The interface of wildlife and nature tourism

by

Rachel Shively

B.S., University of Alaska, 2010
M.S., University of Alaska, 2015

AN ABSTRACT OF A DISSERTATION

submitted in partial fulfillment of the requirements for the degree

DOCTOR OF PHILOSOPHY

Department of Horticulture and Natural Resources
College of Agriculture

KANSAS STATE UNIVERSITY
Manhattan, Kansas

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Abstract

The relationship between tourism and wildlife is complex and multifaceted, with impacts on both the environment and human well-being. This dissertation will investigate the intersection of tourism and wildlife, focusing on three main aspects: the impact of outdoor recreation on wildlife, the potential of virtual nature tourism to decrease impacts on wildlife while still providing health benefits to participants, and the balance between access and protection for both humans and wildlife.

This dissertation focuses on the relationship between wildlife tourism and its impact on both participants and wildlife. The author examines several factors that can shape the development of wildlife tourism, such as the format of the tourism, the beliefs and motivations of the participants, and the effects on both wildlife and participants. Virtual nature tourism will be explored as a potential solution to decrease the impact on sensitive wildlife while increasing access to learn about and observe wildlife in their natural habitat. This can include wildlife webcams and guided tours that can be viewed remotely, such as WildEarth safaris. Virtual nature tourism can be beneficial for people who cannot travel to experience nature in person due to time, financial, or health limitations, while still providing health benefits.

The author notes that outdoor recreation tourism can have both health benefits for participants and negative impacts on wildlife. In order to balance these factors, the author suggests that understanding the patterns of wildlife behavior and human recreation is crucial in developing regulations and educational programs that ensure both wildlife and tourism can thrive. The author also explores the dynamics between wildlife and protected area tourists and how decisions made by park managers affect the balance between conservation and recreation. The author suggests that protected areas can benefit from a zoning approach that caters to different types of tourists and their preferences.

Overall, the author argues that a better understanding of the relationship between wildlife tourism and its impact on both participants and wildlife is crucial for informed management decisions that benefit both. Documenting the variations in benefits and impacts on humans and wildlife will inform management decisions that will allow for a range of access and protection. This dissertation aims to contribute to the larger debate and ongoing efforts towards a sustainable balance between tourism and wildlife conservation.

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Major Professor
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Table of Contents

List of Figures

List of Tables

Acknowledgements

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Chapter 1 - Introduction

Wildlife tourism has the potential to increase how much participants care about wildlife and may drive behavioral changes that help wildlife. However, many forms of wildlife tourism can damage natural resources and increase stress for the very wildlife that participants are hoping to see. Steps to continue refining wildlife tourism management towards the goal of benefiting both participants and wildlife require examining several factors: tourism format, participants beliefs and motivations, and impacts on wildlife and participants.

The relationship between tourism and wildlife is complex. It is well-known that outdoor recreation tourism provides health benefits for participants (Buckley, 2022). It is also understood that most tourists do not intend to negatively impact wildlife (Flower et al., 2021). Less is understood about how specific activities impact wildlife and how those impacts align with the intentions of participants. A more recent development is virtual nature tourism, which may decrease impacts on wildlife while still providing health benefits to participants (Hofman et al., 2021). The author considered three aspects of the intersection of tourism and wildlife.

The impact of outdoor recreation tourism on wildlife involves many variables including state of the animal (e.g., where energetic needs outweigh predator risks, habituation, habitat condition), species, and type/mode of recreation. As the number of outdoor recreation tourists increase, human-wildlife conflicts could increase. Understanding these patterns before conflicts are frequent will allow managers to develop plans for how to implement regulations and educational programs to ensure outdoor recreation/nature tourism and wildlife both continue to thrive in the face of continuing environmental changes. This can also inform management in other regions or in areas where managers are dealing with a particularly sensitive species with a limited habitat. In those cases, more extreme limitations may need to be in place to protect

species while still providing educational experiences to nature tourist. This is where virtual nature tourism may serve multiple purposes.

Possible benefits of virtual nature tourism include a decrease in the impact on sensitive wildlife and habitat along with increased accessibility for a broader audience to learn about more wildlife and observe them in their natural habitat. Virtual nature tourism has multiple formats including webcams and online guided tours which can be viewed live such as WildEarth safaris (Karadimitriou, 2020; Loomis et al., 2018). Time spent outside provides health benefits to humans, so removing access to outdoor recreation is not a goal and remote nature tours are likely most beneficial to people who could not otherwise travel to the experience in person due to time, financial, or health limitations. While outdoor recreation tourists' negative impacts on wildlife are typically unintentional, the benefits to humans and impacts on wildlife need to be in balance. Pinpointing that balance is part of a larger debate and continuing efforts towards balance includes documenting the variations in benefits and impacts on humans and wildlife to inform management decisions that will allow for a range of access and protection.

Background

Protected area tourists and wildlife both move through space interacting with their surroundings over time resulting in complex systems of spatial dynamics. Understanding elements of these dynamics is necessary to make informed management decisions. Protected area managers often strive to provide adequately protected habitat for wildlife while also providing accessible recreational opportunities for a variety of visitors. There are similarities in how wildlife use habitat and tourists use protected areas, which is apparent in the overlapping methods to research that manage these two categories.

Wildlife and protected area tourists disperse across the landscape in relation to valued resources. Wildlife may be concentrated at sites with easy foraging or low predation risks while

visitors may be concentrated near a visitor center or photographic viewpoint (Doerr et al., 1997; Herrero et al., 2005). In both cases, some species and individual visitors are tolerant of high densities and others are not (Fan, 2019). For both wildlife habitat and visitor use, managers make some decisions based on carrying capacity if resources are being depleted through heavy use (Fan, 2019; Ormsby et al., 2004).

