% likelihood that visitors will perceive access impacts. Additionally, if the mean values for weather impacts increased by 1-point, the likelihood that visitors will perceive access impacts increased to 43% (Table 5). This model correctly classified 63% of respondents into appropriate categories.

In the fifth model, weather impacts were associated with a higher likelihood that visitors would perceive trail impacts. Weather impacts significantly predicted trail impacts, with an odds ratio of 3.44:1 (Table 4). This model suggests that at the reported mean levels for weather impacts, there is a 94% likelihood that visitors will perceive trail impacts. Furthermore, if the mean values for weather impacts increased by one point, the likelihood that visitors will perceive trail impacts increase to 98% (Table 5). This model correctly classified 89% of respondents into appropriate categories.

### *4.5. Research Question Four*

To evaluate the overarching relationship between influencing factors, coping behaviors, and intention-to-return at the LBW, Structural Equation Modeling (SEM) was employed. Confirmatory factor analysis (CFA) was used to generate a measurement model for weather, social/situational, trail, and coping factors (Table 6). The latent variables derived from these CFAs were then connected using theoretically informed structural regression pathways (see Section 2). The results indicate significant relationships with satisfactory pathway coefficients between influencing factors, coping behaviors, and intention-to-return (Table 6; Figure 1).

**Table 6.** LBW Confirmatory Factor Analysis for the Structural Equation Model.

| Code [a] | Item | Loading [b] | Item M (SD) | Domain M (SD) |
|---|---|---|---|---|
| **Weather Factors [c]** | | | | |
| V1 | Temperature | 0.62 | 2.29 (1.65) | |
| V2 | Humidity | 0.59 | 2.51 (1.78) | |
| V3 | Rain | 0.66 | 2.55 (2.17) | 2.20 (1.68) |
| V4 | Cloudiness | 0.70 | 1.75 (1.38) | |
| V5 | Visibility | 0.71 | 1.68 (1.41) | |
| **Social/Situational Factors [c] ($\alpha$ = 0.87; $R^2$ = 0.12)** | | | | |
| V1 | The way other visitors are behaving | 0.80 | 1.58 (1.30) | |
| V2 | The actions or behaviors of other visitors | 0.78 | 1.60 (1.33) | |
| V3 | Visible litter, garbage, or waste | 0.85 | 1.77 (1.43) | 1.64 (1.34) |
| V4 | Domestic animal waste | 0.76 | 1.48 (1.15) | |
| V5 | Parking accessibility | 0.52 | 1.74 (1.43) | |
| V6 | Trail Accessibility | 0.53 | 1.72 (1.42) | |
| **Trail Factors [c] ($\alpha$ = 0.83; $R^2$ = 0.46)** | | | | |
| V1 | Trail widening (e.g., excessive width) | 0.74 | 2.11 (1.66) | |
| V2 | Informal trails (e.g., social trails) | 0.56 | 1.87 (1.38) | 2.26 (1.64) |
| V3 | Trail erosion (e.g., bare soil) | 0.77 | 2.79 (1.87) | |
| **Coping [d] ($\alpha$ = 0.91; $R^2$ =0.14)** | | | | |
| V1 | Visited different areas of the LBW | 0.69 | 1.78 (1.54) | |
| V2 | Visited a different location within the LBW | 0.73 | 1.73 (1.49) | |
| V3 | Stopped engaging in my main recreation activity at the LBW | 0.58 | 1.33 (0.93) | |
| V4 | Began a new recreation activity at the LBW | 0.70 | 1.46 (1.18) | |
| V5 | Changed my Recreation activity at the LBW | 0.72 | 1.36 (1.00) | |
| V6 | Visited the LBW during a different season | 0.75 | 1.62 (1.46) | |
| V7 | Visited the LBW on a different day of the week | 0.73 | 1.76 (1.61) | 1.66 (1.01) |
| V8 | Visited the LBW earlier or later in the day | 0.65 | 1.87 (1.72) | |
| V9 | Avoided visiting the LBW on holidays | 0.65 | 1.81 (1.72) | |
| V10 | Changed the gear I use while recreating in the LBW | 0.75 | 1.66 (1.39) | |
| V11 | Considered purchasing new gear for future trips to the LBW | 0.57 | 1.92 (1.67) | |
| V12 | Considered visiting a different location outside of the LBW | 0.55 | 1.90 (1.72) | |
| V13 | Considered abandoning my recreation experience entirely | 0.44 | 1.37 (1.05) | |
| **Intention-to-return [e] ($R^2$ = 0.13)** | | --- | 5.17 (1.65) | |

