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Taking the Plunge: Enhancing the Visitor Experience in Waterfall-Based State Parks

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TAKING THE PLUNGE: ENHANCING THE VISITOR EXPERIENCE IN
WATERFALL-BASED STATE PARKS

A Thesis
Presented to
the Graduate School of
Clemson University

In Partial Fulfillment
of the Requirements for the Degree
Master of Science
Parks, Recreation, and Tourism Management

by
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Accepted by:
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ABSTRACT

Waterfalls have long been popular tourist attractions due to their soundscape, beauty, natural pool, and recreational opportunities. With technological advances and abundant tourism information, more visitors are being drawn to waterfalls. Such high visitation and use amplifies the risk of degrading pristine waterfall sites and their resources. Not only are waterfalls experiencing high demand, but state parks are also seeing large increases in visitation. State parks are typically located closer to population centers and complement the more well-known and iconic national parks by providing recreational opportunities to more, diverse visitors. The present study aims to provide a basis for understanding the visitor experience and carrying capacity at a waterfall-based state park where visitors engage in an activity with the water (e.g., swim in the natural pool, climb the waterfall). Further, the study investigates intrasite displacement from an activity with the water in tandem with the examination of carrying capacity. Visitor surveys and time-lapse field cameras were deployed to collect data on visitor use at a popular waterfall-based state park in Tennessee. The results indicate that use levels are near or above crowding-based thresholds, supporting the implementation of a carrying capacity. While the results do not provide evidence for intrasite or activity displacement, they seem to reflect a reduction in the visitors' freedom of choice in activity or location. The present study fills a gap in the literature by empirically investigating the carrying capacity of visitors at a waterfall site and utilizing an indicators and thresholds-based approach in a state park. Empirical research on these is needed since citizens highly value waterfalls and primarily gain exposure to nature through state park visits.

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TAKING THE PLUNGE: ENHANCING THE VISITOR EXPERIENCE IN
WATERFALL-BASED STATE PARKS

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INTRODUCTION

Waterfalls have long been appreciated by artists and writers but have only recently gained attention from scientists and scholars (Hudson, 2013a). Presently, waterfalls are studied for their aesthetics, geomorphology, and economic potential in the energy and tourism industries (Hudson, 2013b). Indeed, waterfalls are prominent features that can draw millions of tourists to parks (Davis, 2002; Hudson, 1998). For example, Yosemite National Park is well-known for attracting millions of tourists annually to view its iconic waterfalls (Clow et al., 2011).

Increased visitation to waterfall sites has brought attention to the quality of the visitor experience. Crowding, conflict, and human-based impacts associated with high visitation can reduce the quality of the visitor experience (Lawson, Hallo, & Manning, 2008). Further, exploitation of the landscape and overcrowding at waterfall sites has been found to impact the visitor experience (Hudson, 2006). A major challenge in park management is maintaining a balance between providing high quality visitor experiences and protecting resources such as pristine waterfall sites (Hudson, 1998; Lawson et al., 2008).

Public land management agencies and researchers have developed frameworks based in the concept of carrying capacity to understand and improve the visitor experience (Interagency Visitor Use Management Council [IVUMC], 2016; Manning, 2007; National Park Service [NPS], 1997). Carrying capacity, or visitor capacity, is a “component of visitor use management and is the maximum amounts and types of visitor use that an area can accommodate while achieving and maintaining the desired resource conditions and visitor experiences that are consistent with the purposes for which the area

was established” (IVUMC, 2016, p. 113). Addressing issues of carrying capacity to protect experiences and resources has gained public support (Manning, 2011). Indeed, policies and laws are increasingly demanding that public land management agencies address such issues (IVUMC, 2016).

A new planning framework that guides visitor use management decision-making is the Visitor Use Management (VUM) framework (IVUMC, 2016; Marion, 2016). Another commonly used framework is the Visitor Experience and Resource Protection (VERP) framework, which has been widely used by the National Park Service (Manning et al., 2011; NPS, 1997). Both frameworks outline critical steps supported by social science research to allow park managers to make publicly-informed and empirically-based decisions related to carrying capacity.

The concept of carrying capacity has provided the foundation for theoretical and empirical research on crowding (Manning, 2011). Beginning in the 1950s and 1960s, recreation participation rapidly increased and research on crowding started to receive widespread interest. Early research suggested that crowding occurred when too many people used the same area. Crowding has been widely researched in outdoor recreation, especially with the growing and diversifying visitor population (Manning & Valliere, 2001). Additionally, crowding has been shown to negatively impact freedom of choice, self-reliance, understanding, aesthetic enjoyment, esteem, and prestige (Manning, 2011). Thus, park managers must collect information to evaluate crowding to preserve essential qualities and experiences sought by diverse visitor bases.

Research suggests that visitors may respond to crowded conditions through displacement (Anderson & Brown, 1984; Hall & Shelby, 2000). Displacement has been defined variously over the last few decades. Many definitions agree that “displacement is a voluntary behavioral response to the effects of otherwise unacceptable change” (Greenaway, Cessford, & Leppens, 2007, p. 147). Intrasite displacement occurs when visitors move to a less crowded site within the same area (Anderson & Brown, 1984; Kuentzel & Heberlein, 1992; Manning & Valliere, 2001; Schneider, 2007). Areas that offer multiple recreational opportunities may have a higher chance of intrasite displacement occurring. Indeed, waterfall sites can provide ample opportunity for interaction through recreational activities like wading or swimming in the pools, climbing, jumping, and sitting or standing on the geologic features (Hudson, 2006). Thus, a relevant and important question at waterfall-based parks is if increased use has impacted whether people are recreating in the form that they would like to. For example, if a person wants to climb a waterfall or swim in a waterfall’s pool and there are too many people occupying those spaces, does it prevent this person from fulfilling their experiential objectives? Investigating intrasite displacement at waterfalls seems to be important for managers to determine if the visitor experience is of a high quality.

The current study fills a gap in the literature by empirically examining the carrying capacity of visitors at waterfalls and applying an indicators and thresholds-based approach to a state park. Also, this study specifically focuses on waterfalls where visitors engage in an activity with the water (e.g., swim in the pool, climb the waterfall) and considers intrasite displacement from that activity in tandem with the examination of

carrying capacity. These additional foci are seemingly not represented in the literature. Yet, empirical research on each of these topics is needed because waterfalls are highly valued by citizens and the majority of nature exposure in the United States has been reported to occur through state park visits (Hudson, 2013a; Pergams & Zaradic, 2008; Siderelis, Moore, Leung, & Smith, 2012).

The purpose of this study is to provide a basis for understanding the visitor experience and carrying capacity at a waterfall-based state park where people engage in an activity with the water. The specific research questions that guided this study are:

1. What are the crowding-related thresholds for visitor use at the park waterfalls?
2. Has a carrying capacity been reached for the preferred visitor experience at the waterfall?
3. Are visitors displaced from engaging in the activities of swimming in a waterfall's pool or climbing the waterfall when use levels are high?

LITERATURE REVIEW

Waterfall visitation

The Romantic Movement of the 1800s encouraged an affection for the landscape and interest in nature (Runte, 2010). American artists of the Hudson River School are well-known for their paintings of waterfalls (Hudson, 2013a). Waterfalls are curiosities of nature that are uncommon in daily life (Hudson, 2006). The soundscape is particularly unlike other water features (e.g., lakes, rivers) and appeals to visitors (Hudson, 2000). Indeed, waterfalls have been popular visitor attractions for centuries (Hudson, 2006). Beginning in the early to mid-1800s, the commercial potential of waterfalls was also

recognized. New facilities and services were developed to increase access, including guided tours, viewing platforms, and refreshments (Hudson, 2006). Niagara Falls is well-known for uncontrolled and excessive commercialization during that time, leading to public outrage and discontent (Hudson, 1998; Runte, 2010). This public fervor added momentum to the national park movement in the United States, which highly valued natural and scenic resources (Hudson, 1998). The ideology surrounding the Romantic Movement has also been said to persist in the desires of people who seek out nature and wilderness for recreation and adventure (Karlsdottir, 2013). In Iceland, nature-based tourism has been influential in the strength and success of the opposition to the destruction of natural areas (Karlsdottir, 2013).