Some species of wildlife may concentrate in areas with rich food resources. An extreme example of this occurs at food plots and supplemental feeding stations for species including deer and elk (Brown & Cooper, 2006). Hotspots of this nature create challenges for managers through the increased spread of disease and degradation of surrounding rangeland due to increased browsing pressure (Brown & Cooper, 2006). Ideal free distribution models assume increasing population density decreases the average suitability of a site (Bjørneraas et al., 2012). However, when different habitats are occupied across a landscape knowing the contribution of each habitat type to the success of the species is needed in order to prioritize habitat management (Pulliam & Danielson, 1999). Similarly, protected area managers need to understand what locations should be prioritized for conservation or development to maintain desired park visitation rates and diversity (van Riper et al., 2012). While wildlife management faces challenges around prioritizing the conservation of multiple species and habitats with input from competing interest groups, protected area tourism management juggles balancing similar competing interests.

Some tourists travel to protected areas seeking solitude while others prefer easily accessible attractions and are less concerned with crowding (Dangi & Gribb, 2018). While the average tourist does not exist, limited resources result in some protected areas being managed for the average tourist while neglecting the recreational preferences of many groups (Manning, 2011). A framework applied to wildlife tourism suggests a protected area may begin as a site that appeals to specialist, such as a skilled birdwatcher seeking high-quality habitat with few crowds.

As the protected area becomes more popular, managers may add more infrastructure to support the larger crowds and eventually the protected area is less appealing to the specialist bird watcher and more appealing to the novice generalist who prefers the increased infrastructure, in other words there's displacement (Duffus & Dearden, 1990). Protected areas can mitigate this trajectory through zoning different areas for different uses which can be compared to the different management goals for different game management units (Boertje et al., 2007; Doak et al., 2016).

Tourists are often concentrated at hotspots within protected areas which can include scenic outlooks (Guo et al., 2019). Congestion varies with time of day and season which is similar to wildlife habitat use, however, tourist use also varies with day of week and holidays. A study at a Chinese World Heritage Site monitored both protected area entrance levels and the number of tourists at a popular scenic outlook using trail cameras (Guo et al., 2019). Guo et al. found tourist use levels were highest on holidays and crowding at the scenic overlook exceeded tourists' preferred use levels, or social carrying capacity, even though average levels did not exceed the mandated limit, or carry capacity, set by administration (Guo et al., 2019). The concept of carrying capacity, developed from wildlife management, is frequently used in protected area tourists management including the social carrying capacity which considers the level of crowding rated as acceptable by tourists (Hallo & Manning, 2010).

Similar to wildlife hotspots resulting in degradation of the surrounding area (Lobo et al., 2013), crowding at tourists hotspots often leads to increased vegetation trampling and erosion (Monz et al., 2010). Spatial distributions of tourists impact the natural resources and the experience of other tourists making the study of tourists' spatial behaviors important for the management of protected areas for recreation tourism and ecological protection (Riungu et al., 2018). Understanding what landscape features attract different tourism segments is necessary to

understand how shifts in land management will impact the tourism economy (De Aranzabal et al., 2009). The possibility to view wildlife is one feature that attracts tourists, so wildlife populations impact tourism rates and tourism rates impact wildlife simultaneously.

With what is known about wildlife and tourism, virtual wildlife tourism emerges as an appealing option to provide some form of access to view wildlife while protecting the species being viewed from the direct disturbance of tourists. It can be combined with tourist services in order that high impact use is concentrated to select areas while other areas remain off-limits providing protection to key habitat features. Virtual wildlife tourism reaches international audiences including many who cannot travel to experience these places in person. This combination of providing more outreach while minimizing habitat impacts is what makes virtual wildlife tourism a powerful tool in the growing wildlife tourism industry.

Purpose Statement

The purpose of this dissertation is to explore methods of balancing wildlife tourism and protection of habitats. One avenue is through virtual wildlife tourism as an alternative option to wildlife tourism in cases where habitat is too fragile to sustain tourists and in cases where participants are unable to visit the site. Another is seeking to quantify how diverse types of outdoor recreation tourists to a national forest impact the mammal assemblage along trails and roads. Combined, these studies will propose management policies that can be put in place to balance benefits to wildlife tourists with protection of natural resources for future generations.

Structure of this Dissertation

This dissertation examines the impact of virtual wildlife tourism on participants in chapter two. The motivations of participants in virtual wildlife tourism are central to chapter three. Chapter four focuses on the impacts of nature tourism on wildlife. Chapters two and three

examine an alternative to traditional nature tourism, namely virtual, while chapter four considers potential impacts of traditional nature tourism (outdoor recreation). Chapter five summarizes the findings and proposes future research directions. This structure will take the reader from an examination of impacts and outcomes **on** participants to examining impacts **of** participants (Figure 1.1). I want this structure to bring the reader along a journey of considering how an alternative format of nature tourism can benefit participants, increase the number of participants with access to the benefits of nature tourism, while decreasing negative benefits on the very natural resources that attract most participants to the activities. Are different types of virtual tourism impacting participants in the same way physiologically? Do virtual nature tourism participants have motivations and beliefs similar to those of traditional nature tourists? Are different types of nature tourism (outdoor recreation) impacting mammals similarly? These are some of the questions which motivated the following chapters.

