

The experienced condition and moderating variables as a potential predictor of visitor thresholds
in outdoor recreation settings

by

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B.S., Hobart and William Smith Colleges, Geneva, NY, 2014

A THESIS

submitted in partial fulfillment of the requirements for the degree

MASTER OF SCIENCE

Department of Horticulture and Natural Resources
College of Agriculture

KANSAS STATE UNIVERSITY
Manhattan, Kansas

2021

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Abstract

Parks and protected areas (PPA) are commonly managed as a function of visitor related impacts. Indicators of quality, and their associated thresholds help park managers make decisions in the interest of both providing optimal recreation experiences, and ecological resource protection. Given the importance of visitor thresholds in informing managerial decisions, a better understanding of how experienced conditions may influence thresholds, and what factors may moderate this relationship, is essential to successful park management. Potential moderators of this relationship include indicator type, park setting and past use history. Four unique parks were used to provide for the park setting moderation, and to provide unique indicator types. These moderators were investigated using the Hayes PROCESS macro tool. Overall, indicator type and park setting display the potential to moderate the ability for experienced conditions to predict thresholds. This implies that reported thresholds can be altered by certain moderators and this should be taken into account when formulating studies. These findings build the foundation for a deeper understanding of threshold development in recreation settings and will serve to improve how PPAs are managed for visitor use.

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Acknowledgements

I would like to thank the entire Applied Park Sciences Lab at Kansas State University for guiding me through the process of completing this thesis. My advisor, Dr. Ryan Sharp has been a great resource throughout my time at Kansas State and will continue to be a great resource and advocate for Park Management and Conservation students for years to come.

I would also like to extend gratitude to my entire committee, who helped push this project in a meaningful direction that will hopefully become a great contribution to parks and social science. Dr. Matt Brownlee from Clemson University has been an amazing help from day 1, and many of his students, both current and former, have added great value to this project.

Finally, I would like to thank my family, who as always, supported me throughout my two years at Kansas State University. They helped ease the burden of completing my Master's degree during an unprecedented and uncertain time in the world.

Chapter 1: Introduction

Overview

Objective data related to recreational visitation is used by park and protected area (PPA) managers to inform the management decisions of these places. Visitor information commonly includes variables referred as indicators of quality, which are objective, manageable variables that provide information on the quality of visitor experiences (Manning, 2011; Manning, 2013). Indicator data allows researchers to derive thresholds for various aspects of the recreation experience. Thresholds are the degree at which an indicator becomes unacceptable, meaning that it is the point at which visitor experiences begin to degrade. Thresholds are the levels of use or impact for which parks aim not to exceed (Vaske et al., 1986). Management actions that are informed by threshold data are more defensible and provide critical opportunities for long term monitoring of experiential, as well as ecological conditions. Proper monitoring of these conditions to identified threshold levels can serve to maintain desired experiential conditions for visitors to PPAs (Manning, 2011).

Given that visitor threshold data is a tool used to inform management decisions in PPAs, determining possible influences on these reported thresholds is increasingly important. The common method by which thresholds are gathered is through post experience visitor questionnaires (Manning, 2011). If individual visits to PPAs are thought to be unique experiences, then it is intuitive that these unique experiences might influence what is reported on post experience visitor questionnaires. The potential for visitor thresholds to be impacted by the experienced condition is an understudied issue that could serve to strengthen the overall management frameworks of PPAs. Understanding how thresholds are developed and potentially moderated can improve the management recommendations given to park managers. To the

author's knowledge, there has been only one other comprehensive study done on this topic, and given the diversity of America's PPAs, the addition of new park settings, as well as unique indicators could serve to improve these findings. The aforementioned study indicated that experienced conditions had little to no effect on the thresholds reported following said experience (Laven et al., 2005). However, the potential for reported thresholds to be influenced by PPA setting, indicator type and visitation frequency is worth further investigation. Furthering the understanding of visitor threshold development will serve to better the management of PPAs, as well as negate potential inaccuracies in management actions.

This thesis aims to expand our understanding of threshold development to improve management recommendations made by visitor use studies. An analysis of the relationship between experienced conditions and thresholds across 4 unique PPAs is included within this document. Potential moderators of this relationship such as past visitation frequency, indicator type and park setting are also included to provide further depth to this investigation.

Questions and Hypotheses

Q1: What is the strength and direction of the relationship between the experienced conditions and visitor thresholds?

H1: A positive relationship will exist between experienced conditions and visitor thresholds.

Q2: Does park setting, indicator type, and past visitation moderate the relationship between the experienced conditions and visitor thresholds?

H2a: Park setting will not moderate the relationship between experienced conditions and thresholds.

H2b: Indicator type will not moderate the relationship between experienced conditions and

thresholds.

H2c: Past use history will not moderate the relationship between experienced conditions and thresholds.

Chapter 2: Manuscript

The Experienced Condition and Moderating Variables as a Potential Predictor of Visitor Thresholds for Outdoor Recreation Settings

Abstract

Parks and protected areas (PPA) are commonly managed as a function of visitor related impacts. Indicators of quality, and their associated thresholds help park managers make decisions in the interest of both providing optimal recreation experiences, and ecological resource protection. Given the importance of visitor thresholds in informing managerial decisions, a better understanding of how experienced conditions may influence thresholds, and what factors may moderate this relationship, is essential to successful park management. Potential moderators of this relationship include indicator type, park setting and past use history. Four unique parks were used to provide for the park setting moderation, and to provide unique indicator types. These moderators were investigated using the Hayes PROCESS macro tool. Overall, indicator type and park setting display the potential to moderate the ability for experienced conditions to predict thresholds. This implies that reported thresholds can be altered by certain moderators and this should be taken into account when formulating studies. These findings build the foundation for a deeper understanding of threshold development in recreation settings and will serve to improve how PPAs are managed for visitor use.

Introduction

Park and protected area (PPA) managers commonly rely on objective visitor data to determine how to best manage resources and experiences simultaneously. Norms are operationalized in recreation settings as what visitors consider to be the acceptable conditions under which their recreation takes place (Manning, 2011; Manning, 2013). Within park settings, norms can be the standard to which visitors measure the quality of their experience. Measures of quality for recreation settings are associated with a threshold, or a level at which experiences begin degrading. The quality of visitor experiences can be impacted by activities, behaviors and environmental conditions experienced within parks (Vaske et al., 1986). Indicators and thresholds related to the quality of visitor experiences at parks and protected areas can be used to inform management decisions (Manning, 2011). According to Manning (2007), effective

indicators are objective, manageable variables that provide information on the quality of visitor experiences, whereas thresholds are the degree at which specific indicator conditions become unacceptable. This type of visitor data is commonly collected through post experience, in-situ questionnaire visitor intercepts. It is common to pose questions to visitors about their thresholds for a variety of indicators (e.g. people at one time), as well as the experienced conditions (i.e. the conditions they experienced during their visit) for park specific activities (Manning, 2011).

There have been few studies presented in the protected area management literature concerning the relationship between visitor thresholds and their experienced conditions. A study from 2005 found that there was little to no relationship between visitor-based standards of quality (norms) and existing conditions (Laven et al., 2005). However, if the thresholds of visitors to parks and protected areas are influenced by the experienced condition, these thresholds may be misrepresented, and consequently the use levels parks are managing to may be inaccurate. This may contribute to managing PPAs towards maintaining existing conditions even if they do not represent desired future conditions.

Take for example a visitor who has only experienced a certain park during its peak visitation period. They may report feelings of dissatisfaction with park conditions, even though the park in question is most often not under these visitation circumstances. In other words, if that specific visitor had instead visited the park during a period of low visitation, you might expect them to report different thresholds. This relationship is important to understand, because visitor data is commonly collected across years and seasons to ensure a robust sample as well as to account for a multiplicity of potential changes over time. That said, visitor surveys are historically cross-sectional capturing just one moment in time. If thresholds are dependent on

experiences, managers may over or under manage a specific aspect of their park simply due to responses from a few exceptionally busy days, or vice versa.