Waterfall sites remain popular in many diverse places, playing an important role in the tourism industries in the Caribbean, Hawaii, Australia, Iceland, and elsewhere (Hudson, 2006). Waterfalls are largely regarded as attractions, but a few outstanding sites have become tourist destinations (Hudson, 2006). The proliferation of books, guides, and travel websites for the use of “waterfall lovers” who engage in “waterfalling” reflect the growing public interest in waterfalls (Hudson 1998; Hudson, 2013a). Tourist materials may also include aesthetic ratings of waterfalls based on surrounding scenery, height, and form (e.g., plunge, horsetail, cascade) (Hudson, 2000). Visitors may be attracted to waterfall sites for various reasons, such as sacredness, aesthetic pleasure, or enjoyment of leisure activities (Hudson, 2006). Visitors may also desire to visit some waterfalls for the satisfaction of visiting a famous site that they had heard about or seen advertised, such as Niagara Falls. Visitors may choose a location based on scenery but often intend to seek

other pleasures as well. Waterfalls, unlike other geomorphic features like caves, have been described as user-friendly for the public and varied in leisure opportunities (Hudson, 2006). For example, leisure activities enjoyed at waterfall sites range from passive scenery viewing and exploration to rafting and rock climbing (Hudson, 2013a). The most commonly enjoyed activities include walking, bathing, picnicking, fishing, photography, and the aesthetic experience (Hudson, 2006). However, not all waterfall sites are highly visited, at least continuously. A waterfall at a sacred Aboriginal site in Victoria, Australia experienced a sharp decline in visitation despite historically high use (Clark, 2002).

In the 1940s, the study of waterfalls was considered unnecessary, and waterfalls were largely neglected as landscape features (Hudson, 2013a). Serious study of waterfalls did not gain traction until the early 1980s, and has been markedly growing since the mid-1990s. Scientists and scholars from diverse backgrounds like art, cultural geography, and anthropology have begun inquiry into waterfalls (Hudson, 2013a). Presently, waterfalls are studied for their geomorphology, aesthetic qualities, and economic roles as resources for tourism and energy (Hudson, 2013b). Literature on waterfalls as recreation and tourism resources has been gaining attention but is still lacking (Hudson, 1998). In particular, empirical social science investigations of visitors' experiences and the management of these experiences at waterfalls are scant. Yet, waterfalls are prominent geomorphic features or processes that draw millions of visitors to both national and state parks annually (Davis, 2002). Thus, waterfalls, waterfall sites, and waterfall visitors are worthy of serious attention and study, especially as human activities threaten the experience and protection of waterfalls (Hudson, 2013a).

State park visitation

The state park movement in the United States was influenced by the national park movement as a push for regional conservation (Cox, 1993). In 1921, delegates from 28 states gathered for the National Conference on State Parks (NCSP) in Iowa. The NCSP served not only to provide information to delegates but also to advocate for the growth of the nation's state park movement (Cox, 1993). State park mission statements closely resemble those of national parks, with an emphasis on the dual purpose of providing both public enjoyment and resource conservation (McCool & Reilly, 1993; Morgan, 1996). State parks are often designated for their combination of historic, cultural, and natural resources that meet a pre-defined criterion of significance (McCool & Reilly, 1993; Morgan, 2006). The purpose of state parks has expanded from outdoor recreation and natural resource protection to provision of services and facilities like restrooms, campsites, and picnic tables (Siderelis et al., 2012). Citizens value state parks, including their ecological, economic, and social benefits (Siderelis et al., 2012; Stein, Anderson, & Thompson, 1999). For example, communities near an Illinois state park valued the park for its contribution to community character, maintenance of local emotional identities, and provision of ecosystem services (Davenport, Baker, Leahy, & Anderson, 2010).

The total number of visits to state parks has grown dramatically, while that at national parks has remained relatively stable for decades (McCool & Freimund, 2016). As of 2006, annual visitation to state parks was over three times greater than that to national parks (Morgan, 2006). Between July 1, 2015 and June 30, 2016, 791.4 million day and overnight visits to state parks were recorded (National Association of State Park

Directors [NASPD], 2017). Additionally, there were 10,336 total areas on 18.6 million acres of state park land (NASPD, 2017). State parks provide a critical supply of outdoor recreation opportunities and have a highly significant positive effect on nature-based recreation (Morgan, 2006; Siderelis et al., 2012; Siikamäki, 2011). Indeed, visits to state parks constitute the majority of nature exposure in the United States (Esprit & Smith, 2011; Pergams & Zaradic, 2008). The scarcity of federal public lands in the eastern United States underlines the value of state parks there (Esprit & Smith, 2011). State parks near population centers complement national parks by providing recreation opportunities to more, diverse people (Gomez & Hill, 2016). Parks near population centers also promote more frequent visitation and recreation use (McDonald et al., 2009). These differences between state and national parks suggest a need for separate research inquiry. Indeed, some researchers have demanded that serious attention be directed at the philosophy and management of state parks (Morgan, 1996).

Many state parks have experienced high visitation, reduced funding levels, and a lack of political support (Morgan, 1996). Indeed, managers are challenged to provide high-quality visitor experiences with operating budgets that have been on a steady decline since 2006 (Smith & Siderelis, 2017). The differing popularity and funding status of state and national parks have reinforced an expectation for state parks to be self-sufficient (Llewellyn & Tappin, 2003). State parks have substantial economic benefits but depend more on revenue generated from visitors and through tourism (McCool & Reilly, 1993; Morgan, 2006). Visitation is key to budget determinations (Whiting, Larson, & Green, 2012). Notably for the present study, state parks in Tennessee do not charge entrance fees

and budget determinations are thus solely made by a committee (Smith & Siderelis, 2017).

Visitor experience and carrying capacity

After World War II, the popularity of outdoor recreation rapidly grew, alongside public concern about resource impacts in parks and protected areas (Whittaker, Shelby, Manning, Cole, & Haas, 2011). Increased use initially brought attention to these resource impacts, but later garnered interest in the quality of the visitor experience (NPS, 1997). The visitor experience encompasses the “perceptions, feelings, and reactions that a visitor has before, during, and after a visit to an area” (IVUMC, 2016, p. 113). Visitor experiences can deteriorate with issues of crowding, conflicting uses, and aesthetic resource impacts (Whittaker et al., 2011). The quality of the visitor experience is thus influenced by the amount and type of visitor use, which are critical to carrying capacity assessments.

The concept of carrying capacity originated in natural resources and was introduced to the field of outdoor recreation in the 1930s (Whittaker et al., 2011). Park managers are continually facing the challenge of addressing carrying capacity by balancing high-quality visitor experiences and resource protection (Lawson et al., 2008). Visitor management and carrying capacity frameworks have been developed to help park managers address the quality of the visitor experience (Marion, 2016). These frameworks provide steps to improve management decision-making using publicly-informed and empirically-based social science (Marion, 2016).