[a] Note: Variable code refers to SEM model, see Figure 1. [b] Note: Standardized factor loadings. All loadings were significant at $p < 0.05$. [c] Note: Weather, social/situational, and trail impacts latent variable items (1 = no impact, 7 = major impact). [d] Note: Coping latent variable items (1 = never, 7 = always). [e] Note: Intention-to-return single item (1 = definitely not, 7 = without a doubt)

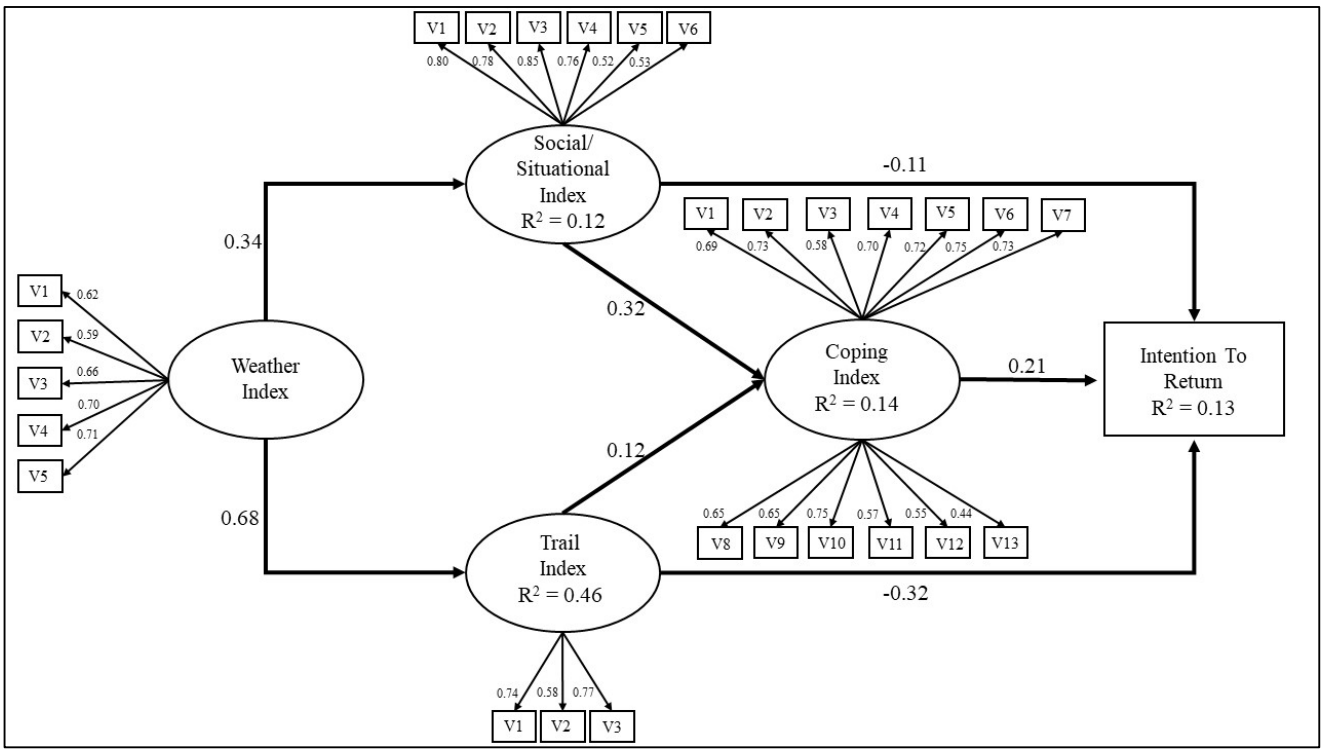


**Figure 1.** Structural Equation Model for LBW Visitors. Note: $\chi^2$:494.3; *df* = 327; $p < 0.001$; CFI = 0.97; TLI = 0.96; RMSEA = 0.03; SRMR = 0.05. Note [1]: All relationships and error covariances were significant at $p < 0.05$. Note [2]: SEM included several error covariances between measured variables based on theoretical constructs: CopingV4 with V5 and V6; CopingV5 with V6; CopingV2 with V3; CopingV9 with V8 and V7; CopingV13 with V14; CopingV12 with V14; CopingV10 with V9 and V8; CopingV8 with V7; WeatherV1 with V2; WeatherV5 with V3 and V6; Social/Situational V3 with V4; Social/SituationalV4 with V5; TrailV1 with V2.