This study serves to revisit the linkage between visitor thresholds for various forms of recreation, and the conditions that were experienced during their visit. Forms of recreation encompassed within the scope of this analysis include hiking, boating (motorized and non-motorized), backpacking, vehicle use and wildlife viewing. It will provide an updated analysis on the potential relationship between experienced conditions and thresholds, while incorporating data from different studies and indicator variables that have not been addressed in the literature. Identifying a linkage between experienced conditions and thresholds could provide additional confidence to park managers when making management decisions that are informed by visitor data. A coherent linkage between experienced conditions and thresholds could yield a new and improved method to which thresholds are interpreted and consequently managed to.

Additionally, experienced conditions are not limited to the visit in which visitors were captured during a sampling period. High frequency of visitation to an area can intuitively be associated with an abundance of diverse experienced conditions. Norms might be influenced by the expectations a visitor has going into an experience. Expectations can be derived from experienced conditions during previous visits to a recreation space (Laven et al., 2005). Consequently, this study will also examine a possible relationship between visitation frequency and thresholds. A relationship between repeat visitation and thresholds could afford justification for interpreting thresholds differently based on visitation frequency. Another potential moderator of the relationship between experienced conditions and visitor thresholds is park setting. In addition to having diverse ecological features, parks offer a wide and diverse range of possible experiences within their confines. Given that experiences likely differ from park to park, their

impact on visitor thresholds may also prove to differ across park setting. Improving our overall understanding of the various aspects of park visitation promotes improved management of these often-delicate places.

Literature Review

Norms, in the form of indicators and thresholds, are a way in which visitors to parks and protected areas evaluate the quality of their experiences and it is expected that the thresholds accompanying these norms will influence management action (Vaske et al., 1986). By aggregating data on visitor norms, such as acceptability of different crowding scenarios, these personal norms become a manageable social norm (Manning, 2011).

Maintaining thresholds through management practices is essential for public land agencies to avoid sanctions like public backlash, lawsuits or visitor displacement (Manning, 2013). Coupling visitor thresholds with ecological variables is one way to justify and garner support for restrictive management actions. Developing management practices surrounding thresholds is essential to the protection of park resources. One of the ways park managers determine the amount of use which a resource can sustain is referred to as visitor carrying capacity. Visitor carrying capacity does come with limitations, but remains a justification by which use may be restricted (Manning, 2013; Manning et al., 2005; Lindberg et al., 1997; Stankey & McCool, 1984)

Past studies have found that imposing formal sanctions on visitors in recreation settings can be more effective than informal sanctions (Shelby et al., 1996). For example, when thresholds are violated for encounters in a recreation setting, likely leading to informal sanctions, crowding levels do not decrease (Heywood, 1996). This leads to the potential for resource and experiential degradation if effective management is not enacted. Improving our understanding

about threshold development may provide stronger justification for imposing formal sanctions, which have been shown to be more effective, yet often receive public backlash.

Whittaker and Shelby (1988) contributed that there are three different types of norms that occur within recreation settings: no tolerance, single tolerance and multi tolerance norms. No tolerance norms are those with an acceptability threshold of no impact. Single tolerance norms are those which allow for some impact greater than zero, but no acceptance of anything greater than this level. Finally, multi tolerance norms are those which have multiple levels of acceptable impacts, making them the most difficult type of norm to manage for. Each of these norm types is associated with different challenges in terms of management. Utilizing these characteristics about norms can be an essential factor in developing thresholds to manage to.

Data related to a range of acceptable conditions within a recreation setting provides confidence that the social norm for a particular variable has been identified, especially given that visitors are confident in their ability to self-report crowding norms and they agree that these numbers should be used to inform management actions (Manning et. al., 2001). Few studies have analyzed the validity of these thresholds and their relationship to experienced conditions (Laven et al., 2005; Manning, 2011; Manning, 2013). In addition to crowding related indicators, there are also experiential related indicators that do not pertain to other human visitors. Indicators such as distance to wildlife can be significantly more nuanced than simple crowding indicators, as they take into account feelings of safety, wildlife ethics, viewing medium, and other factors (Verbos et al., 2018). Given the stark differences that exist between potential indicators of quality in PPAs, it is necessary to evaluate the impact that experienced conditions, and multiple moderators may have across different indicator types.

The potential capability of experienced conditions to predict thresholds is essential for managers and researchers to understand given the impact these data have on the decisions made within parks and protected areas. If visitors are reporting their thresholds based on the conditions they experienced during their visit, then it is possible for environmental resource, as well as social conditions to degrade while visitors are still reporting a relatively high-quality experience. This is possible in a scenario where existing conditions deteriorate incrementally, and threshold violations remain nonexistent. The quality of the resource visitors yearn for may thus decrease incrementally as well.

Norms in recreation settings may be influenced by expectations surrounding certain activities and parks. Previous experiences play a role in shaping these expectations for future visits (Flood, 2002). If this holds true, then a visitor that has already had their thresholds violated at a park, may expect this during their next visit and report that it is now an acceptable condition. Visitors have also been shown to have their behavior and interaction with the resource altered based on the experienced condition (Samdahl & Christensen, 1985). In the backcountry of Grand Canyon National Park, experiences were found to be negatively affected by the number of encounters visitors had during their trip, however the effect was very minimal and therefore may not warrant management action. This suggests that visitors may always evaluate what they experience as acceptable; changing their norms so that the experience is always reported as being satisfying to some degree, a theory known as product shift (Stewart & Cole, 2001). Regardless of this, the relationship between reported norms and experienced conditions has been found to be weak to non-existent for both repeat visitors and first-time visitors (Laven et al., 2005).

Laven et al., (2005) tested the strength of association between visitor thresholds and experienced conditions, while breaking indicators into four categories: Crowding, ecological

impact, graffiti/litter and other indicators. However, this may not be the most effective approach to this question. Visitor ability to report norms related to recreation impacts has been shown to be very limited (Lucas, 1979; Manning, 2011). In addition, even visitors who report recreation impacts, do not frequently include that it impacted the quality of their experience (Knudson and Curry 1981). Also, recreationists are sometimes accepting of certain recreation impacts as opposed to others. This was found to be true with rock climbers in the Adirondack region of New York State (Monz et al., 2006). Using this justification, indicators of visitor created ecological impacts may not be the most reliable way to ensure desired conditions are being met.

Visitors have reported different thresholds for encounters with different types of user groups, this led to the idea that researchers must focus on a wide variety of specific norms (Schreyer & Neilson, 1978). Examples of additional variables may include boats at one time, horse users at one time, mountain bike encounters, vehicles at one time, parking spot availability, size of group encountered, etc.

Laven et al., (2005) have laid the foundation for analyzing multiple indicator variables across different study areas within a comprehensive research focus. Their study analyzed 214 different indicator variables across 14 NPS units. Intercepts achieved with these questionnaires were in diverse settings and seasons, yielding 12,766 respondents. Laven et al., (2005) not only addressed the relationship between thresholds and experienced conditions, but also attempted to spotlight any variance in the strength of this relationship across indicator type. Over half (59.8%) of contingency coefficients computed for each indicator variable revealed a weak to non-existent relationship between thresholds and experienced conditions, with another 35% showing a moderate relationship (Laven et al., 2005). This study also found that a weak relationship between thresholds and experienced conditions held true, regardless of visitation frequency. In

fact, first time visitors displayed an even weaker relationship than repeat visitors, despite intuitively having less experience at the NPS unit (Laven et al., 2005). Despite completing this across 14 NPS units, park setting was not an evaluative dimension of this study. This research contributes a further look into potential moderators on the relationship between experienced conditions and thresholds that were not addressed in Laven et al., (2005). These moderators include indicator type, with the creation of three indicator levels (People per view (PPV), Encounters, Wildlife), park setting, with 4 NPS units not previously analyzed, and past use history as a continuous variable, as opposed to simply first-time vs repeat visitation.