Many planning and decision-making frameworks have been developed by researchers and agencies to guide and inform land managers as they address visitor impacts and carrying capacity (Whittaker et al., 2011). These frameworks include Limits of Acceptable Change (LAC), Visitor Activity Management Process (VAMP), Carrying Capacity Assessment Process (C-CAP), Visitor Impact Management (VIM), and Visitor Experience and Resource Protection (VERP) (Whittaker et al., 2011). A new framework – the Interagency Visitor Use Management Council (IVUMC) Visitor Use Management (VUM) planning and decision-making process – was introduced in 2016 (IVUMC, 2016; Marion, 2016). The VUM framework uses management experience, natural and social science studies, and professional judgment to address complex management issues (Marion, 2016). Each of these frameworks necessitates a determination of desired conditions, indicators, and thresholds (i.e., standards) (Manning, 2011). Desired conditions are “statements of aspiration that describe resource conditions, visitor experiences and opportunities, and facilities and services that an agency strives to achieve and maintain in a particular area” (IVUMC, 2016, p. 113). Indicators are “specific resource or experiential attributes that can be measured to track changes in conditions so that progress toward achieving and maintaining desired conditions can be assessed” (IVUMC, 2016, p. 113). Thresholds, previously known as standards of quality, are “minimally acceptable conditions associated with each indicator” (IVUMC, 2016, p. 113). Carrying capacity is reached and management is required when thresholds are almost or already violated.

As visitation to both waterfalls and state parks increases, carrying capacity and the quality of the visitor experience become increasingly important to study and manage (Hudson, 1998; Hudson, 2006; McCool & Freimund, 2016). The experience of visitors at waterfall sites can be impacted by degradation of the landscape (Hudson, 2006). Excessive development or commercialization of a scenic or natural resource can threaten its sustainability (Hudson, 1999). For example, the Dunn's River Falls in Jamaica experienced high visitation and prominence until crowds and environmental impacts resulted in negative publicity and declines in visitation (Hudson, 1999). Some visitors may seek to visit more pristine sites once a previous attraction becomes too crowded, and the process of degradation renews (Hudson, 2006). Additionally, interference by other visitors and visual intrusions like fences and signs can also degrade the visitor experience (Hudson, 2006). Several management approaches (e.g., visitor limits, resource maintenance thresholds, viewing platforms, artificial waterfalls for climbing) may be deliberated to protect scenic resources offered by waterfall sites (Hudson, 1999).

High visitor use at waterfall sites may also present other issues that can impact the visitor experience and resources. Some of these issues include stream-bank erosion, channel widening, sediment transport, water quality and contamination, extensive unauthorized trails, risky behavior, injury, drowning, and mortality (Attarian, 2015; Clow et al., 2011; Girasek, Marschall, & Pope, 2016). For example, hikers were more likely to approach water sources and waterfalls as air temperatures rose, which increased the potential risk of drowning (Girasek et al., 2016). Thus, monitoring visitors and ecological impacts in parks and protected areas is important, especially at iconic sites like waterfalls

(Hadwen, Hill, & Pickering, 2007). Planners and conservationists have been called upon to address issues and problems posed at waterfall sites (Hudson, 2006).

A few studies have begun to address such issues. Resource and experiential impacts were studied at Margoon Waterfall Protected Area in Iran (Ahmadi, Bemanian, & Ansari, 2014). The authors implemented a survey to understand the experience of tourists and native community members. The results indicate that the most frequent activity that tourists participate in is watching the waterfall. The authors suggest careful landscape design to ensure improvements in aesthetic evaluations as well as identification of incompatible land uses and ecological impacts. Another study conducted at the Tortum Waterfall in Turkey assessed carrying capacity on heavily used areas such as viewing platforms, walkways, and staircases (Gökтуğ, Bulut, Yıldız, & Demir, 2013). The authors used an adapted version of a method from the Highway Capacity Manual (HCM) to understand pedestrian flows and visitor numbers on walkways and viewing platforms (Parks Victoria, 2002; Transportation Research Board, 2010). The authors examined uninterrupted and interrupted pedestrian flows and estimated visitor number for an optimum quality of recreation use. The results demonstrate the need for management action as visitor demand increases at Tortum Waterfall. The authors advise rebuilding stairways and walkways to increase average capacity and provide a more comfortable and safe trip (Gökтуğ et al., 2013).

A study conducted at Yosemite National Park also assessed carrying capacity, specifically at the bases of and trails to Yosemite Falls and Bridalveil Falls (Manning, Valliere, Wang, Lawson, & Newman, 2003). The authors used surveys and computer

simulation modeling to estimate the maximum use levels that can be sustained without violating crowding-related thresholds. They developed indicators, thresholds, and computer simulation models to estimate a range of carrying capacities at study sites and for Yosemite Valley (Manning et al., 2003). A study at two national parks in Iceland and Thailand examined the effects of accessibility on environmental impacts and visitor composition (Tverijonaite, 2017). The study briefly mentioned carrying capacity within the model of tourism area life cycle (TALC) but did not assess carrying capacity (Butler, 1980; Tverijonaite, 2017). Another study briefly noted an increase in the social and environmental carrying capacity on the Canadian side of the Niagara Falls, facilitated by providing attractions away from the waterfalls (Healy, 2006). However, these studies have not specifically investigated carrying capacity at waterfalls attracting various recreational uses such as swimming or climbing.

An overwhelming majority of state parks have yet to use or report using carrying capacity frameworks (e.g., VERP, VUM) to inform visitor use management. A few studies have addressed river-based applications of these approaches (Alaska State Parks [ASP], 1993; ASP, 2010; Oregon State Parks, 1987). However, more research is needed, especially at waterfalls. The lack of research may stem from an erroneous perception that studies of carrying capacity are not considered valid or useful in solving management problems at state parks (Burch, 1984). Financial constraints may further reduce the ability of state parks to measure resource conservation and public enjoyment. Yet, carrying capacity studies can help managers determine the conditions, needs, and issues specific to state parks. These studies can also help state parks balance their responsibilities of

providing for both resource protection and enjoyable experiences, particularly at places like waterfalls where these priorities are in greater conflict (Morgan, 1996).

Crowding and displacement

Theoretical and empirical research on crowding is based in the concept of carrying capacity (Manning, 2011). Crowding has been defined as the negative interpretation of use level that is “perceived to interfere with or disrupt one’s objectives or values” (Manning, 2011, p. 116). Further, crowding is not “purely a question of density, but is contingent on evaluations about appropriate use levels in conjunction with specific activities and settings” (Kuentzel & Heberlein, 1992, p. 378). Crowding has been understood as a normative process in which visitors have preferences, expectations, or thresholds to judge if situations are crowded (Manning, 2011). Such thresholds, along with measures of the number of groups or visitors encountered, are utilized to assess crowding. Visitors can rate the acceptability of encountering increasing numbers of groups and the resulting data can provide a measure of social crowding norms. These social norms can be illustrated graphically with two dimensions: 1) acceptability ratings and 2) number of visitors. Visual approaches in the measurement of crowding have been developed and use photographs to illustrate different use levels for ratings of acceptability (Manning & Freimund, 2004; Manning & Lawson, 2002). Research on the crowding perceptions of visitors has often been conducted in national parks and wilderness areas, where there are large proportions of first-time visitors (Arnberger & Brandenburg, 2007). Therefore, more research is needed in state parks.

Crowded conditions may increase the chances of displacement (Manning & Valliere, 2001). Displacement has been defined as a “behavioral coping mechanism in that it involves spatial or temporal changes in use patterns” (Anderson & Brown, 1984; Manning, 2011, p. 110). Other definitions of displacement exist, many suggesting that displacement occurs in response to unacceptable change (i.e., experiential, resource, managerial) (Greenaway et al., 2007). Recreationists more tolerant of higher use levels may remain (Manning & Valliere, 2001). Displacement is often discussed in relation to crowding but may also arise due to managerial or resource changes like fees or erosion, respectively (Schneider, 2007). A visitor’s willingness to displace may be influenced by factors such as preferences, skill level, past experience, monetary investment, and frequency of participation (Wu, Wang, Liu, & Wang, 2009). Displacement can have important impacts on the quality of the visitor experience and visitor use and patterns (Hall & Shelby, 2000). Displacement behaviors may allow visitors to have a satisfying experience even if other areas, times, or activities are avoided (Arnberger, 2012). Data on displacement are informative for managers to anticipate and respond to resource and experiential impacts (Schneider, 2007).