The final SEM, using maximum likelihood estimation, with all CFAs and structural regression pathways, is displayed in Figure 1. The SEM showed a good fit to the data ($\chi^2$:494.3; *df* = 327; $p < 0.001$; CFI = 0.97; TLI = 0.96; RMSEA = 0.03; SRMR = 0.05). Model pathways suggested that weather factors accounted for a substantial portion of the variance in influencing factors (social/situational factor $R^2 = 0.117$; trail factor $R^2 = 0.463$) but were not significantly related to coping behaviors. However, influencing factors accounted for notable variance in coping behaviors employed by visitors ($R^2 = 0.135$). Furthermore, coping behaviors partially mediated the effects of social/situational and ecological factors on intention-to-return. The latent variable for social/situational had a direct positive relationship with coping behaviors and a direct negative relationship with intention-to-return (standardized parameter estimates of 0.319 and −0.110, respectively). The trail index latent variable had a direct positive relationship with coping behaviors and a direct negative relationship with intention-to-return (standardized parameter estimates of 0.124 and -0.321, respectively).

## 5. Discussion

Visitation to PPAs across the country has surged in recent years. This dramatic increase in visitation has raised concerns over the outdoor recreation visitor experience as well as the overall longevity and resilience of natural resources. These concerns are even more pronounced in congressionally designated wilderness areas which are managed to provide highly primitive experiences and opportunities for immersive solitude [3]. The current study assessed the influence of social, situational, and ecological factors upon coping behaviors and visitors' intention-to-return across a broad spatial scale within the LBW.

The findings suggest that various social, situational, and ecological factors had a significant influence upon visitor behaviors and future decision making. The study results extend the SES and coping frameworks and emphasize the value of assessing not only social factors, but also ecological and situational factors within the visitor experience.

### *5.1. Theoretical Implications*

Study findings have several implications relative to the SES, coping, and weather frameworks in PPA settings. Assessing both social *and* ecological aspects of PPAs on a broader spatial scale was central to this study. This approach validated the existing literature regarding the influence of social, situational, *and* ecological impacts on visitors' behaviors and experiences [9] and extended the literature by assessing said impacts on coping behaviors and intention-to-return at several spatial locations within the LBW [7,8]. The results further suggest that visitors are adapting their behaviors (i.e., coping) to mitigate social, situational, and ecological impacts and preserve desired outcomes (e.g., intention-to-return) within the LBW system. For example, as perceptions of impacts become more severe, visitors reported spatially adapting (e.g., changing where they recreated, avoiding certain locations) and temporally adapting (changing time of day, changing day of week) their recreation behaviors [10,11]. These behaviors suggest that visitors are able to effectively cope with any impacts encountered, which alludes to the LBW system's ability to adapt to increasing visitation, further emphasizing the robustness and resiliency of both the LBW visitor and system [10,11].

The results also extend the limited research examining the relationship between weather and outdoor recreation behaviors and decision-making. In the presence of undesirable weather conditions (e.g., temperature, rain, humidity, cloudiness, visibility), LBW visitors are often impacted by ecological factors (e.g., trail conditions) and are somewhat likely to be impacted by social and situational factors (e.g., crowding, conflict, litter, and access). The findings further suggest that when weather conditions are undesirable, social, situational, and ecological impacts may become more apparent. Study results serve to corroborate and extend the literature regarding the influence of weather upon outdoor recreation experiences by examining the relationship between weather and not only social impacts, but also situational, and ecological impacts [35,37,41]. These findings also add to the literature by examining in situ the influence of not only temperature, but other weather variables such as rain, humidity, cloudiness, and visibility [34,35,37,39,41]. Moreover, weather factors were shown to indirectly influence visitor coping behaviors (Figure 1). These findings further extend the literature by detailing how PPA visitors interact with weather [35] to better understand their weather-based decision making.