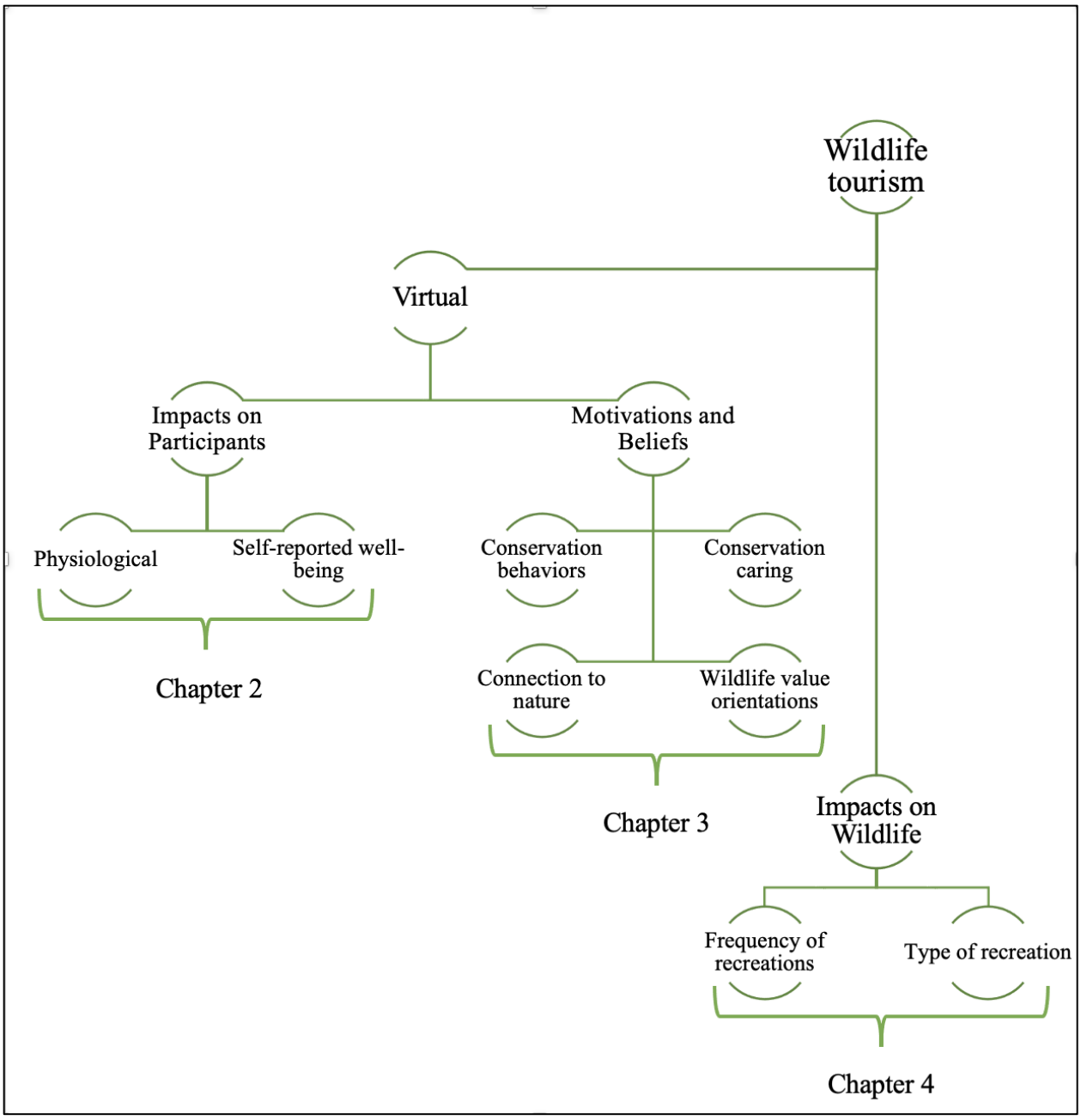

Figure 1.1. Diagram visualizing the structure of this dissertation with two chapters focused on virtual wildlife tourism participants and one chapter focused on impacts of nature tourism.

Chapter 2 - Potential health benefits of virtual wildlife tourism participation: physiological stress and self-reported state-of-mind

Abstract

Wildlife tourism can provide a variety of mental health benefits to travelers such as reducing stress, increasing happiness, and enhancing connections to nature. Virtual wildlife tourism allows participants to explore the world from home, helping to protect sensitive environments and wildlife while still providing potential health benefits to participants. To investigate this potential, we exposed university students (n = 21) in Kansas, USA, to three types of viewing sessions designed to represent different types of virtual experiences: a virtual African safari (guided nature), virtual local wildlife viewing (unguided nature), and a virtual urban walking tour of NYC (guided not nature). Using both physiological (e.g., electrodermal activity) and psychological assessment (e.g., self-reported surveys) approaches, we found all three virtual experiences had a similar positive effect on physiological stress levels. Significant impacts based on self-reported surveys indicated the African safari increased connections to nature, local wildlife viewing decreased self-reported stress and increased connections to nature, and the urban walking tour increased happiness and decreased connections to nature. Results suggest that virtual tourism can decrease stress levels and provide other positive mental health benefits to participants, while virtual wildlife tourism also limits the negative impacts of tourism on the natural environment.

Introduction

Stress negatively impacts mental health and leads many individuals to seek stress relief through physical relaxation, cognitive restoration, emotional regulation, and social support (Chen et al., 2016; Etzion, 2003; Pagen et al., 2021). Many of these avenues of stress relief can be found in components of participation in virtual nature tourism. Virtual nature tourism is defined

as the use of digital technologies to simulate natural environments and provide immersive experiences that replicate the benefits of actual nature experiences (Akesson et al., 2020; Karadimitriou, 2020). Specific features of virtual nature tourism likely to be effective for stress relief include exposure to nature, sense of escape from daily stressors, and ability to learn something new in a low-pressure setting (Buckley, 2020; Yeo et al., 2020). Virtual nature tourism is a potential mode of aiding the participant in achieving reduced stress and anxiety, improved mood, increased cognitive performance, and better overall well-being.