Displacement can be viewed as typology of four responses: 1) temporal displacement; 2) spatial displacement (intrasite and intersite); 3) activity displacement; and 4) cessation or absolute displacement (Hall & Shelby, 2000; Hall & Cole, 2006). This typology was adopted from the substitution literature (Hall & Shelby, 2000). Intersite and intrasite displacement have also been categorized as two forms of spatial displacement – interspatial and intraspatial displacement, respectively (Arnberger &

Brandenburg, 2007). Intrasite displacement has been studied in an area that features waterfalls but was not examined specifically at the waterfall area (Fleishman, Feitelson, & Salomon, 2007). The study's authors found that short-term intrasite displacement contributes to shifts in usage and undesirable relocation to prohibited ecologically sensitive areas (Fleishman et al., 2007). Activity displacement has been defined as visitors changing their primary activity, shifting from one activity to another, or ceasing an activity and taking up an alternative, often in response to problems (Arnberger & Haider, 2007; Greenaway et al., 2007; Robertson & Regula, 1994; Wu et al., 2009). The literature on displacement and substitution sometimes equates activity displacement with activity substitution, or fails to recognize one or both concepts (Brunson & Shelby, 1993; Greenaway et al., 2007; Fleishman et al., 2007; Miller & McCool, 2003). Substitutability seems to be related to use displacement (Arnberger & Brandenburg, 2007). Displacement might be considered a subset of substitutability (Manning & Valliere, 2001). Alternatively, displacement could be a main driver of substitutability and subsequent substitution decisions (Oh, Sutton, & Sorice, 2013). A thorough investigation into the relationship between these concepts is thus needed.

METHODS

The present study aims to understand the visitor experience, visitor use, and crowding-based carrying capacity at a waterfall-based state park. Data were collected at the park using visitor surveys and time-lapse field cameras during the peak summer use season of June through August in 2016.

Study setting

Cummins Falls State Park is a 211-acre day-use park within the Tennessee State Parks (TSP) system. The park is located nine miles north of Cookeville, Tennessee and boasts the state's eighth largest waterfall. TSP offers recreational opportunities across 56 state parks, several of which feature waterfalls. TSP aims to preserve and protect the state's natural, cultural, and historic resources. Cummins Falls, established in 2012, has been ranked as one of the best swimming holes in the nation by several national media outlets. This shows that demand for this park extends well beyond the state's borders.

Most visitors to Cummins Falls steeply descend by trail into the river corridor where they hike a mile and a half alongside or in the river to reach the falls. Visitors at the falls often swim, climb the waterfall, jump from rock ledges into the plunge pool, or sunbathe. The numerous recreational opportunities afforded in a relatively small area near the waterfall indicates the importance of studying the visitor experience, carrying capacity, crowding, and intrasite displacement. Indeed, Cummins Falls was selected due to its high demand. Such popularity presents management challenges due to crowding and unacceptable impacts to fragile natural resources. Currently, there is no limit to the number of visitors that come to this park. This translates into conditions on peak use days that are characterized by a high density of use at the waterfalls and increased conflict between visitors. Safety incidents (i.e., three drownings and 64 rope-assisted evacuations from 2012 to 2016), enforcement challenges, and resource degradation also increase with the park's high use, but there is uncertainty about how visitors perceive these issues.

Visitor surveys and study population

A visitor survey was utilized at Cummins Falls (see Appendix A). The survey was developed by researchers at Clemson University in collaboration with staff members affiliated with TSP. The researchers also addressed issues of reliability and validity by constructing the survey using questions and techniques that have been well-tested and applied in numerous parks and protected areas (Manning, 2007). Additionally, the researchers based the survey and implementation procedure on the best practices of social science research in parks (Vaske, 2008).

Participants selected for this study were visitors that were age 18 or over. Surveys were distributed on-site. Visitors were asked if they were willing to participate in a research study and complete a survey as they were exiting the waterfall area and leaving for the day. Visitors or visitor groups were selected randomly. Only one person from each group was selected randomly (e.g., birthday closest to the date of data collection) to complete a survey. Survey response rates were recorded. Data collection times were between 10:00 a.m. and 3:00 pm. The desired sample was at least 250 surveys, or surveys resulting from 12 days of sampling effort (split evenly over weekdays and weekend days) over three randomly selected week-long periods. This sampling approach provided a more representative sample of park visitors.

The visitor survey was designed to collect data to not only provide basic information to the TSP staff but also answer questions related to the visitor experience, carrying capacity, crowding, and intrasite displacement. The researchers followed a normative approach to experiential thresholds. One survey question asked visitors about

use levels in the park, specifically the number of people seen at one time (PAOT) at the waterfall area. Photos of the waterfall area depicting a range of use densities were presented to help provide a basis for, and more validity to, participants' answers. Six photos were used with increasing numbers of PAOT: 0, 25, 75, 150, 225, and 325 (Figure 1). Visitors were asked to rate each photo by indicating on a response scale from -4 to +4 how acceptable (+4) or unacceptable (-4) they think it is based on the number of people shown. The average rating for each photo was used to determine the acceptability threshold. Visitors were then asked to indicate which photos represented a use level when management action should be taken to reduce crowding (i.e., a management action threshold) and when they would choose not to visit again because it is too crowded (i.e., a displacement threshold). Visitors were also asked to indicate a photo showing the average use level typically seen during their visit. This approach has been widely used in the development of thresholds in parks (Manning, 2007). By comparing the use conditions reported as typically seen to these thresholds, the experiential carrying capacity can be assessed.

Time-lapse field camera

A field camera was deployed to count recreation users and determine use timing at the waterfall area in the park. The Moultrie D-555i field camera utilized is a commercial off-the shelf unit often used by private individuals for recording wildlife activity. This camera was selected for the study because it allows high resolution photos (8 MB) to be taken over a long period without being downloaded. Additionally, the camera has a programmable time-lapse function that allows photos to be taken at

specified intervals and during specified hours. The camera is weatherproof, designed to be easily mounted in natural settings, and is of modest cost (~\$120).

Field cameras are both reliable and field-tested for the purposes of automatically recording recreation use at a site. Field cameras offer the advantage of allowing for much more detailed and robust data collection since they are not reliant on an individual being present on-site. Photo-based data collection may also increase validity and reliability by removing some of the error and subjectivity associated with observer-based use counts, particularly under high-use conditions. The camera was programmed to capture photos every 30 minutes, beginning at 9:00 a.m. and ending at 6:30 p.m.. The placement of the camera was decided in conjunction with TSP staff to capture the waterfall area of the park, and it was deployed between June and August 2016. This time period was selected because it is recognized as the peak recreation season in the study area and coincides with the data collection period used for the visitor surveys. The cameras were hidden from view and secured to trees at an angle that maximized capture of the primary use area.

Data Analysis

Surveys completed by visitors were coded and entered into a spreadsheet for further analysis. Descriptive statistics (i.e., frequency tables, means, standard deviations) were used to represent survey responses. Respondents were asked to rate simulated photos of the waterfall area based on their acceptability. Average responses for each photo were compared in the form of a social norm curve. A social norm curve plots acceptability (i.e., on a scale from -4 to +4, unacceptable to acceptable) against number of PAOT (Figure 2).