Utilizing available datasets from studies done at four unique national park service units allow for an analysis of the relationship between visitor thresholds and the conditions which they experienced during their time at the park. This study tests indicator variables which were not addressed within other studies, as well as applies this concept to a group of unique parks and protected areas. This will provide a more comprehensive analysis of this relationship across additional variables and parks to conclude if past research findings are consistent throughout the outdoor recreation landscape. This type of analysis has been infrequently completed within the field of PPA research, and a comprehensive analysis of this sort has not been completed within the past 15 years, to our knowledge.

Given that the relationship between visitor experiences and their associated thresholds within recreation settings is not a closed loop, investigating variables (moderators) that may alter the nature of this relationship is essential. Moderation analyses determine if the relationship between a focal predictor (X) and outcome (Y) depends upon a moderator variable (W) (Montoya, 2019). Moderation is essentially meant to determine the complexity of a relationship rather than investigating without the potential impact of outside variables. Traditionally,

dichotomous moderation analyses were conducted by adding an interaction term to a multiple regression model (Aguinis, 2004). Moderators modify the strength of a causal relationship. When dealing with a multi-level categorical moderator (i.e. park setting), it provides information related to when, where or for whom an independent variable (experienced conditions) causes a dependent variable (thresholds) (Wu & Zumbo, 2008).

The Hayes PROCESS macro tool allows researchers to conduct mediation and/or moderation analysis within SPSS (Hayes, 2017). This tool bypasses the creation of “dummy” and “interaction” variables which typically accompany a dichotomous moderator analysis. When conducting a multi-categorical moderation analysis using the PROCESS macro tool, the process becomes relatively simple. The tool autonomously chooses values of the focal predictor (X) and the moderator (W) and generates estimates of the outcome (Y) from these values. Overall, this tool provides an easier and valid means of conducting a wide variety of mediation and moderation analyses (Hayes & Rockwood, 2017).

The ability for different variables to have a moderation effect on the relationship between experienced conditions and thresholds will be the main form of analysis accomplished by this manuscript. Moderation analysis will surround three main research questions, related to indicator type, park setting and past use history. The direct questions meant to be answered are as follows:

Q1: What is the strength and direction of the relationship between the experienced conditions and visitor thresholds?

H1: A positive relationship will exist between experienced conditions and visitor thresholds.

Q2: Does park setting, indicator type, and past visitation moderate the relationship between the experienced conditions and visitor thresholds?

H2a: Park setting will not moderate the relationship between experienced conditions and

thresholds.

H2b: Indicator type will not moderate the relationship between experienced conditions and thresholds.

H2c: Past use history will not moderate the relationship between experienced conditions and thresholds.

Methods

Data Collection

This manuscript utilizes data from studies at Buffalo National River (BUFF), Theodore Roosevelt National Park (THRO), Cumberland Island National Seashore (CUIS), and Katmai National Park and Preserve (KATM) (Brownlee et al., 2018; Brownlee et al., 2019a; Brownlee et al., 2019b; Brownlee et al., 2019c). The diversity between each of these park settings adds to the novelty of this study. Each park is vastly different from the other, as the settings respectively are river, badlands, island seashore and Alaskan.

Questionnaires were distributed to visitors using traditional paper methods, tablets, and business cards with links to an online version of the questionnaire. Regardless of the distribution method, the style of these questionnaires remained constant, and each was administered post-experience. Interviews with stakeholders (e.g. park managers, community members and concessionaires) were crucial to developing indicators that were eventually utilized in the questionnaires (Interagency Visitor Use Management Council, 2016). These studies resulted in a cumulative sample size of 2,165 respondents. Indicators were broken down into 3 categories for analysis purposes: People per View (PPV), Encounters, and Wildlife. These differing indicator categories allow for the comparison of crowding densities (PPV), Encounters along a river, and

the wildlife indicator, proximity to bears, to see if these different types of indicators effect experienced condition's ability to predict visitor thresholds.

In each of these studies, visitors were asked to evaluate the acceptability of park conditions such as crowding along trails, rivers, in parking lots and other popular destinations. There were also evaluative questions related to preferences for wildlife viewing conditions. The majority of indicator related questions were accompanied with photo panels that represented varying levels of the specific indicator; a strategy first used by Manning et al. (1996) and continues to be an accepted form of understanding this phenomenon (Cribbs et al., 2019). For example, visitors to BUFF were shown a series of photographs displaying crowding at a river access area (Figure 1). Other questions simply utilized scales to gather information of visitor thresholds for different indicators.

In order for an indicator to qualify for this study, it needed to be paired with information regarding the experienced condition during visit. In other words, visitors must have reported the actual conditions they encountered for an indicator to qualify. This data was gathered by additional evaluative questions related to the experienced condition. Previous studies have used the comparison of these variables as a means of evaluating the relationship between the experienced condition and visitor thresholds (Laven et al., 2005). In addition to this, each of these studies, aside from KATM, contain information on frequency of visitation measured as visits within the past year.

Table 1. National Park Service Units and Data Sets.

Site	Indicators
BUFF	PPV, River Encounters
THRO	PPV
CUIS	PPV
KATM	Proximity to Bears

Abbreviation: People Per View (PPV)

Threshold Development

Visitor thresholds for various different indicators was a latent variable in each of these data sets. Threshold values were created by observing visitor norm curves. These curves are produced by a ranking of conditions from most acceptable to least acceptable. From this, there is intuitively a point at which visitors deem a given indicator or condition to become unacceptable. In the context of social norm curves, this is the point at which the curve crosses zero. This point is referred to, again, as the threshold for a given condition, or the point at which visitor experiences begin to become unsatisfactory.

In the past, studies which develop thresholds as a latent variable have used a simple linear equation or a polynomial equation to determine individual thresholds found on social norm curves. While this measure certainly is effective in achieving its purpose, it is true that often times these curves are not best defined by linearity or a polynomial equation, meaning that this is not the most accurate method by which the latent threshold variable is derived. A model was developed within R to more accurately create this latent threshold variable (B. Russell, personal communication, November, 2020).

The model that generated the threshold score for each individual was a logistic model with four parameters (or four family logistic regression). The research team worked through six different ways to generate the threshold and determined this model to be the best fit and alignment with assumptions taken into account. In the case of social norm curve data, this simply means that the logistic model fits two markers (instead of one) on each side of the x-axis, which allows for more individual variation in responses as opposed to the usual dichotomous logistic regression.

Statistical Methods

A moderation analysis is used to determine if the relationship between two variables (i.e. experienced conditions and thresholds) depends on the value of a third variable (i.e. indicator type, park setting, past use history). A continuous dependent variable and continuous independent variable may hold a different relationship depending on the level of a given moderator. This is usually visualized as an X variable predicting a Y variable, with M moderating this relationship to a certain degree (Figure 2). In order to successfully conduct this analysis with a pair of multicategory moderators (indicator type & park setting) the PROCESS macro tool for SPSS was utilized (Hayes, 2017). This runs a model which reveals the effect that each level of a given moderator has on the X to Y relationship. For an example within context of this manuscript, the PROCESS macro tool produces separate slopes and significance values of the relationship between experienced conditions (X) and thresholds (Y), based on whether the indicator (M) in question is PPV, Encounter or Wildlife.

In order to address the potential for an indicator related moderation, unique indicators only addressed at KATM and BUFF respectively were used within the first moderation analysis (Model 1). To include a third indicator level into this moderation, PPV from THRO was also

used within this model. This provided results on which, if any, indicator type moderates the relationship between experienced conditions and thresholds.

Model Framework

Park setting is also a multi-categorical variable, similar to indicator type. In order to investigate the potential moderation effect of park setting on the relationship between experienced conditions and thresholds, the same indicator must have been used across parks to control for the indicator variable. Using this justification, all parks which have PPV data were able to be compared in this moderation. Those include THRO, BUFF and CUIS. In terms of park setting, THRO may be most commonly categorized as a park where the use of a vehicle is necessary (i.e. a driving park), BUFF may be characterized as a park where the predominant feature of the park is river recreation (i.e. a river park) and finally CUIS, a park only accessible by ferry, may be characterized as a walking park. More simply put, these three units differ in their specific designation: National Park, National River, National Seashore. Model 2 displays the fundamental analysis conducted to investigate the moderation effect of park setting on experienced conditions and thresholds (Model 2).