Health benefits of tourism

Tourism provides many mental health benefits, including the feeling of escaping daily stressors and having a positive effect on participants' life satisfaction (Chen et al., 2016; Petrick et al., 2021). Decreasing stress levels is a common motivation for traveling (Mahboob et al., 2021). Nature tourism, a broad category that includes a range of activities such as hunting, fishing, hiking, boating, car camping, wildlife watching, and ecotourism, is known to increase happiness, decrease stress, and improve health (Buckley, 2020; Kuenzi & McNeely, 2008). In addition to stress reduction, pro-environmental attitudes are linked to more engagement in nature-based tourism (Line & Costen, 2017). Connectedness to nature, which is also increased through participation in nature tourism, is positively correlated with psychological well-being (Cervinka et al., 2012; Howell et al., 2011). As tourism continues to attract more participants globally, participants may seek to increase happiness and decrease stress through more accessible methods (e.g., virtual tourism) for instances when physical travel isn't an option.

If tourists are motivated to participate by the potential to decrease stress and increase happiness, tour providers need to understand what can influence these positive outcomes. It is clear tourism contributes to the mental health of participants (Buckley, 2022). Stress reduction has been touted as an outcome of tourism through the opportunities leisure provides participants

to relax and detach from work (Chen et al., 2016). While stress levels are generally lower after a vacation, work stress was observed to revert back to pre-vacation levels within three weeks of a trip (Etzion, 2003). Identifying options to decrease stress more regularly without the cost associated with some vacations may mitigate this rapid return of job stress. Happiness and connection to nature is increased through nature tourism and an increased connection to nature is correlated to improved well-being (Cervinka et al., 2012). While these benefits of tourism are well understood, less is known about how virtual tourism impacts stress reduction, increased happiness, and increased connection to nature.

Virtual tourism

Despite the health benefits afforded by tourism, many people are unable to travel due to financial, health, logistical, or other constraints, especially during times of crisis, such as the COVID-19 pandemic. Virtual tourism provides an alternative mechanism by which participants can explore the world from home. Virtual tourism is a growing field with one travel destination webcam host (Skyline) reporting an 85% increase in visits during the COVID-19 lockdown (Jarratt, 2021b). Thus, virtual tourism is an attractive option for individuals who cannot participate in traditional tours for various reasons (Orru et al., 2019). Virtual tourism makes locations that are far away more accessible to a broader audience. Virtual urban tours can provide views from city streets along with the educational benefit of a guide while decreasing costs and the potentially overwhelming task of navigating a crowded area. A virtual reality scenario in an urban setting was found to provide participants with a restoration effect based on the Restoration Environment Scale which includes measurements of the escape or being away, fascination, compatibility, and abundance (H. Li et al., 2021). Understanding the health benefits of virtual tourism compared with traditional travel will help destination managers optimize virtual tourism experiences for individuals who are unable or unwilling to travel.

As interest in nature tourism grows (Buckley et al., 2003; Kuenzi & McNeely, 2008; Schwoerer & Dawson, 2022), virtual experiences are being developed to grow the audience for interactive nature tours (Jarratt, 2021a). These virtual nature tours provide an alternative income source to tour companies (Chirisa et al., 2020), while potentially providing participants with a means to obtain some of the benefits of nature tourism without physical travel. Increased participation in nature tourism has required increased effort to balance the quality of the environment with the quality of service (O'Neill et al., 2010; Winter et al., 2020). In line with this balance, virtual nature tourism may help protect sensitive environments and wildlife by removing the impacts associated with on-site activities, while still providing the benefits of nature tourism to participants (Jarratt, 2021a). Similar to nature tourism, simply viewing scenes of a natural setting can provide stress relief. Nature programming has been identified as a useful component of healthy indoor recovery (Largo-Wight, 2011). Blood donors who watched either no TV or videos of nature scenes had lower blood pressure than donors who watched regular television programs or videos of urban scenes (Ulrich et al., 2003). Watching nature scenes has a restorative effect after stress (de Kort et al., 2006). If virtual nature tours show similar benefits to viewing scenes of nature, they may be a suitable alternative to would-be participants facing a travel constraint.

Specifically, virtual nature tourism may help would-be participants bypass aspects of the hierarchical leisure constraints model that prevent some from participating in nature tourism (Currie et al., 2021) while providing similar benefits. It's unclear if the nature part of virtual nature tourism is more impactful on happiness and stress levels than the experience of escape through virtual tourism, so a comparison of tours in different settings (e.g., nature vs. urban) is needed. A better understanding is needed of the health benefits that may come from participation

in virtual tourism experiences with specific consideration of nature-based vs urban and guided vs. unguided variations.

Objectives

Using physiological and psychological measures, we assessed changes in stress, happiness, and connection to nature of university students during three virtual tourism viewing sessions: a guided virtual safari, a wildlife webcam (unguided), and a guided urban tour. Specifically, while controlling for baseline differences in mental health and demographic attributes, we considered: 1. How do different virtual treatments (safari, webcam, and urban) impact stress levels based on physiological and self-reported measures? 2. How do different treatments impact self-reported happiness? 3. How do different treatments impact self-reported connection to nature? 4. Which virtual tourism treatment is mostly likely to yield mental health benefits for participants?