Photo data processing included counting recreation users and entering these counts in a database. Database entry was accomplished using the image analysis software package *Timelapse 2* (Figure 3). This software package has been previously utilized and described in detail, but has not yet been widely used in park or recreation research (Greenberg & Godin, 2015). Visitors were categorized depending on their location in the images (i.e., on the rocks to the sides of the waterfall, on the waterfall, or in the natural pool) to facilitate analysis. The boundaries between the locations were delineated prior to counting visitors and a visitor could not be in two locations at once. Data from the field cameras were plotted to examine average PAOT, maximum PAOT, and total PAOT across a season. The actual numbers of PAOT from the photos were compared to use levels determined using the simulated photos (e.g., the thresholds for acceptability, management action, and displacement) to assess carrying capacity.

The authors also aimed to determine if intrasite displacement was occurring at Cummins Falls using the photo data. In other words, as the site becomes more heavily used does the PAOT in certain locations, like the waterfall's pool, vary in a predictable way? To answer this question, curve estimation models were run using IBM SPSS software for Windows version 24.0. At some timepoints, the total number of visitors was zero. For curve estimation, several models (e.g., logarithmic, inverse) cannot run with values of zero. Thus, timepoints with a total of zero PAOT were excluded from the remaining analyses.

Three plots were created for each location, yielding nine plots total. Each plot visualizes the data for all timepoints, split by day of the week (weekend vs. weekday),

time of day (peak vs. non-peak), and level of use (low, medium, and high). The authors hypothesized that displacement would be more likely to occur on weekends, at peak use times during the day, or with higher levels of use. Peak includes timepoints between 12:45 p.m. and 4:45 p.m., which is supported by photo data (Figure 4C). Non-peak includes timepoints from 8:55 a.m. to 12:44 p.m. and 4:46 p.m. to 7:05 pm. Low level of use includes timepoints with less than 50 total PAOT. Medium level of use includes timepoints greater than or equal to 50 to 160 total PAOT. High level of use includes timepoints with greater than or equal to 160 total PAOT. This is supported by a management threshold of 157.5 PAOT (Figure 2).

RESULTS

Visitor surveys

A total of 300 surveys, with a response rate of 74.3% and a 5.6% confidence interval, were completed by a representative sample of visitors at Cummins Falls State Park. Almost all (99%) visitors reported residing in one of 28 states in the United States, with 65.4% from Tennessee. A quarter of visitors (24.7%) were repeat visitors within the last two years. Visitors' responses to open-ended questions and other results reflect themes that emerged while coding. Visitors most frequently reported that the primary reason for their visit was to see waterfalls or scenery (40.7%), hike (17.5%), swim (16.5%), or be with people (16.2%). Visitors reported that they liked the waterfalls, scenery, or natural setting the most (73.2%) and the crowds the least (18.8%). Most visitors participated in viewing the waterfall and related scenery (90.3%) and swimming

(76.3%). When asked about past displacement, 10.6% of visitors reported that they have not been able to, or chose not to visit the park in the past because it was too crowded.

Visitors were asked to rate each photo on a poster labelled Waterfall Area (Figure 1) by indicating how acceptable or unacceptable they think it is based on the number of people shown. The results are summarized in a social norm curve (Figure 2). Visitors reported that when use levels reach 206.3 PAOT it becomes unacceptable, but 157.5 PAOT is the point when more people should be restricted from using the waterfall area because it is too crowded. When 235 or more PAOT are present, visitors said they would no longer use the waterfall area. These results represent thresholds for acceptability, management action, and displacement, respectively. The perceived use level typically seen – on average from 9:00 a.m. to 6:30 pm, including inclement days – overall was 112.5, on weekdays was 82.5 PAOT, and on weekends was 157.5 PAOT. These results indicate that perceived use on weekends and holidays often reached or violated the management threshold and experiential carrying capacity at the waterfall area.

Time-lapse field camera

A total of 1,048 photos were captured between June 15, 2016 and August 6, 2016 on a field camera directed at the primary use area at the base of the park's waterfall (Figure 1). A total of 52,850 people was counted at the waterfall site. The results in Figure 4A show counts (i.e., occurrences in camera photos taken every 30 minutes) of PAOT for each day over the study period. Both the maximum PAOT and the average PAOT that occurred during the day, which includes lower use times earlier or later in the day, are shown. The average PAOT fluctuated over the season from very low use in

early-mid July due to severe summer storms that closed the park to high use periods that occurred on most weekends. The maximum PAOT during the day crossed the management threshold (horizontal line indicating 157.5 PAOT) on 13 days. The average PAOT crossed the management threshold once on the July 4th holiday weekend and approached the threshold on three other occasions. Figure 4B shows the total PAOT observed per day throughout the study period. Total PAOT peaked on weekends and holidays, with the highest on July 3 (3,553 PAOT). Figure 4C shows PAOT throughout an average day time-period for both weekdays and weekend days. The highest use occurs in the early afternoon from 1:00 p.m. to 4:30 p.m. Figure 4D shows average daily total PAOT and average daily PAOT on each day of the week. On average, use is greatest on the weekends, followed by Mondays. Use levels on weekend days are, on average, about 3 times the amount that occurs on weekdays.

Figure 5 displays plots of the percent of PAOT in each location (i.e., on the waterfall, in the pool, on the rocks) against the total PAOT across all timepoints in the study period. Each plot represents all timepoints with different markers (and corresponding coloration) based on day of the week (Figure 5A), time of use (Figure 5B), and level of use (Figure 5C). Generally, each plot follows a funnel shape that narrows from left to right, in which percent of PAOT is more variable when total PAOT is low. As total PAOT increases, percent of PAOT becomes less variable and ranges between 0.20 (20%) and 0.40 (40%). One visible difference is that percent of PAOT on the rocks has a greater range between 0.0 (0%) and 1.0 (100%) when total PAOT is low. Figure 5A segments timepoints by whether the image was taken on a weekday or a weekend day.

Figure 5B segments timepoints into peak and non-peak times of use. Figure 5C segments timepoints into low, medium, and high levels of use. Weekend days reach a higher total PAOT, as previously indicated in Figure 4D. The funnel shape still applies on weekdays and to non-peak times, with several data points representing a high total PAOT. Figure 5C clearly delineates the trend that the variability of percent of PAOT at low levels of use is higher than at medium and high levels of use.

DISCUSSION

Carrying capacity and crowding

The present study described the outcomes of a scientifically rigorous visitor-based data collection effort at one waterfall-based Tennessee state park. This effort included collecting 300 surveys and over 1,000 photo observations during the summer 2016 peak use season. Cummins Falls State Park has remarkable natural resources and recreational opportunities that will likely see more demand and use in coming years. Use on weekends and holidays often reached or violated the management threshold and experiential carrying capacity at the waterfall area. For example, study results clearly indicate that use levels – measured by both visitor perceptions and field cameras – are already routinely near or above crowding-based thresholds and experiential capacities. Crowding was also consistently mentioned as detracting from the visitors' experience, and more than 1 in 10 visitors reported previously choosing not to visit at times because it was too crowded.

The authors recommended the implementation of a visitor capacity in the river corridor leading to the falls at Cummins Falls. This capacity could be implemented using

various methods such as limiting parking, avoiding overflow parking, restricting use at the trailhead, or requiring a use permit for the river corridor (Manning, 2011). Substantial precedent exists in parks for using these methods to manage visitor use and capacity, particularly where intensive use necessitates intensive management. For example, Tallulah Gorge State Park in Georgia successfully limits the number of people in the gorge itself to 100 per day (Porter & Tarrant, 2005). However, this specific use limit was “chosen somewhat randomly” and “out of the air” (Porter & Tarrant, 2005, p. 304). This quantitative limit at Tallulah Gorge State Park did not rely on either empirical data or the input of visitors themselves in determining a carrying capacity, which is considered a current-day best practice (IVUMC, 2016; Manning, 2007). At Cummins Falls the results of visitor-based data collection support a capacity of between 110 and 160 PAOT in the river/waterfall corridor, depending on the desired conditions for the visitor experience that TSP intends to provide. Other management and implementation considerations (e.g., facilities, staffing, safety concerns) might warrant a higher or lower capacity.