The third and final research question to be addressed is the potential moderation of past visitation, or past use history (PUH) on experienced conditions and thresholds. Data was available in terms of “visits within the past year” from all parks with the exception of KATM. Given the PUH is a continuous variable as opposed to the multi-categorical variables present in models 1 & 2, this analysis was simpler to model. Model 3 displays a setup for a moderation analysis of experienced conditions predicting thresholds with PUH as the moderator (M).

Some potential limitations exist within the framework of this study. One limitation is that these studies were not conducted during the same time periods, some differing by a few years.

Given that visitor related studies can be influenced by the social, political and environmental climate of the world, this could be a slight limitation to any conclusions made. Another potential limitation is that certain indicator types were only used at specific park locations, and not others. For example, wildlife indicators were only used at KATM, and encounter indicators were only used at BUFF. An attempt at resolving this issue is done through the park setting model (Model 2), where the same indicator, PPV, was used throughout each park.

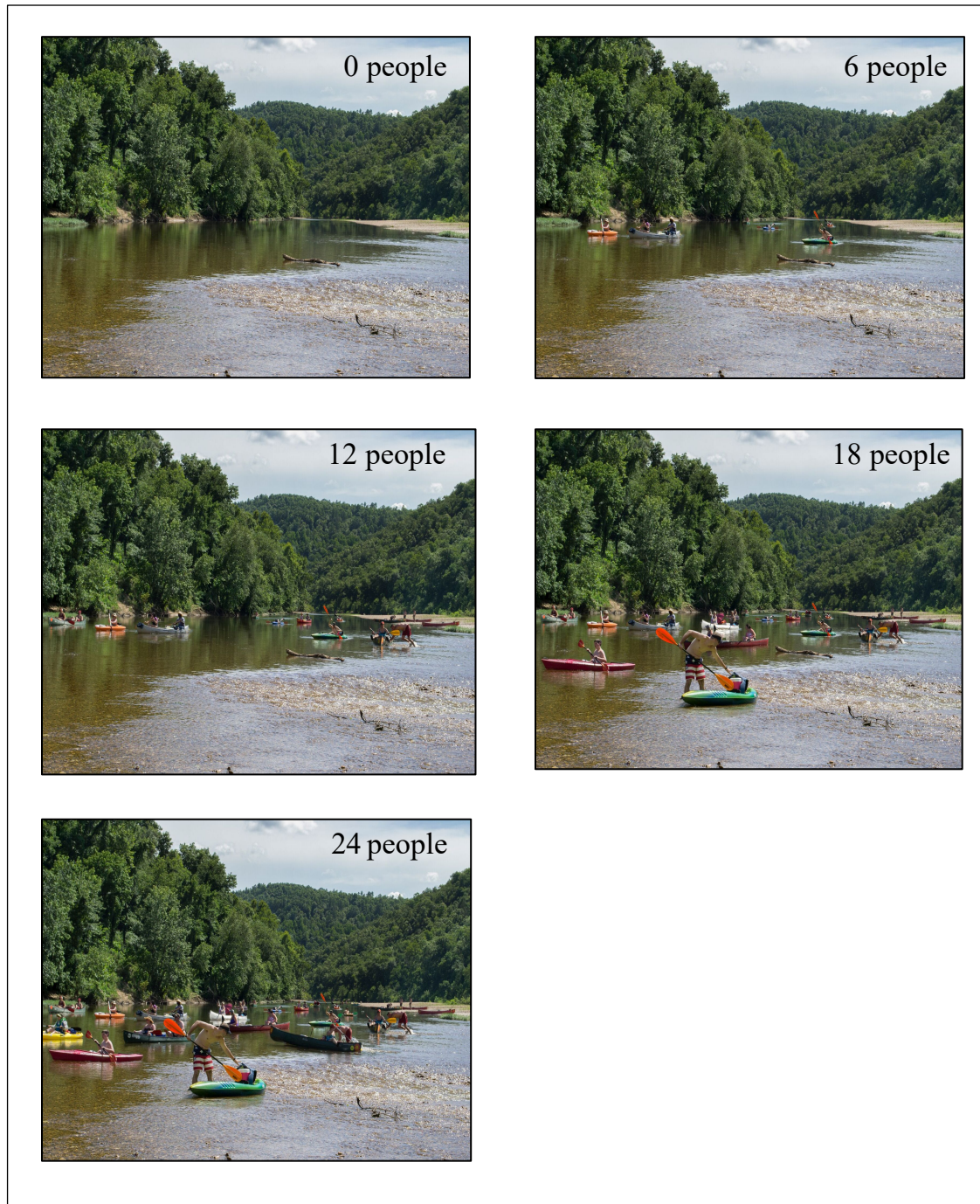


Figure 1. Example photo panel for crowding on the river at BUFF

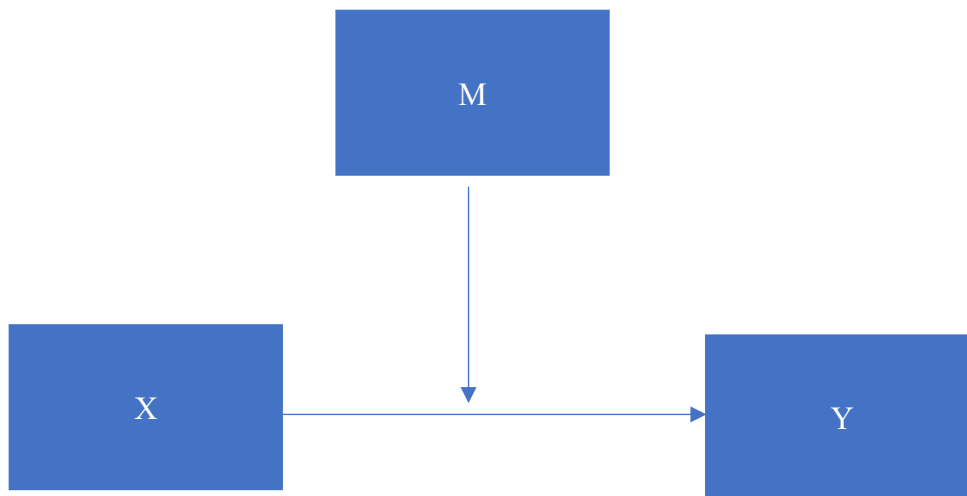


Figure 2. Sample moderation analysis. The ability of *M* to moderate the relationship between *X* and *Y*.

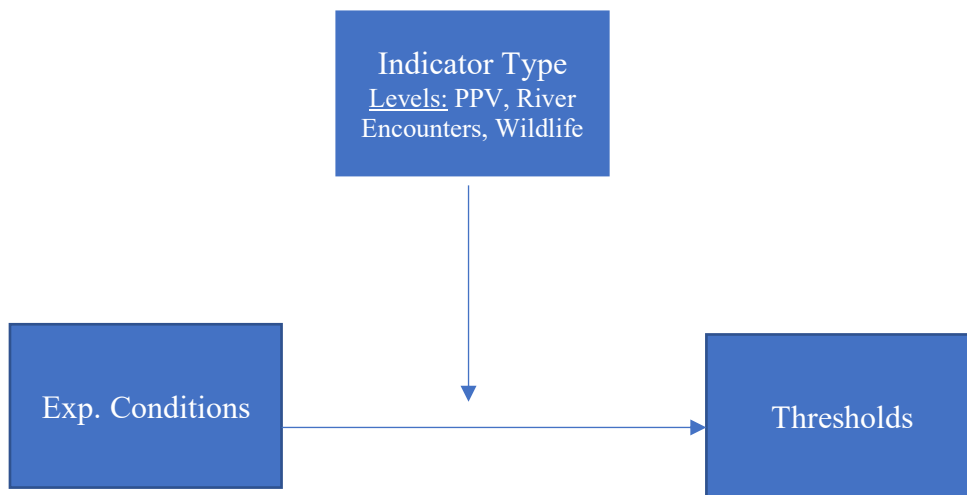


Figure 3. Model 1 - The model investigating the moderation effect of indicator type on the relationship between experienced conditions and thresholds.