Methods

Participants and study site

Participants were recruited via fliers and a posting in a university-wide email from a student population at a large public university in the midwestern United States (n=21) and were monitored during three different virtual viewing sessions (63 sessions; IRB-10566; Appendix A). We used a prior power analysis to determine the sample size needed (n = 15 needed) to detect significant treatment effects (significance level =0.05, power 1-=0.95, effect size = 20, and standard deviation = 20; Julious et al. 1999). Anticipated effect size and standard deviation were based on the Moodmetric scale and results in Krupic et al. (2021) and supported by the effect size and standard deviation of the study's questionnaire portion (Krupić et al., 2021). We increased the suggested sample size as much as possible to enhance robustness, increasing the likelihood of detecting any treatment effects that might exist.

All sessions occurred in the same windowless room on a 32-inch screen and were administered by the same researcher. Each participant's sessions were scheduled at the same time of day on three different days within a three-week period. Each session began with a three-question survey to gage current stress, happiness, and connection to nature. Because we were focused on stress recovery, we then administered a modified 5-minute version of the Markus & Peters Arithmetic Test (MPATest; Peters et al. 1998) to increase participants' stress levels prior to viewing virtual tourism segments. Next, participants viewed one of the following 10-minute virtual tourism segments: safari (guided, wildlife), webcam (unguided, wildlife), or urban tour (guided, not wildlife). The safari segment was footage of a guided virtual safari through wildlife areas in South Africa. The webcam provided footage of bison and prairie chickens in a tallgrass prairie environment in the midwestern local to the university. As a contrast to the nature scenes, the urban tour was footage of a guided walking tour in New York City, US. All footage for the viewing segments was preselected to ensure all participants viewed the same footage and to control for intensity of scenes (e.g., no predation scenes). The order in which participants viewed each segment was randomly assigned. Participants completed a survey after each virtual tourism session which asked about the experience and again gaged stress, happiness, and connection to nature (Appendix A). The session types were chosen specifically to provide the comparisons of guided (safari and urban tour) to unguided (webcam) along with urban (urban tour) and nature settings (safari and webcam).

Measurements

Electrodermal activity (EDA) is useful for measuring short term variations in stress and arousal levels (D. K. Brown et al., 2013; Cowley & Torniainen, 2016; Jussila et al., 2018; Visnovcova et al., 2018) and is promisingly aligned with self-perceived stress (Pakarinen et al., 2019). During this study, we monitored EDA using a Moodmetric smart ring which participants

put on their finger for each session prior to the first set of surveys and wore until the final set of survey questions were complete (Moodmetric, Tampere, Finland). The provided unit of EDA measurement, MM, is on a scale of 0-100 with 100 being the highest stress level and 0 being no stress (Posada-Quintero & Chon, 2020).

Participants provided demographic information, an estimate of time spent outside and watching screens, in addition to their experience with hunting, wildlife watching, and foreign travel (Orru et al., 2019). These questions were asked because past experiences are part of what shapes participants current experiences (Ormsby et al., 2004).

Before and after each of the three viewing sessions, each participant completed a single item measure of stress (These days I feel tense, restless, nervous, or anxious) and a single item measure of happiness (I feel happy in general), both on a scale of 1- strongly disagree to 5 - strongly agree before and after each session to determine general mood (Abdel-Khalek, 2006; Elo et al., 2003). Participants also completed the one question nature connectedness scale (Yeo et al., 2020) to determine participants' sense of connection to nature.

After each session, participants answered two open-ended questions about what they just viewed (Brown et al., 2013; Thompson, 2007). Those open-ended questions were: 1. How did watching this make you feel? and 2. Was this a positive or negative experience for you? Explain. Following the last of segment in the three-session rotation, participants were asked to pick which, if any, of the three sessions made them feel each of the following: happier, less stressed, and more connected to nature.

Data analysis

One-way ANOVA with repeated measures compared the mean EDA measure to examine differences in physiological stress response among sessions. This comparison of EDA response during the stress portion of each session (MPATest) determined if order of session impacted

physiological stress response level. The comparison of mean physiological stress level during the virtual tourism portion of the session detected any differences in stress recovery among the type of virtual tourism (safari, webcam, and urban tour). The results of pre- and post-assessments were analyzed using a paired t-test to detect significant self-perceived shifts in stress, happiness, and connection to nature for each of the three types of virtual tourism. Differences in changes among the three types of virtual tourism were compared using one-way ANOVA with repeated measures on the difference between the assessments (pre-assessment scores minus post). All statistical analysis was done using STATA 16 (Statacorp, College Station, TX).

Results

Of 21 participants, 20 provided demographic data including 12 females, 6 males, and 2 nonbinary participants. Participants provided estimates of their time spent in nature and viewing screens for recreation on weekdays and weekend days. Estimated time varied widely with higher means for time spent viewing screens than in nature (Table 2.1). Most participants reported having traveled to other countries (79%) and to view wildlife (68%) while less than half of participants reported having hunted (42%; Table 2.2).

Table 2.1. Mean estimates provided by participants of their time spent in nature and watching screens for recreation on weekdays and weekend days.

Participants' recreational time	Mean minutes (±SD)
Time spent in nature for recreation on a weekday	65 (±50)
Time spent in nature for recreation on a weekend day	133 (±80)
Time spent watching screens for recreation on a weekday	176 (±151)
Time spent watching screens for recreation on a weekend day	228 (±204)

Table 2.2. Participants' self-reported experience with travel and wildlife.

Participants' previous experiences	Yes (percentage of participants)
Experience traveling to other countries	79%
Experience hunting	42%
Experience traveling to view wildlife	68%

Physiological

Participants' stress levels (EDA) were significantly higher during the stress portion (MPATest) of each session than the safari, webcam, or urban tour viewing portions (t (62) = -13.59, p = <0.001). Session order did not have a significant effect on participants' stress levels as the math portion was equally stressful each time (F (20,2) = 0.58, p = 0.5625). Mean and minimum stress levels were not significantly different among the viewing sessions (Table 2.3). Maximum stress levels during the viewing session occurred at the beginning which was immediately following the MPATest. Because they were most likely the result of the MPATest, maximum stress levels during the viewing session were not analyzed.