A practical visitor experience monitoring program for the crowding-related indicators described in this study is necessary. Unfortunately, management of carrying capacity in parks most often seems to end with the determination of the capacity itself. However, without continued monitoring of the current condition of indicators (e.g., PAOT at a waterfall), studies of carrying capacity and the indicators and thresholds-based approach underlying it are of limited use. For example, a monitoring program at Cummins Falls might be structured as a ‘rapid assessment’ by deploying a field camera for 8 to 12 days annually. This camera would record use levels at the waterfall area

examined in this study. Resulting photos could be used to assess if use conditions have changed and are approaching thresholds established for experiential capacities.

Future studies of this type might consider excluding low use times and inclement weather days in considering capacity. By doing this, managers can focus on peak use times since those are what are most often managed for and what bring about issues. Otherwise, combining data from high and low use times (e.g., weekdays and weekends, peak times in the day and early morning and late evening hours) and including inclement days can ‘wash out’ and skew the results of a carrying capacity determination in a way that does not reflect the times when most people want to experience their parks. The current study did segment weekdays from weekend days, but did not break out low use times during the day and inclement days in determining a carrying capacity. This approach seems quite typical of carrying capacity studies (Manning, 2007). Yet, it suggests that a carrying capacity is much more often reached than typical study results show, including the present study’s results, on the nice-weather weekends when an overwhelming majority of people choose to recreate.

Displacement

The results of this study point to the importance of swimming at Cummins Falls. Swimming was reported as one of the primary reasons visitors went to Cummins Falls. Engaging in activities like swimming was one of the most frequent responses for what visitors liked most about their visit. Further, swimming was one of the most important activities and most visitors participated in swimming. Most visitors indicated that if they could not swim at the waterfall then there are no other activities at the park that would

provide them with the same level of satisfaction and enjoyment. Visitors also disagreed strongly with the statement that ‘seeing the waterfall from built/improved overlooks would be just as good as getting to swim in its pool.’ Thus, understanding if visitors are displaced from locations like the waterfall’s natural pool is critical. The authors explored whether visitors are experiencing activity displacement, either in addition to or instead of intrasite displacement. Is it possible that visitors at a site would be prohibited from engaging in their intended activities because of crowded conditions?

The present study does not provide evidence for intrasite or activity displacement at Cummins Falls. The authors investigated the relationship between the use level in specific locations around the waterfall area and total use level (Figure 5). As total PAOT increases, percent of PAOT becomes less variable. This may reflect a decline in the freedom of choice that the visitor enjoys in selecting an activity or location. Visitors may not be able to spend as much time as they would like in locations engaged in an activity. As use level increased, the percentage of visitors in each location around the waterfall area did not change. If there was a change in use level in a specific location, the researchers might have suspected that a capacity had been met there. Visitors did not leave the natural pool due to crowding, but did they stay in the pool for as long as they wanted to? Visitors at the Grand Canyon limited the number of sites visited and the time spent at sites to avoid crowding or encounters with other users (Nielson & Shelby, 1977). Visitors at Cummins Falls may have also limited the time spent swimming and the distance covered around the waterfall area to avoid crowding. During peak use times, visitors may have taken turns in certain locations or participating in certain activities.

Recommendations for future studies are aimed at collecting and testing the ideal data needed to detect activity or intrasite displacement. The authors suggest examining high use levels, peak use times (i.e., middle of the day), and peak use days (i.e., weekend, holiday). Activity or intrasite displacement may be more easily detected at highly used sites with various recreational opportunities, particularly if they are smaller sites that permit the use of field cameras. As in this study, researchers could categorize visitors in photos based on their location or activity. GPS could also be used to track the movements of visitors. If the site offers water-based recreation, wearable, waterproof GPS devices might be considered. Researchers could define boundaries in an area and count boundary crosses in a time block (e.g., 12-3pm).

Survey data on the expected and actual duration of time spent in locations or participating in activities are also valuable. A pre-survey could be distributed on-site to determine: arrival time, primary activities and their expected duration, expected trip duration, and alternative/substitutable sites. Surveys could then be distributed at those alternative sites to understand displacement behaviors (Hall & Shelby, 2000). An on-site post-survey could gather data on: departure time, primary activities and their actual duration, activities visitors did not get to participate in, the reason for non-participation, actual trip duration, and suggestions for management. The reason for non-participation is critical to know if visitors are displaced, as opposed to reducing use for reasons such as time or cost (Hall & Shelby, 2000). Researchers could use the data to understand the relationship between duration of time in specific activities or locations and total use levels. Future studies could also explore how displacement relates to substitution, as well

as other behavioral coping mechanisms and decision-making frameworks (Hall & Shelby, 2000; Manning & Valliere, 2001; Schroeder & Fulton, 2010).

A final recommendation is that all future studies of carrying capacity include some measure of *actual* displacement. In the literature, carrying capacity studies to date have only measured the use conditions that *would cause* a visitor to be displaced (Manning, 2011). This is likely related to the difficulty of finding or sampling people who have already left an area because of overcrowding. Approaches exist for overcoming this methodological barrier (e.g., a survey of the general public), but they are often not cost-effective or otherwise feasible. As one solution, the present study asked current visitors if they had ever not been able to, or chosen not to visit, because it was too crowded. Results from this question provide a reasonable proxy for actual displacement. Without such a measure of actual displacement – a concept representing one of the most egregious outcomes of a park visitor’s experience – carrying capacity studies may err in reporting that use levels are acceptable when in reality many people have left the park, and cannot offer their input on a survey, because use levels are already too high. At Cummins Falls, one in ten current visitors reported that they had been displaced due to crowding. This means that there are likely a substantial number of past or potential visitors who are not visiting the park because it is too crowded for them already.

Conclusions

The present study fills an important gap in both research and practice. Many visitors are drawn to state parks and waterfall sites, but there is a dearth of empirical carrying capacity examinations at these places. As visitation increases at these sites,

social science-based research is and will continue to be needed to inform management decisions. To the authors' knowledge, this is the first study to report using the VUM framework to inform managers at state parks or at waterfall sites.

The results demonstrate that use levels at Cummins Falls are already near or above crowding-based thresholds and experiential capacities. Further, the results support a capacity between 110 and 160 PAOT in the river/waterfall corridor. A visitor experience monitoring program is thus critical to ensure that experiential capacities are not being violated. The present study also explored if activity or intrasite displacement was occurring at the waterfall area. While the results did not provide evidence for either form of displacement, they indicated that visitors may have experienced a reduced freedom of choice in activity or location. The authors made recommendations for future studies to collect the ideal data for detecting these forms of displacement (e.g., selecting highly used sites, collecting data on timing). Data on displacement can help managers improve management strategies as well as anticipate and respond to resource or experiential impacts (Schneider, 2007).

Overall, the results provide a scientifically-based and reliable source of visitor-based input that can be used to help ensure public enjoyment and high-quality visitor experiences, now and in the future. The next steps in building a stronger foundation for this type of research are promising and may take many forms (e.g., new methodologies, different sites). For example, future studies may compare the visitor experiences at different types of waterfalls (e.g., plunge pools, cascades). After all, the significant

resources present at waterfall sites and state parks are crucial to protect, especially for the many generations of visitors, now and in the future, who hope to enjoy them.