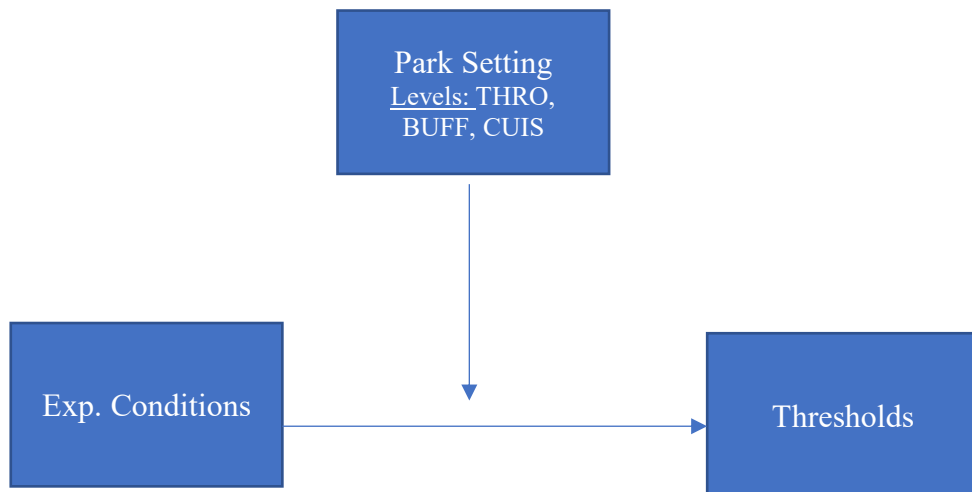


Figure 4. Model 2 - The model investigating the moderation effect of park setting on the relationship between experienced conditions and thresholds.

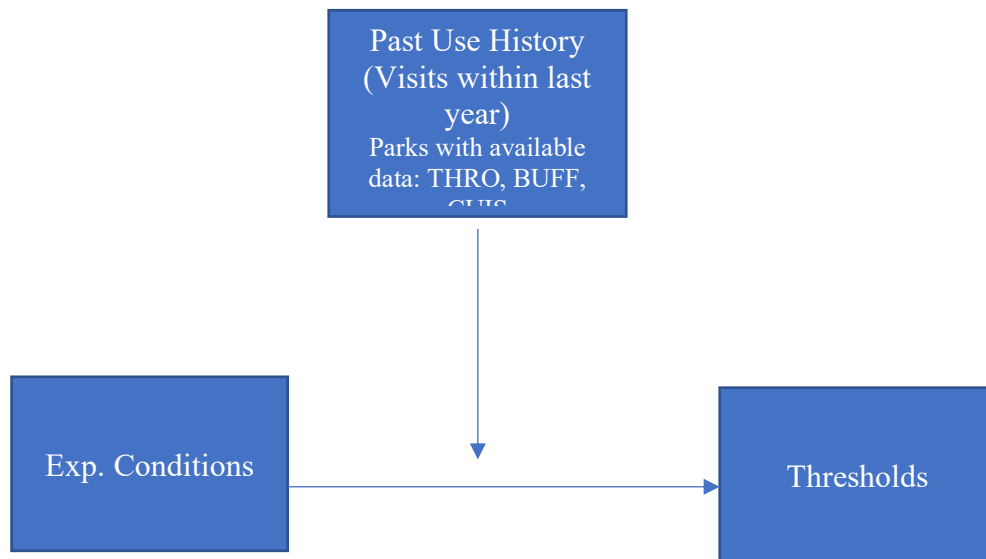


Figure 5. Model 3 - The model investigating the moderation effect of past use history on the relationship between experienced conditions and thresholds.

Results

Demographics

The sample size values indicate respondents to threshold related surveys, although multiple survey types may have been administered within different studies (See table 2 for a summary of demographics from each study site).

BUFF (n=603)

Respondent's average age at BUFF was 48. Respondents also identified evenly as male (49.6%) and female (50.1%). Additionally, 72.8 % of study participants completed a minimum of some college level education. This breakdown included 17.5% who had completed some college, 32.2% who had received a four-year degree, and another 23.1% reported receiving a graduate or professional degree. The large majority of respondents (86.6%) self-identified as white, and 4.6% self-identified as Hispanic or Latino/Latina, with the rest of participants self-identified as other races. Finally, participants also reported various levels of household income. The following three income ranges were most common throughout the sample: 16.5% reported a household income of \$50,000 to \$74,999, 14.0% reported a household income of \$75,000 to \$99,999, and 13.7% reported a household income of \$100,000 to \$149,999 (Brownlee et al., 2018).

THRO (n=405)

Respondent's average age at THRO was 51. Respondents also identified relatively evenly as male (52.1%) and female (47.7%). Additionally, 72.4% of study participants completed a minimum of some college level education. This breakdown included 14.9% who had completed some college, 27.5% who had received a four-year degree, and another 30% reported receiving a graduate or professional degree. The large majority of respondents (84.2%) self-identified as white, 1.8% as Asian, and 1.4% as Hispanic or Latino/Latina, with the rest of participants self-

identifying as other races. Finally, participants also reported various levels of household income. The following three income ranges were most common throughout the sample: 15.5% reported a household income of \$50,000 to \$74,999, 14.0% reported a household income of \$75,000 to \$99,999, 19.7% reported a household income of \$100,000 to \$149,999, and 17.4% declined to answer (Brownlee et al., 2019a).

CUIS (n=426)

Respondent's average age at CUIS was 47. Respondents also identified as 41.2% male and 58.0% female. Additionally, 72.5% of study participants completed a minimum of some college education. This breakdown included 9.0% who had completed two-year college, 31.0% who had received a four-year degree, and another 32.5% reported receiving a graduate or professional degree. The majority of respondents (86.6%) self-identified as white. Finally, participants also reported various levels of household income. The largest group of respondents (19.3%) reported household earnings between \$100,000 and \$149,000 annually (Brownlee et al., 2019b).

KATM (n=439)

Respondent's average age at KATM was 53.5. Respondents also identified as 59.9% male and 40.0% female. Additionally, 75.4% of study participants completed a minimum of a four-year college degree. This breakdown included 32.2% who had completed a four-year degree, and another 43.2% who reported receiving a graduate or professional degree. The majority of respondents (75.3%) self-identified as white, while 2.5% identified as Asian, 5.7% declined to answer and the remaining self-identified as other races. Finally, participants also reported various levels of household income. The following three income ranges were most common throughout the sample: 25.9% reported a household income of \$200,000 or more 17.3%

reported a household income of \$100,000 to \$149,999 and 11.6% reported a household income of \$150,000 to \$199,999 with an additional 19.3% who preferred not to answer (Brownlee et al., 2019c).

Table 2. Total demographics of each study site before analysis. Grey areas define missing data, as all locations did not ask the exact same wording.

	Basics		Education (%)			Race/Ethnicity (%)			
Location	Avg. Age	Gender (%) (M/F/O)	Some college	4-year degree	Professional degree	White	Hispanic/Latinx		Other
BUFF (n=603)	48	49.6/50.1/3.3	17.5	32.2	23.1	86.6	4.6		8.8
			Some	4-year	Professional	White	Hispanic/Latinx	Asian	Other
THRO (n=405)	51	52.1/47.7/0.3	14.9	27.5	30	84.2	1.4	1.8	12.8
			2-year	4-year	Professional	White			Other
CUIS (n=426)	47	41.2/58/0.8	9.0	31.0	32.5	86.6			13.4
				4-year	Professional	White		Asian	Other
KATM (n=439)	53.5	59.9/40.0/0.1		32.2	43.2	75.3		2.5	16.5

Experienced Conditions predicting Thresholds

By conducting a simple linear regression utilizing all available data with both experienced condition and threshold values, a positive and significant relationship was identified. This test established that experienced conditions statistically predict thresholds, $F(1, 1682) = 55.808$, $p < .0005$ and experienced conditions accounted for 3.2% of the explained variability in thresholds. The regression equation was: Thresholds = 1.443 + (0.154 x Exp. Conditions). This

equation and associated coefficients shows a positive relationship between the two variables, meaning that as experienced conditions increased, so did thresholds.