The study results also suggest several insights for the coping literature. Findings determined that strategic substitution (i.e., changing the gear used while recreating), along with temporal (i.e., changing the time of day and/or day of week one recreates) and resource substitution (i.e., changing the site recreated on within an area), were the most frequently employed behavioral adaptations. These findings validate the coping literature suggesting visitors most often employ temporal and resource substitution behaviors to mitigate experiential impacts [4,5,41]. The results further indicate that social factors (e.g., conflict), situational factors (e.g., litter, access), and ecological factors (e.g., trail conditions) significantly influenced coping behaviors. The extent to which coping behaviors mediate the effect of influencing factors upon intention-to-return is much higher for social/situational factors than ecological factors. In other words, modeling suggests it may be easier for visitors to cope with social/situational impacts as opposed to ecological impacts, in pursuit of an outcome. Taken together, the study results reaffirm the literature by suggesting visitors can successfully employ coping mechanisms to mediate the relationship between impacts and desired experience outcomes [5,6,9,48]. The study findings extend the coping literature by empirically demonstrating visitor abilities to successfully mediate the influence of social, situational, and ecological impacts upon outcomes *beyond* experience quality and satisfaction (e.g., intention-to-return) [4,9].

*5.2. Management Implications*

The study results suggest several challenges and opportunities that may also be of interest for PPA managers, particularly those managing congressionally designated wilderness areas where opportunities for solitude and minimal human impacts are integral components of the visitor experience. For instance, the study sample largely consisted of out-of-state first-time visitors to the LBW. This not only suggests the LBW is a *destination wilderness* location, but also that reported impacts and coping behaviors may be artificially low as first-time visitors often do not perceive impacts nor cope as much as repeat visitors [19]. Still, research question one found that visitors were most impacted by trail conditions (e.g., trail muddiness, erosion, widening) followed by weather (e.g., rain, humidity, temperature). Outside of ecological factors, visitors were also impacted by social factors such as crowding; however, these impacts were generally less pervasive. These findings are critical for resource managers, suggesting ecological factors are just as important, if not more important, to the visitor experience as social factors in PPA settings [12].

Moreover, the presence of undesirable weather conditions contributed to a much higher likelihood that visitors would perceive additional social, situational, and/or ecological impacts. Recognizing that resource managers cannot control the weather, the findings indicate the importance of proactive communication strategies when mitigating the effects of weather upon visitor experiences and natural resources. The findings further suggest that a one-point increase in perceived weather severity further increases the likelihood of visitors experiencing other social, situational, and/or ecological impacts by up to 10% (Table 6). This relationship is critical for managers as PPAs are increasingly subjected to atypical and adverse weather conditions related to global climate change [35,58].

Results further indicate that as LBW visitors encounter undesirable conditions, they typically use strategic, temporal, and resource substitution behaviors to maintain their experiences. In these instances, visitors' coping behaviors may generate additional impacts on other LBW visitors, the resource itself, as well as adjacent communities and economies. For example, shifting visitation away from high-use areas, as is common with resource substitution, can cause low-use areas with fragile ecosystems to become significantly impacted. Visitors requiring additional gear, consistent with strategic substitution, may also continue to recreate under circumstances they normally would not (e.g., during inclement weather) which may lead to further resource degradation. These types of behavioral adaptations inherently alter the demand placed on recreation resources and are often indicative of larger underlying issues; thus, proactively addressing these issues should be a top priority for managers.

Despite the employment of various coping behaviors, the results suggest visitors are only able to *partially* cope with the impacts associated with social/situational and ecological factors (Figure 1). The model suggests that while visitors are largely able to cope with social/situational impacts, they are largely unable to cope with ecological impacts, with ecological impacts likely decreasing future intentions-to-return. These findings, however, are advantageous for resource managers as they further justify infrastructure upgrades (e.g., trail maintenance, restoration). Similarly, social impacts are often more difficult and resource intensive to address (e.g., ranger patrol to combat instances of crowding, conflict), whereas ecological impacts are comparatively simple, time, and cost efficient to fix (e.g., installing water-bars, trail communication). These findings are also vital to wilderness managers entrusted with maintaining natural resources in their most natural state to fulfill visitor expectations of solitude. Thus, from a management perspective, ecological impacts should be a primary focus as they more severely detract from visitor experiences, especially as use-levels and associated impacts intensify amidst the COVID-19 pandemic [59,60].