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FIGURES

Figure 1. A series of simulated photos showing varying use densities at Cummins Falls State Park evaluated by visitors to obtain thresholds for crowding.

Figure 2. Summary of preferences and thresholds; 206.3 PAOT is the reported acceptability threshold, calculated as the neutral point of the social norm curve.

Figure 3. User interface for *Timelapse 2* software.

Figure 4. A) Average and maximum PAOT for each day. B) Daily use estimates. C) PAOT for time of day. D) Average daily total and average daily PAOT for each day of the week.

Figure 5. Percent of PAOT in each area plotted against total PAOT segmented by day of the week (A), time of use (B), and level of use (C).

REFLECTION

The purpose of this study was to provide a basis for understanding the visitor experience and carrying capacity at a waterfall-based state park where visitors engage in an activity with the water. Given the high demand and use of waterfall sites and state parks, this research is critical. Research inquiry surrounding waterfalls spans multiple disciplines from the earth and environmental sciences to public health and tourism. A variety of issues may face the managers of waterfall sites. Stream-bank erosion, water quality and contamination, and risky behavior are only a few of such issues. Similarly, state parks are experiencing higher use levels at the same time as lower funding levels. Many studies have demonstrated the value and benefits of state parks. Yet, the literature on waterfall-based sites and state parks is still limited. Consequently, I urge other researchers to explore the wide-ranging questions surrounding visitor use management at waterfall-based sites and state parks. Such scientific inquiries can inform not only other researchers but also protected area managers.

One of the contributions that I think this research makes to the professional practice is a major managerial implication regarding the assessment of carrying capacity in protected areas. With increased demands placed on protected areas, carrying capacity determinations and visitor use monitoring will continue to gain importance. Carrying capacity determinations have typically used data from high and low use times as well as from inclement days. These data can ‘wash out’ the results. In 1969, Shafer underlined the reliance of research on averages with his work titled, “The Average Camper Who Doesn’t Exist.” Accordingly, I encourage future researchers and managers to shift their

focus away from the “average use level that doesn’t exist.” As was mentioned in the manuscript, the times with average use levels do not seem to reflect the times when most people want to experience their parks. Indeed, carrying capacity is much more often reached than typical study results show. As managers address the increasing demands placed on protected areas, they may need to start focusing on and managing for high-use conditions. Managers can then enhance the quality of the visitor experience and reduce the risk of unnecessary and sometimes irreversible resource damage. Thus, managers can satisfy their dual mandate of ensuring public enjoyment and protecting resources. The implementation and continual improvement of monitoring programs will be critical to ensure that experiential capacities are not met and that the dual mandate is still satisfied.

Another contribution that this study makes to both the professional practice and the scientific research field is the examination of activity and intrasite displacement. Given the popularity of and demand for Cummins Falls State Park, the authors wanted to know if visitors were being displaced from activities or locations within the waterfall area. More importantly, the authors aimed to determine if Cummins Falls can still offer a high-quality visitor experience with high levels of use. Even though activity and intrasite displacement were not detected in the present study, these concepts deserve further research investigation both theoretically and empirically. A question that I have found myself asking in various ways goes something like this: is it possible for activity, spatial, and temporal forms of displacement to occur simultaneously or sequentially at a site? Further, do people wait to use an area to participate in a certain activity that they have

been temporarily displaced from? The concept of displacement, especially in conjunction with substitutability, is ripe for thorough examination.

Regarding future directions, the present study has the potential to inform the research questions and methodology of visitor studies at waterfall sites and state parks. The authors' recommendations for future assessments of carrying capacity seem not only practical but also pertinent. Future studies can more thoroughly investigate displacement by analyzing each form (i.e., temporal, spatial, activity, and absolute) and comparing them to substitution behaviors, other behavioral coping mechanisms, and decision-making frameworks. The resulting information would be valuable to both managers and researchers. Theoretical and empirical work is especially needed on activity displacement and efforts should be made to collect the ideal data to detect this and other forms of displacement. Studies on visitor use at waterfall sites and state parks will remain relevant for years to come. Visitors are demanding high quality experiences at these special places. Thus, managers and researchers must work together to ensure public enjoyment and the preservation of precious resources. Future studies may benefit from the use of planning frameworks such as VERP and VUM. In particular, I encourage the use of the new VUM framework at state parks and waterfall sites given its utility in this study.

Finally, this research has made a substantial contribution to my career. Clemson University has proved to be an exceptional place to further my education. I applied to the Department of Parks, Recreation, and Tourism Management thanks in part to a meaningful conversation with a previous graduate student. Afterward, I learned more about the faculty, research projects, and opportunities in the department. I instantly

gravitated to the Parks and Conservation Area Management concentration because I cared deeply about promoting conservation. I also understood that focusing on people and engaging in social science would be a critical part of advancing conservation efforts. Clemson clearly offered social science expertise and opportunities to learn new skills.

As I near the end of my graduate school experience, I can say that Clemson has surpassed by expectations. The classes have shone a light on concepts, methods, and issues I would not have learned otherwise. I feel prepared to build on my theoretical foundation as well as to employ social science methods in the field to answer questions. The students and professors at Clemson whom I have met are inspirational. I continue to be impressed by their genuine dedication to and investment in education and research. Participating in the student chapter of the George Wright Society has also been a positive experience that has opened my eyes to new opportunities. The opportunities I have been afforded as a graduate student have helped shape my goals. For example, a fellow graduate student and I received scholarships to attend a conference in Arizona. We then got to experience the wonder that is Grand Canyon National Park thanks to our advisor.

Opportunities like this can be transformative and galvanizing for students as they forge their own paths and develop goals. Indeed, my experience as a graduate student at Clemson has had a powerful role in shaping my academic, career, and personal goals. While I have faced some challenges in graduate school, I have been fortunate to also reap the rewards. I feel prepared to promote conservation and serve as an active proponent of leisure as well. I look forward to building my career in the environmental field and to contributing my own efforts and expertise toward conservation efforts.

APPENDICES

Cummins Falls State Park - Visitor Survey

1. Have you visited Cummins Falls State Park more than once in the last two years?

- ☐ Yes → including this visit, how many times in the last two years? _____
☐ No → would you come back or recommend it to someone else? (Check one box below.)

Definitely not ← ☐ ☐ ☐ ☐ ☐ → Definitely

2. a. What did you like **most** about your visit to Cummins Falls State Park?

- b. What did you like **least** about your visit to Cummins Falls State Park?

3. Please check which of the following activities you participated in while visiting Cummins Falls State Park on this trip. Then please indicate how important each activity was to your visit. If you did not participate in an activity then leave that line blank.

	Check if you participate in this activity		How important was this activity to your visit?		
			Not at all important	Somewhat important	Very Important
Fishing	☐	→	☐	☐	☐
Hiking/walking	☐	→	☐	☐	☐
Picnicking	☐	→	☐	☐	☐
Swimming	☐	→	☐	☐	☐
Jumping from waterfalls/cliffs*	☐	→	☐	☐	☐
Viewing scenery/rivers/waterfalls	☐	→	☐	☐	☐
Studying and learning about nature	☐	→	☐	☐	☐
Other (please specify):		→	☐	☐	☐

*Jumping from waterfalls and cliffs is extremely dangerous and is discouraged.

4. What was the primary reason for your visit to Cummins Falls State Park today?

5. Please rate the quality of the following items during this visit to Cummins Falls State Park.

	Very Poor	Poor	Average	Good	Very Good
Overall quality of visitor services in the park	☐	☐	☐	☐	☐
Overall quality of the facilities in the park	☐	☐	☐	☐	☐
Overall quality of recreational opportunities in the park	☐	☐	☐	☐	☐
Overall quality of your visit in the park	☐	☐	☐	☐	☐

6. Please indicate the extent that the following issues were problems for you at Cummins Falls State Park. (Check one box for each issue, or indicate that you don't know.)