This allows for the acceptance of Hypothesis 1 (H1) which states that a positive relationship exists between visitor experienced conditions and visitor thresholds. Given that this relationship shows significance, proper justification for continuing with a moderation analysis has been obtained. If a relationship was shown to not exist between experienced conditions and thresholds, then intuitively, a relationship that does not statistically exist could not be statistically moderated.

Model 1 Results (Indicator Type)

The overall model for the moderation of indicator type on the relationship between experienced conditions and thresholds was statistically significant ($F(5, 347) = 7.28, p = .0000, R^2 = .0950$).

Interaction terms are also evaluated to determine the significance these have on the overall model. Interaction 1 (Int 1) is best defined as encounter indicators versus PPV indicators, multiplied by experienced conditions. The analysis revealed no interaction present for this term ($b = .1795, t(347) = .8402, p = .4014$). Interaction 2 (Int 2) is best defined as wildlife indicators versus PPV indicators, and also showed no significant interaction ($b = -.1712, t(347) = -.8504, p = .3957$). This data is summarized in Table 3.

Table 3. Overall statistical summary of Model 1.

	b	t(347)	p
Int 1	.1795	.84	.4014
Int 2	-.1712	.18	.3957

When interaction terms do not show significance, Aiken and West (1991) have suggested that a simple slope analysis can be completed to further clarify the relationships between different levels of the moderator. This further test was conducted using the PROCESS macro tool and is associated with a more intuitive interpretation of this moderation. It allows for the analysis of significance for each level of the given moderator using the slope of the relationship between experienced conditions and thresholds for each specific indicator type. This analysis reveals that PPV and wildlife indicator categories are not significant moderators. In other words, when using PPV or wildlife indicators, experienced conditions do not predict thresholds effectively. This is evident through the associated p-values of PPV and wildlife indicator slopes respectfully ($p = .2539$; $p = .5120$). However, for encounter related indicators, experienced conditions predict an increase in thresholds by 0.3957 points and shows significance ($p = .0001$). Intuitively, this means the encounter related indicators have a stronger moderation effect on the relationship between experienced conditions and thresholds than PPV or wildlife indicators do. Figure 6 displays this relationship, sorted by indicator type and provides a visual aid for interpreting this moderation effect.

The results from Model 1 allow for the rejection of Hypothesis 2a (H2a). H2a states that there is no discernable pattern between experienced conditions and thresholds across indicator type. However, it does appear that specific indicator types may carry a stronger moderating effect on this causal relationship than others. Encounters show a significant ability to moderate this relationship, while PPV and wildlife indicators do not.

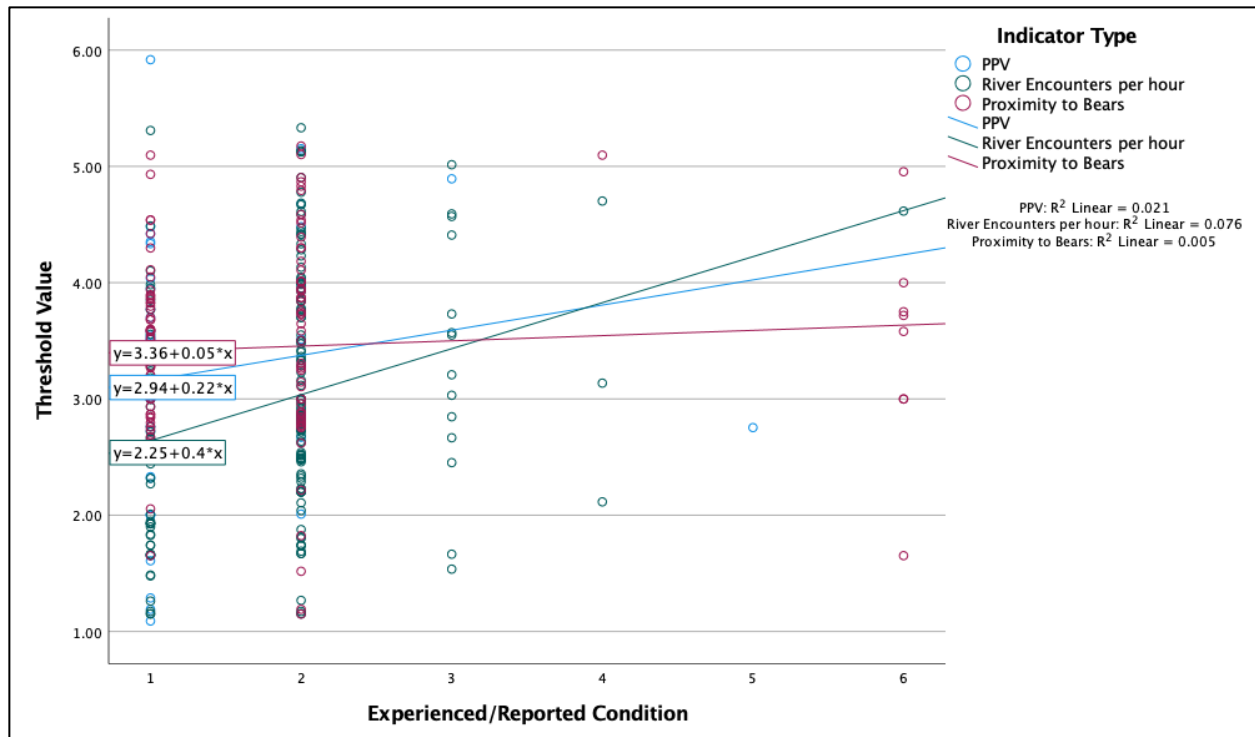


Figure 6. Simple slope analysis for the moderation of indicator type on experienced conditions v. thresholds.

Model 2 Results (Park Setting)

The overall model for the moderation of indicator type on the relationship between experienced conditions and thresholds shows significance ($F(5, 1129) = 11.24, p = .0000, R^2 = .0474$).

Interaction terms are also evaluated to determine the significance these have on the overall model. Interaction 3 (Int 3) is best defined as BUFF setting versus THRO setting, multiplied by experienced conditions. The analysis revealed no interaction present for this term ($b = -.1486, t(1129) = -.4939, p = .6215$). Interaction 3 (Int 3) is best defined as CUIS setting versus THRO setting, multiplied by experienced conditions, and also shows no significant interaction ($b = -.2136, t(1129) = -.7159, p = .4742$). This data is summarized in Table 4.

Table 4. Overall statistical summary of Model 2.

	b	t(1129)	p
Int 3	-.1486	-.4939	.6215
Int 4	-.2136	-.7159	.4742

Similar to model 1, when interaction terms do not show significance, Aiken and West (1991) have suggested that a simple slope analysis can be completed to further clarify the relationships between different levels of the moderator. A simple slope analysis was also conducted through the PROCESS macro tool and is associated with a more intuitive interpretation of this moderation. It allows for the analysis of significance for each level of the given moderator using the slope of the relationship between experienced conditions and thresholds for each specific park setting. This analysis reveals that the park setting of THRO is not a significant moderator. In other words, when using THRO compared to BUFF or CUIS, experienced conditions do not predict thresholds as effectively. This is evident through the associated p-values of BUFF and CUIS setting slopes respectfully, which each show significance ($p = .0022$; $p = .0093$). With BUFF and CUIS (national river and national seashore) as park setting, experienced conditions predict an increase in thresholds by .1719 and .1141 points respectfully. Intuitively, this means that thresholds were more effectively predicted by the experienced condition at BUFF and CUIS as opposed to THRO. Figure 7 displays this relationship, sorted by park setting and provides a visual aid for interpreting this moderation effect.

The results produced from Model 2 allow for the rejection Hypothesis 2b (H2b). H2b and H2b state that there is no relationship, and additionally no moderating effect from park setting on the relationship between experienced conditions and thresholds. Given that there are differences

in the significance of this moderation effect between THRO, BUFF and CUIS when using the same indicator (PPV), certain park settings must be capable of moderating this relationship. Both BUFF and CUIS were significant individual moderators of the relationship between experienced conditions and thresholds, while THRO was not, leading to the rejection of H2b.