Table 2.3. Mean, standard deviation, and ANOVA results for stress levels (EDA MM) during each session. EDA MM is on a scale of 0-100 with 100 being the highest stress level and 0 being no stress.

		Mean (SD)			F (20,2)	p
		Safari	Webcam	Urban tour		
Electrodermal Activity (MM)	Mean during session	34.4 (8.42)	36.6 (8.40)	36.2 (10.58)	0.62	0.544
	Minimum	19.4 (10.78)	19.7 (9.76)	22.4 (11.40)	0.85	0.434

Mean during MPATests	77.9 (16.0)	0.58	0.563

Self-reported measures

Participants reported a significant decrease in their self-reported happiness after viewing the urban tour, as well as a decrease in stress after viewing the webcam. Connection to nature increased significantly after viewing the safari and webcam but decreased after viewing the urban tour (Table 2.4). After completing all three sessions, participants reported which of the sessions they recalled having the most impact on happiness, stress, and connection to nature (Table 2.5). Combined, virtual tourism sessions were rated as 84% positive experiences and 13% as neutral experiences by participants. The urban tour was rated as a negative experience by two participants; one mentioned feeling claustrophobic and the other mentioned the skylines triggering their fear of heights.

Table 2.4 T-test results for self-reported levels of happiness, self-reported stress, and connection to nature before and after each session. Results are reported on a scale of 1 to 5 with one being strongly disagree or not at all connected and 5 being strongly agree or extremely connected in response to three prompts: I feel happy in general, 2. These days I feel tense, restless, nervous, or anxious, and 3. What best describes how you feel right now about your connection to nature (represented by diagrams). Significant results ($p < 0.05$) are indicated by an *.

	Safari			Webcam			Urban tour		
	Mean (±SD) pre	Mean (±SD) post	T-test	Mean (±SD) pre	Mean (±SD) post	T-test	Mean (±SD) pre	Mean (±SD) post	T-test
Self-reported stress	3.1 (±1.1)	2.9 (±1.2)	t (20) = 0.90, p = 0.189	3.1 (±1.4)	2.9 (±0.9)	t (19) = 2.52, p = 0.010*	3.0 (±0.8)	3.0 (±0.8)	t (20) = 0.82, p = 0.214

Happiness	4.0 (±0.8)	4.1 (±0.9)	t (20) = -1.37, p = 0.090	4.2 (±0.7)	4.2 (±0.5)	t (19) = 0.70, p = 0.247	4.0 (±0.7)	3.9 (±0.7)	t (20) = -2.17, p = 0.021*
Connection to nature	3.2 (±0.9)	3.5 (±0.7)	t (20) = -2.83, p = 0.005*	3.2 (±0.9)	3.5 (±0.7)	t (19) = 2.35, p = 0.015*	3.2 (±1.2)	2.9 (±1.3)	t (20) = -2.83, p = 0.005*

Table 2.5 Percentage of participants reporting the sessions they most identified with each condition. Some participants gave more than one answer leading to percentages not totaling 100.

	Safari	Webcam	Urban tour
Increased happiness	37%	32%	47%
Decreased stressed	68%	37%	5%
Increased connection to nature	58%	79%	0%

In response to open-ended questions asking about each viewing session, participants often noted feeling calm and relaxed. Other common themes to responses concerned learning and being interested in the content. Word clouds formed from responses from all participants for each session highlight similarities and differences (Figure 2.1-2.3)

Figure 2.1. Word cloud from participants responses after viewing a guided safari to the following questions: 1. How did watching this make you feel? And 2. Was this a positive or negative experience for you? Explain. Figure made using NVivo by Sarah Jackson.

Figure 2.2. Word cloud from participants responses after viewing an unnarrated wildlife webcam to the following questions: 1. How did watching this make you feel? And 2. Was this a positive or negative experience for you? Explain. Figure made using NVivo by Sarah Jackson.

Figure 2.3. Word cloud from participants responses after viewing a guided urban tour to the following questions: 1. How did watching this make you feel? And 2. Was this a positive or negative experience for you? Explain. Figure made using NVivo by Sarah Jackson.

Discussion

Our findings indicate that all three virtual tourism experiences had a positive effect on physiological stress levels. However, the three experiences differed in their impact on self-reported measures. Specifically, the webcam virtual wildlife tourism experience had a greater positive impact on self-reported stress and connection to nature compared to the other two virtual tourism experiences. It is notable that the webcam was the only session which did not include humans. Both sessions set in nature (safari and webcam) significantly increased participant's sense of connection to nature.

When it came to self-reported happiness, there were no major differences in self-reported happiness from before viewing to after viewing for any of the sessions. However, 47% of participants remembered viewing the urban tour as increasing happiness when they were asked about it after all three sessions had been completed. The nature viewing sessions both had a larger impact on reducing stress and increasing connection to nature, with the unguided nature session (webcam) resulting in the biggest self-reported decrease in stress. This larger decrease in stress during the webcam session was likely due to a combination of the lack of narration or vehicles in the session. Additionally, the environment depicted was familiar to most of the participants as there is a herd bison in a local prairie in the same town as the university where the study was conducted.