	Not a Problem	Small Problem	Big Problem	Don't Know
Litter	☐	☐	☐	DK ☐
Visitors damaging the natural resources of the park	☐	☐	☐	DK ☐
Other visitors interfering with what you wanted to do	☐	☐	☐	DK ☐
Types of recreation uses that should not be allowed	☐	☐	☐	DK ☐
Visitors not following rules or behaving badly	☐	☐	☐	DK ☐
Crowds	☐	☐	☐	DK ☐
Condition of trails	☐	☐	☐	DK ☐
Visitors making their own trails or using unauthorized trails	☐	☐	☐	DK ☐
Condition of facilities	☐	☐	☐	DK ☐
Adequate information about the park	☐	☐	☐	DK ☐
Adequate trails	☐	☐	☐	DK ☐
Adequate picnic areas	☐	☐	☐	DK ☐
Adequate restrooms	☐	☐	☐	DK ☐
Adequate scenic overlooks at waterfalls	☐	☐	☐	DK ☐
Too many signs to read	☐	☐	☐	DK ☐
Not enough signs to provide information	☐	☐	☐	DK ☐
Adequate parking	☐	☐	☐	DK ☐
Availability of rangers and park staff	☐	☐	☐	DK ☐
Other (please specify): _____	☐	☐	☐	DK ☐

7. Did you or your personal group encounter any safety issues or concerns during your visit to Cummins Falls State Park?

☐ Yes → please explain _____
☐ No

8. How did the current conditions of the park make you feel about the following safety concerns?

	Very Unsafe	Unsafe	Neither Safe nor Unsafe	Safe	Very Safe	Don't Know
Hurting yourself by slipping or falling	☐	☐	☐	☐	☐	DK ☐
Hurting yourself by jumping into the water	☐	☐	☐	☐	☐	DK ☐
Drowning	☐	☐	☐	☐	☐	DK ☐
Theft/crime	☐	☐	☐	☐	☐	DK ☐

9. Did you read any signs about safety precautions or potential hazards at Cummins Falls State Park?

☐ Yes →
 Did this change how careful you were while at the park?
 Not at all ← ☐ ☐ ☐ ☐ ☐ → A lot
☐ No → please explain why: _____

10. Within the last four years 3 people have drowned at Cummins Falls State Park and 64 people have had to be evacuated with ropes by park staff due to injuries. Does knowing this change how careful you would be while at the park?

☐ **Not at all** ←————→ **A lot** ☐

11. We would like to know how many people at one time you think could use a waterfall area at Cummins Falls State Park.

a. Please rate each photo on the poster labeled **Waterfall Area** by indicating how acceptable or unacceptable you think it is based on the number of people shown. (Circle one number for each photo.)

	Very Unacceptable	Unacceptable	Moderately Unacceptable	Slightly Unacceptable	Neither Acceptable or Unacceptable	Slightly Acceptable	Moderately Acceptable	Acceptable	Very Acceptable
Photo 1	-4	-3	-2	-1	0	+1	+2	+3	+4
Photo 2	-4	-3	-2	-1	0	+1	+2	+3	+4
Photo 3	-4	-3	-2	-1	0	+1	+2	+3	+4
Photo 4	-4	-3	-2	-1	0	+1	+2	+3	+4
Photo 5	-4	-3	-2	-1	0	+1	+2	+3	+4
Photo 6	-4	-3	-2	-1	0	+1	+2	+3	+4

- b. Which photo shows the highest number of people that should be allowed at the waterfall area? In other words, at what point should people be restricted from using the waterfall area because it is too crowded?

Photo number: _____ **OR** ☐ People should not be restricted from using the waterfall at any point **OR** ☐ None of the photos are so unacceptable that use should be restricted

- c. Which photo shows the level of use that is so unacceptable that you would no longer use the waterfall area?

Photo number: _____ **OR** ☐ None of the photos are so unacceptable that I would no longer use the waterfall area.

- d. Which photo looks most like the number of people you typically saw at the waterfall area today?

Photo number: _____ **OR** ☐ I did not visit the waterfall area

12. Please indicate the extent to which you agree or disagree with each of the following statements about Cummins Falls State Park.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Don't Know
Visitors and their use of the park should be managed <u>more</u>	☐	☐	☐	☐	☐	DK ☐
Laws and rules in the park should be enforced <u>more</u>	☐	☐	☐	☐	☐	DK ☐
If needed, a parking fee of \$5 per vehicle could be charged without it being a problem for me	☐	☐	☐	☐	☐	DK ☐
If needed, it is acceptable to place limits on the number of people who can use the park at any one time	☐	☐	☐	☐	☐	DK ☐
If needed, it is acceptable to use a permit or reservation system to limit the number of people at the waterfall area at any one time	☐	☐	☐	☐	☐	DK ☐
If needed, it is acceptable to use parking availability to limit the number of people who can use this park at one time	☐	☐	☐	☐	☐	DK ☐
If it becomes too crowded for park staff to keep visitors safe then it is acceptable to stop more people from entering this site	☐	☐	☐	☐	☐	DK ☐
If needed to keep the public safe, it is acceptable to restrict access to specific areas where more injuries or deaths occur	☐	☐	☐	☐	☐	DK ☐
If the park's natural resources are being negatively impacted, it is acceptable to place limits on the number of people who can use the park at any one time.	☐	☐	☐	☐	☐	DK ☐
Seeing the waterfall from built/improved overlooks would be just as good as getting to swim in its pool	☐	☐	☐	☐	☐	DK ☐
Swimming in the pool below the waterfall is dangerous	☐	☐	☐	☐	☐	DK ☐
Swimming in the river is dangerous	☐	☐	☐	☐	☐	DK ☐

13. We would like to know how long you think it is acceptable to wait for parking at Cummins Falls State Park.

a. How many minutes is it acceptable to wait to find parking at Cummins Falls State Park?

Acceptable parking
wait time in minutes: _____

b. How long of a wait for parking is so unacceptable that you would no longer visit Cummins Falls State Park?

Waiting time in minutes
that would cause
you not to visit again: _____

OR ☐ I would visit no matter how long
I had to wait to park.

c. How many minutes did you wait to find parking on this visit?

Minutes spent
waiting to park: _____

OR ☐ I did not have to wait to park.

14. If you could not go swimming at the waterfall area at Cummins Falls State Park, are there any other activities at the park that would provide you with the same level of satisfaction and enjoyment?

☐ Yes

Please list up to three park activities that could substitute for swimming at waterfalls:

☐ No _____

15. If you could ask the park staff to change some things about the way they manage Cummins Falls State Park, what would you ask them to do?

(Continue on back side if needed)

16. Have you ever **not** been able to, or chosen **not** to visit Cummins Falls State Park because it was too crowded?

☐ Yes

How much of a problem do you think it is that you were not able to visit on this occasion?

Not a Problem Small Problem Big Problem
☐ ☐ ☐

☐ No

17. How many people are in your vehicle today, including yourself? _____

18. What is your zip code? _____

Thank you for completing this survey! Please return it to the person who gave it to you.

Tennessee State Parks has authorized Clemson University to collect this information. This information will be used by park managers to understand visitor use and the perceptions of recreation management at this park. Responses to this request are voluntary and anonymous. Direct comments regarding this survey or other aspect of this data collection to: Dr. Jeffrey C. Hallo, Associate Professor, Clemson University, Department of Parks, Recreation and Tourism Management, 280B Lehotsky Hall, Clemson, SC 29634-0735, jhallo@clemson.edu