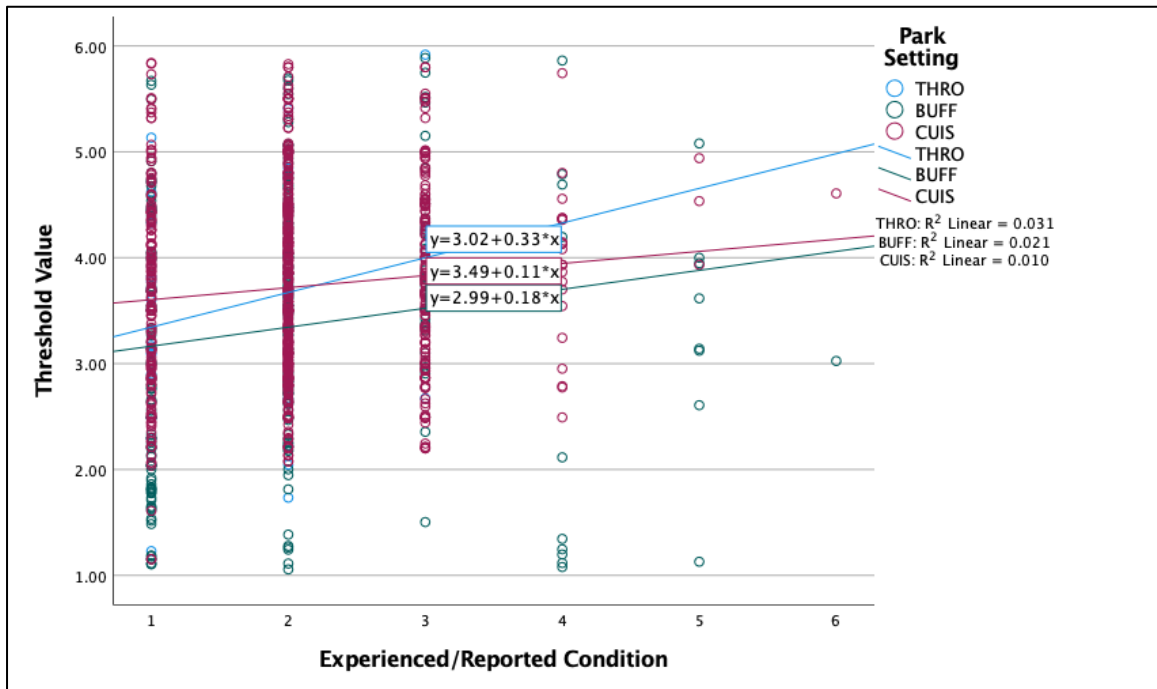


Figure 7. Simple slope analysis for the moderation of park setting on experienced conditions v. thresholds.

Model 3 Results (Past Use History)

Past use history is a continuous moderator variable and is measured as visits within the past year to a specific PPA. The overall model for the moderation of PUH on the relationship between experienced conditions and thresholds shows significance ($F(3, 1549) = 24.1004$, $p = .0000$, $R^2 = .0446$). However, when analyzed further, past use history alone does not show significance within the model ($b = -.0033$, $t(1549) = -.3343$, $p = .7382$). The interaction term for this specific moderation (past use history multiplied by experienced conditions) also doesn't display any significant interaction ($p = .2395$). Figure 8 displays this relationship and provides a

visual aid for interpreting this moderation analysis. For ease in visualization, Figure 8 sorts past use history in terms of low (0-5), medium (5-10), or high visitation (>10). The overall trend of past use history's lack of moderating ability remains true regardless of visitation level.

The results produced from model 3 suggest the acceptance of the third part of hypothesis 2 (H2c). H2c states that frequency of visitation, or past use history does not moderate the relationship between experienced conditions and thresholds for recreation settings. Despite the entirety of the model displaying significance, this is a result of the overall relationship between experienced conditions and thresholds outweighing the lack of significance that exists for past use history alone, and the associated interaction term created within the PROCESS macro tool. This conclusion aligns with findings from Laven et al. (2005), who only compared first time visitor versus repeat visitor. In contrast, this study used visits within the past year, a continuous variable, and was still able to accept H2c which was drawn largely from Laven et al. (2005).

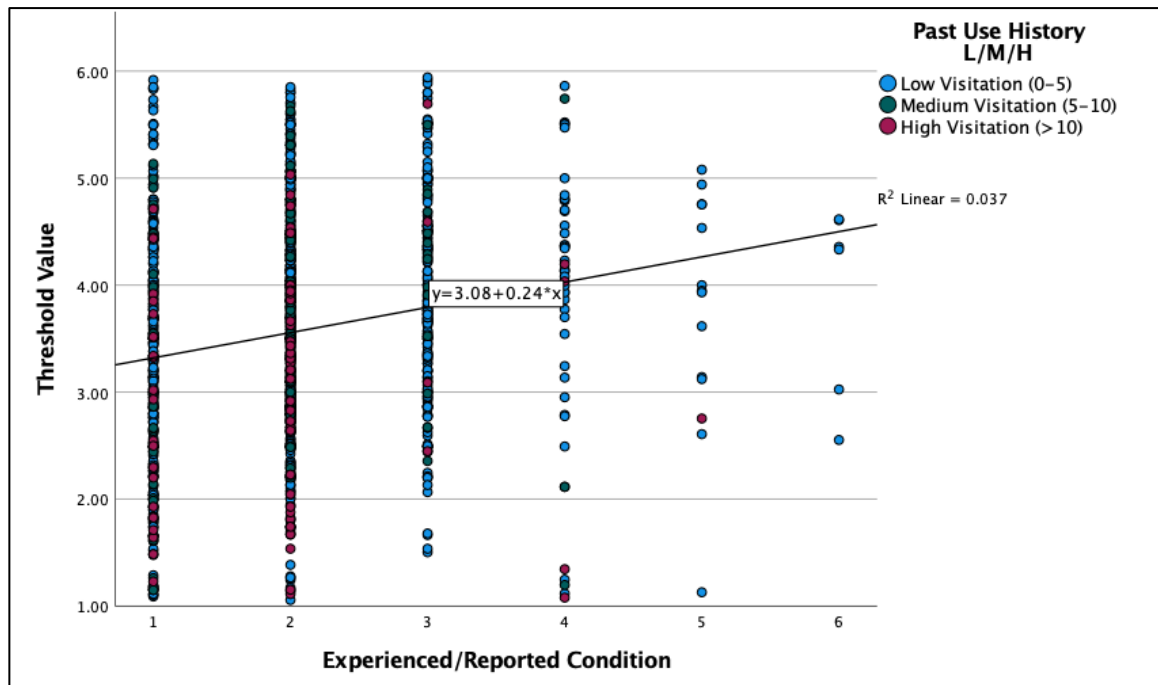


Figure 8. Simple slope analysis for the moderation of past use history on experienced conditions v. thresholds.

Discussion

Evaluating human social dimensions can be extremely nuanced and difficult to comprehend. The method by which information is commonly collected in PPAs is not void of these complications. Before even considering the relationship between experienced conditions and visitor reported thresholds, it is first valuable to consider the simple differences that exist amongst park studies.

The most obvious difference between the park studies utilized within this manuscript, is of course the setting. Each and every NPS unit is home to its own unique landscape, location, facilities, accessibility, opportunities for recreation it provides, and countless other factors. For this simple reason, a better understanding of how the methods that the PPA research community uses may be affected by park setting is essential. Although an abbreviated look into the hundreds of PPAs that exist within the United States, findings from this moderation analysis suggest that there are potential differences in how experienced conditions predict thresholds between park settings. This provides the PPA research community with the potential for better interpretation of results produced through visitor use studies. For example, at CUIS and BUFF, our model shows that these settings are more capable of being a significant moderation of the relationship being investigated. With this information in mind, PPA researchers may feel it necessary to design their data collection to address the potential moderator effect of experienced conditions in these specific settings. In other words, it may make more sense for data collection periods to occur only on days where justifiably similar experiences were had by different visitors. This could serve the purpose of minimizing the large diversity in experienced conditions that often exist in PPAs, and work to negate the ability of experienced conditions to influence thresholds.