This study provides evidence of the potential benefits of virtual nature tourism on well-being, stress reduction, and connection to nature. Additionally, the study found that virtual wildlife tourism (webcam and safari) had a greater impact on self-reported stress and connection to nature than the urban tour. These findings suggest that virtual nature tourism can be an effective tool for promoting pro-environmental behaviors, stress reduction and well-being. Many of the participants stated they would be seeking out the links to watch the safari and webcam on

their own, particularly during high-stress periods such as college finals week. Virtual nature tourism could be promoted to students as low-cost option to take breaks aimed at lowering stress and finding a connection to nature when they do not have time to leave campus. Many studies have examined the potential benefits of viewing nature while inside, and college campuses may be a natural setting to apply this (Jo et al., 2019).

Overall, participants memories about which session(s) decreased stress, increased happiness, and increased connection to nature agreed with their assessments during the sessions. However, participants remembered the safari session decreasing stress even though this was not indicated by the before and after self-assessments during the individual sessions. Virtual tourists likely benefit from remembering a positive effect even if they did not report that effect at the time. Remembering an incident in a positive light may have a more long-term benefits than a more temporary assessment of something as positive (Jorgenson et al., 2019; Kahneman, 2011). Autobiographical memory, including memories of experiences, has a significant effect on the decision-making process (Conway & Pleydell-Pearce, 2000; Jorgenson et al., 2019; Kuwabara & Pillemer, 2010). Thus, positive memories associated with a virtual tourism experience could influence future behaviors and, in this case, the positive memory of the two nature sessions could lead to an increase in conservation behaviors while the positive memory of the urban tour could lead to support for the preservation of urban landmarks (J. H. Kim, 2018).

As the popularity of virtual tourism continues to increase, it is important for evaluation tools to be refined in order to ensure that virtual tour providers can effectively gauge the impact of their tours on participants (J. Li et al., 2022). Virtual tourism can provide an alternative escape from daily life and stressors for individuals who are unable to travel. Our study found that all virtual tourism sessions resulted in a significant drop in physiological stress levels among participants. One possible explanation for this may be that participants were viewing the sessions

without engaging in other potential distractions, such as using their phones, which may have allowed them to fully immerse themselves in the experience and take a break from other worries. The opportunity to sit and watch a virtual tourism experience provided participants with a brief escape from daily stressors.

Moreover, our virtual nature tourism sessions provided the additional advantage of increasing self-reported connection to nature. While guided virtual tourism likely provides additional educational benefits, the unguided session (webcam) was the only session resulting in a significant decrease in self-reported stress. This suggests that virtual nature tourism can be an effective tool for promoting pro-environmental behaviors, stress reduction, and well-being. The webcam session was able to facilitate this connection to nature using the relatively low-cost option of streaming footage with an unmanned camera. It also makes it clear that this type of connection to nature in a virtual nature tourism format does not require an exotic or faraway location to benefit participants.

Therefore, this study highlights the potential benefits of virtual tourism as an alternative form of escapism and stress reduction. Additionally, it suggests that virtual wildlife tourism and unguided nature sessions can have a greater impact on self-reported stress and connection to nature than other virtual tourism experiences. Therefore, virtual nature tourism can be an effective tool for promoting pro-environmental behaviors and well-being.

Limitations and future directions

The sample size was limited, though statically significant. A larger sample size that included individuals outside of the Kansas State University student population may have provided a wider range of responses. This study was also limited in scope because it only compared virtual tourism with an educational and/or nature component. While this limitation was important for narrowing down what we were comparing, it would be interesting to contrast

these types of virtual tourism with general television programming without an educational or nature component. The length of sessions likely impacts resulting stress recovery (Suppakittpaisarn et al., 2022). Optimizing the length of experience for desired impact (stress, happiness, connection to nature, or memory of impact) would add more depth to the results.

In addition to broadening the scope of the study, future research could explore why the memory of experience was different than self-reported experiences at the time. Also, while all three types of virtual tourism had a positive impact on stress, happiness, or connection to nature, none had a positive impact on all three. Future research could delve into which combination of elements would create a virtual tourism experience that could positively impact all three.

In conclusion, virtual tourism can provide a variety of benefits to participants including decreasing stress levels, increasing happiness, and increasing connection to nature. In addition to the decrease in stress level at the time of participation in virtual tourism, participants may continue to benefit from the experience when they remember it as a positive experience.

Chapter 3 - Motivations for participation in virtual wildlife tourism (Mpala)

Abstract

This study examines the connection to nature that individuals can experience through viewing African wildlife webcams. Through anonymous surveys, it was found that viewing these webcams led to increased knowledge and appreciation of the animals and their habitats, as well as a sense of connectedness to the natural world. Additionally, viewing the webcams serves as a form of virtual nature tourism, providing a means for individuals to experience the beauty of Africa's wildlife without causing harm to the animals or their habitats. The study highlights the potential of technology to serve as a tool for conservation and education, as well as for personal well-being.

Introduction

Tourism, including wildlife tourism, is growing (Moorhouse et al., 2015). Virtual tourism is developing to increase outreach and decrease the negative impacts on local "destinations" and wildlife. Additionally, virtual nature tourism's potential benefits include providing opportunities for people to learn about nature that would otherwise be inaccessible due to physical or financial constraints (Loomis et al., 2018). Virtual experiences, such as the Mpala Research Centre webcams on the explore.org platform, are an attractive option for individuals who cannot participate in physical tours for various reasons including travel restrictions, health concerns, and financial constraints (Orru et al., 2019; Karadimitriou, 2020). Even as virtual nature tourism has increased, little is known about participants' motivations and conservation attitudes and beliefs (Jarratt, 2021a; Nadegger, 2021). Knowledge of motivations, attitudes, and beliefs has potential to help optimize nature education for positively impacting viewers' future nature conservation behavior while increasing understanding of the role of webcams in sustainable, virtual tourism.