Accordingly, wilderness managers may find value in adopting policies to specifically address impacts from weather, trail conditions, and crowding, reducing the need for visitor coping behaviors and ultimately protecting both visitor experiences and natural resources. For example, indirect management strategies are well suited for addressing

uncontrollable weather-associated impacts. These might include signage and/or educational campaigns around desired behaviors (e.g., Leave No Trace) and the susceptibility of natural resources to human impacts during and/or after inclement weather. Managers might also consider enforcing more direct management policies to address the prevalence of crowding and worsening trail conditions. These may involve policies regarding limiting group sizes, reservation systems, requiring visitors to stay on designated trails, and/or modifying existing infrastructure to guide visitor behaviors. While these more direct management approaches are typically less favorable amongst visitors in wilderness settings, they are often more effective and receive greater support when implemented specifically to combat worsening conditions [16,61]. Together, coupling direct and indirect management strategies to address social, situational, *and* ecological factors will aid resource managers in reducing negative experiential impacts to wilderness visitors and support the sustainable management of recreation resources.

### *5.3. Implications for Future Research*

The study findings suggest multiple implications for future research. While this study focused on the influence of specific social, situational, and ecological factors on visitor coping behaviors, these factors only explained *some* of the variance in coping, suggesting the presence of other unknown factors may be contributing to coping behaviors. Future studies might consider further examinations of additional elements within this typology of factors (e.g., ecosystem services) as well as other types of influencing factors (e.g., motivational factors, insect bites, fatigue, minor injuries, poor planning, wrong equipment) and their roles in the coping process. This study also operationalized and examined only specific *behavioral* coping mechanisms (e.g., activity, resource, temporal substitution, strategic, type one displacement). Future research might consider integrating additional *behavioral* (e.g., direct action, type two displacement) as well as *cognitive* (e.g., product shift, rationalization) coping mechanisms into study designs. Moreover, this study operationalized and extended the substitution typology and found strategic coping mechanisms to be favorable. As a comparatively understudied coping mechanism, future studies should further develop the construct used to measure strategic coping behaviors. This study used a single-item intention-to-return construct as an outcome in the coping process. Recognizing the complex nature of determining the behavioral intentions of PPAs visitors, future studies should consider a more robust, multi-item measure coupled with intention-to-return, such as visitor loyalty [43]. To broaden the applicability of the coping framework, future research might also consider assessing other suitable variables as outcomes in the coping process such as support for management actions and/or health benefits derived from recreating.

Although this study also incorporated several SES concepts by evaluating a broadened spatial scale as well as social, situational, *and* ecological factors within PPAs, it did not explicitly test SES theory. Future research might consider applying and evaluating SES theory to more intricately examine the interdependent social systems (e.g., resource users, public infrastructure providers) and ecological systems (e.g., the resource, public infrastructure) within PPA experiences [11]. Additionally, future research should consider evaluating activity-specific and location-specific factors and subsequent coping behaviors amongst PPAs visitors. It should be noted that the authors attempted to segment and model activity-specific and location-specific factors, but no significant differences were found. Broadening the approach of future research in such ways may positively impact the sample diversity and further increase the generalizability and applicability of future findings. Additionally, future research might consider assessing and integrating additional managerial factors (e.g., degree of regimentation or management restrictions), especially for future research in wilderness areas. Moreover, this study collected cross-sectional data related to weather conditions as they influenced wilderness visitors over a three-month period in the summer. Future studies should not only consider collecting weather data longitudinally across multiple seasons, but also across various climates and

in a variety of PPAs settings and activities to better understand the weather's influence on visitor experiences. Future studies might also consider integrating components of the weather dependency framework [58] to more comprehensively examine the relationship between weather and PPA experiences.

## 6. Conclusions

Increasing outdoor recreation visitation has strained PPAs managers' abilities to provide both high-quality visitor experiences and preserve natural resources. This dual mandate is particularly challenging in congressionally designated wilderness areas where resource managers must provide visitors with opportunities for solitude. To extend the scope and applicability of outdoor recreation research, this study incorporated concepts from the SES and coping frameworks to evaluate visitor behaviors, experiences, and intention-to-return in the LBW. The study results indicate that not only social factors, but also situational *and* ecological factors significantly influenced visitor experiences, coping behaviors, and intention-to-return to the LBW. Additionally, undesirable weather conditions increase the prevalence of perceived impacts. The results further demonstrate that LBW visitors may more effectively cope with social and situational impacts, as opposed to ecological impacts, in wilderness settings. These findings suggest that PPAs experiences are multifaceted, requiring social, situational, *and* ecological considerations for proactive and sustainable visitor use management to be successful. This research provides empirical evidence to support both the coping and SES theory frameworks and emphasizes the prominence and utility of employing an adaptive systems approach for sustainable PPA management. Further clarity amongst these relationships will assist in developing policies and practices that encourage sustainable PPA management, especially in congressionally designated wilderness where opportunities for solitude are central.

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