In contrast to this approach, new models may be developed that can use experienced conditions to predict thresholds without necessarily having to gather acceptability ratings for different conditions. If a specific park setting is known to have a stronger positive moderator effect on the ability for experienced conditions to predict thresholds, surveying may become a more simplified process, as experienced conditions could possibly explain a great deal about what thresholds will be reported as. If we predict thresholds based on current conditions, rather than future desired conditions, experiential and resource quality may continue to decline over time. Also, the three park settings utilized in this model were three different types of NPS unit: National Park, River and Seashore. Further research may be conducted on the moderation effect of park setting on the ability for experienced conditions to predict thresholds in terms of the way park units are defined. For many, the namesake “park” may provide a different connotation and associated expectations as opposed to preserve, river, seashore, monument, historical site, etc.

Given that different parks offer the potential for a wide range of recreation related experiences, the types of indicators that are appropriate also change from park to park. It is appropriate to answer density or crowding related questions (PPV) in almost all parks, but not every park needs information on the acceptability matrix of proximity to bears, or river encounters per hour, nor would these make sense outside of the context of very specific parks. However, certain parks offer the potential for a wide range of indicator types to be addressed. Understanding how different indicator types moderate the ability for experienced conditions to predict thresholds is essential to this conversation. If indicator type is affecting threshold development, and visitor thresholds are what PPAs commonly manage for, furthering our understanding of this moderation effect is essential to improve the way in which PPAs are managed. A better understanding of visitor thresholds might help ensure that we are

recommending management actions for future desired conditions, rather than managing consistently for current conditions, which results in a continuous decrease in resource quality, as well as experiential quality.

This manuscript provides three unique indicator categories that were presented across three different NPS units. The amount of indicator categories possible within the large scope of the PPA field is nearly infinite. However, these model findings do suggest the possibility for further differences in moderating potential amongst indicator types. The encounter indicator type's ability to significantly moderate the relationship in question hints at the need for indicator related data to be dealt with differently based on what it addresses.

Likely the most frequently used indicator is PPV (sometimes referred to as people at one time) did not show a strong moderation effect. This means that when PPV indicator data is being collected, the experienced condition's ability to predict thresholds neither improves or weakens significantly. Since PPV or other population density indicators are used widely in nearly every visitor use study, these variables may best be checked using park setting as the potential moderator as opposed to indicator type. The same can be said for wildlife related indicators. Although they do not appear to be a significant moderator, it is possible that park setting may still moderate how well thresholds are predicted by experiences.

Using additional data from previous visitor use studies in parks may allow researchers to effectively control for these potential moderations in future studies. If specific indicator types are set to be used, and they are known to have a moderating effect, this could be a limitation for research teams to consider. Also, if prior data reveals that a specific study site has a strong moderation effect on the ability for experienced conditions to predict thresholds, this too could be a limitation that needs to be addressed.

Past use history has once again shown to not have an impact on visitor thresholds being predicted by experienced conditions, this time displaying no moderation effect despite being analyzed as a more descriptive, continuous variable. Perhaps in contrast with popular thinking, it does not appear that the number of times a particular visitor attends a park influences their thresholds, regardless of the additional and likely diverse experiences they have had at said PPA. It is also possible that an abundance of experiences minimizes impacts to reported thresholds since these visitors likely know how a variety of different use levels feel. Overall, past use history does not appear to be influencing visitor thresholds significantly and in turn does have an impact on the management actions derived from these thresholds.

Another possibility when considering past use history, however, might be an issue with the distance into the past that the study reaches. The concept of shifting baselines is that we as visitors judge our future experiences and standards of quality based on the original way in which we experience something. Baseline shift is the idea that over the years, new baselines are created as new generations of visitors and recreationists are experiencing different PPAs for the first time (Craig, 2015; Duarte et al., 2009; Papworth et al., 2009). A visit to Yellowstone National Park in 1980 would likely provide a much different experience and baseline than for someone who has only experienced Yellowstone in the 2010's. Future work should be considered that takes into account the year of first visit to the park in question. This may serve to provide a further understanding on the concept of past use history and how it relates to visitor thresholds in recreation settings.

Conclusion

Managing the ecological and experiential conditions of PPAs, while optimizing visitor experiences as a means of acceptability is essential to the preservation of our park's resources

and visitor's admiration for these places. In order for PPA researchers to effectively and accurately prescribe management recommendations, a firm grasp of how thresholds are developed and may be influenced is crucial. Similarly, if park managers are to enact restrictive management actions, they need to be as confident in the data that is informing these decisions.

Visitor thresholds are commonly a latent variable which is derived from acceptability matrix questions on post experience questionnaires. While the experience is necessary for the participant to appropriately relate to questionnaire content, the differences in these experiences holds potential for altering the answers we, as researchers, receive. Additionally, the experiences had, are influenced by the setting in which they occurred, and the indicator/threshold being addressed is fitting of this setting too. Initially, it might be hypothesized that the abundance of these experiences (i.e. past visits) may too influence the predictive qualities of experienced conditions, but this has been shown to not be the case.

Utilizing existing data to evaluate moderation effects of park setting and indicator type may be a powerful tool for improving threshold reporting as a measuring stick for management recommendations. Long held assumptions that indicators and park setting constitute little to no effect on the thresholds derived from them, may now be questioned. If nothing else, researchers and park managers alike should investigate the ability for chosen indicator types and settings to ultimately impact thresholds, by strengthening (or weakening) the ability for experienced conditions to predict these thresholds. A further investigation and improved consideration of these interrelated aspects of PPA visitor use studies will advance and fine-tune how we manage our nation's public lands.

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Chapter 3: Reflection

The process of writing this thesis provided an opportunity to improve my ability to conduct research, while contributing to the overall field of visitor use management in parks and protected areas (PPA). Overall, the results of this study work to improve the way in which we, as a PPA community, manage for the consistent increase in visitation. Specifically, in the social media era, PPAs have become even more so places that are glorified through stunning photography and videography posted for the world to see, thus inspiring new explorers daily.

Over the course of the past year, our world has been subjected to a multiplicity of unprecedented conditions, and for large sections throughout the year, it seemed that outdoor recreation spaces were some of the only places available for people to safely leave their houses. In the coming years, PPAs will likely continue to provide essential opportunities for recreation, solitude and deeper connections with our natural environment. Optimizing how we manage these often fragile, yet overwhelmingly extraordinary places has never been a more pressing issue since the creation of our first national park in 1872. With that being said, I believe that this research accomplishes one major and meaningful objective.

Objective: To provide park researchers and managers with a deeper understanding about factors that may influence the development or fluidity of visitor thresholds in recreation settings.

It is my opinion that this thesis delivers this objective by displaying the potential for park setting, as well as indicator type, to moderate the relationship between the experienced condition and visitor thresholds. While this study is limited by 4 park settings, and 3 indicator categories/types, I feel that the diversity in said park settings and indicator types provides

adequate justification for the conclusion that each of these variables has the strong potential to be a significant moderator.

The findings from this thesis show that not every level of the given moderators (i.e. specific park, specific indicator type) has a significant moderator effect on the relationship between experienced conditions and visitor thresholds. This likely means that the ability for these variables to be a significant moderator, strongly depends on the level of each variable in question. This means that in order to get meaningful use from these conclusions in future studies, park managers would likely have to be dealing with a specific indicator type or park setting that is already aware of the strength of this potential moderator. Nonetheless, this information helps improve the overall interpretation of visitor related data and consequently yields optimal managerial decision making.

Additionally, this thesis provides reinforcement to conclusions of previous research, that past use history does not play a significant role in either predicting or moderating the experienced condition's ability to predict thresholds. I think this is a strong and potentially underrated contribution of this thesis, because I believe it is contrary to what most park managers and researchers would initially hypothesize. Corroborating with past studies, this thesis allows us to justifiably put to bed any concern over how visitation frequency may affect PPA visitor data.