Motivations for participation in virtual safaris

As the interest in nature tourism grows, virtual experiences are being developed to increase the outreach of nature areas and wildlife reserves (e.g., explore.org). As virtual tourism continued to develop (Srinivasa Rao & Krantz, 2020; Voronkova, 2018), it was able to support African tourism during travel restrictions due to the COVID-19 pandemic (Chirisa et al., 2020). Studies have been conducted on how to best incorporate virtual tours in the marketing of tourist destinations (Cho et al., 2002; Huang, 2011), but less is known about virtual tours as a product. Virtual nature tours provide a solution to the distance barrier when potential tourists have the desire to travel but are unable to do so due to time, physical, or financial constraints (Karadimitriou, 2020). This is particularly relevant during the COVID-19 pandemic which has resulted in virtual tourism providing a potential buffer against economic losses owing to decreased travel in Africa (Chirisa et al., 2020). Virtual tours can also engage viewers by allowing them to interact with guides in real time through online chat features.

Additionally, online wildlife viewing has been found to increase awareness of and interest in conservation (Skibins & Sharp, 2019). Even as virtual nature tourism has increased, little is known about participants' motivations and conservation attitudes and beliefs related to virtual nature tourism. Understanding participants' motives may help tour companies and webcam operators engage their audiences in a manner that increases repeat web visitors. Knowledge of motivations, attitudes and beliefs has the potential to ensure that guides are providing well-targeted nature education to positively impact viewers' future nature conservation behavior (Nelson et al., 2020). Sustainable tourism requires incorporating reliable and relevant information about participants in order to provide experiences that have the potential to increase participants' care for the wildlife and nature shared in tours, as well as greater awareness about the environment in general (Moscardo & Saltzer, 2004; Nelson et al., 2020). An increase in pro-

environmental behavior may serve as a measurable outcome for the success of virtual nature tourism. This information about participants can then be used to tailor virtual nature tourism experiences to better meet the needs and interests of participants, and to increase the potential for these experiences to promote both conservation behaviors and a greater connection to nature. Additionally, incorporating educational components into virtual nature tourism experiences can help to increase participants' awareness about the environment and conservation issues of the area featured (Hofman et al., 2021; Loomis et al., 2018; Yung & Khoo-Lattimore, 2019). Increased awareness can include information about the specific wildlife and habitats featured in the tour, as well as broader environmental issues such as climate change and conservation efforts.

While many studies have examined the motivations and beliefs of participants in nature-based tourism, there remains a knowledge gap in these areas for virtual nature tourism such as webcams. Nature-based tourists have a variety of motivations for traveling, which have been classified into four types of motive trends: experience the environment, rest and relax in pleasant settings, pursue special interests, and for health and fitness (Luo & Deng, 2008). Motivations for participation in virtual nature tours likely overlap with motivations for traditional nature travel including social interaction, an escape from the mundane of daily life, and appreciation for nature (Crompton, 1979; Lee et al., 2014). Virtual tourists may seek to socialize with like-minded individuals through online chat features of webcams. While virtual tourism does not offer physical escape from daily life, it offers a short-term mental escape. Additionally, virtual tourism is likely to satisfy participants motivated by knowledge seeking (Guttentag, 2010).

Participant attitudes, beliefs, and behaviors

Past research has examined how likely nature tourists are to practice conservation behaviors (Larson et al., 2015) and how they view their level of connection to nature and

conservation caring (Nisbet & Zelenski, 2013; Skibins & Powell, 2013). Many studies have found a positive relationship between appreciative recreational activities (e.g., birdwatching and nature photography) and concern for the environment (Teisl & O'Brien, 2003). It is possible the correlations of virtual wildlife tourism are similar to those for appreciative recreation and positively correlated to conservation behaviors, connection to nature, and conservation caring. This study aims to understand participants' perceptions of benefits from viewing, as well as their specific preferences and dislikes, in relation to conservation behaviors, connection to nature, and conservation caring.

Conservation caring, and specifically wildlife tourists feeling a connection to charismatic megafauna, has been linked to increased likelihood to engage in conservation behaviors (Skibins et al., 2013). As a measure of tourists emotional connections to nature, conservation caring is a construct well suited to estimating conservation behaviors (Skibins & Sharp, 2019; Skibins & Powell, 2013). Similarly, connection to nature is well-established as a pathway to increased conservation behaviors (Lumber et al., 2017). Previous studies identified the visual experience of nature as impactful on connection to nature making webcams a promising conduit to increase wildlife tourists' connection to nature (Jarratt, 2021b). Conservation behaviors vary and include joining or donating to NGOs, actively engaging in ecosystem improvements such as planting a wildlife garden, altering consumer behaviors to increase sustainability, and so on (Clark, 2006). Thus, the combined effect of increasing connections to nature, conservation caring, and conservation behaviors may lead to positive effects. These positive effects are possible both locally to wildlife tourists' homes and the location of the webcams (Mpala Research Centre).

Interactional model of wildlife tourism

This study will help identify the benefits and outcomes of virtual wildlife tourism in the framework of an interactional model (Fig. 3.1). Interactional models of nature tourism allow

researchers to consider how outcomes of experiences, particularly in terms of impacts on participants, are related to inputs (participant characteristics) and outputs (experience characteristic) along with the interactions of inputs and outputs (Cajiao et al., 2022; Powell et al., 2009). This interactional framework could be applied to develop a wildlife tourism model. Wildlife tourism encompasses a diverse range of participants and experiences including wildlife webcams such as MpalaLive. Understanding how participant characteristics (e.g., demographics and motivations) interact with experience characteristics (e.g., type of activity and quality) to influence changes in values and behaviors of participants has the potential to be used in informing best practices to achieve the desired results.

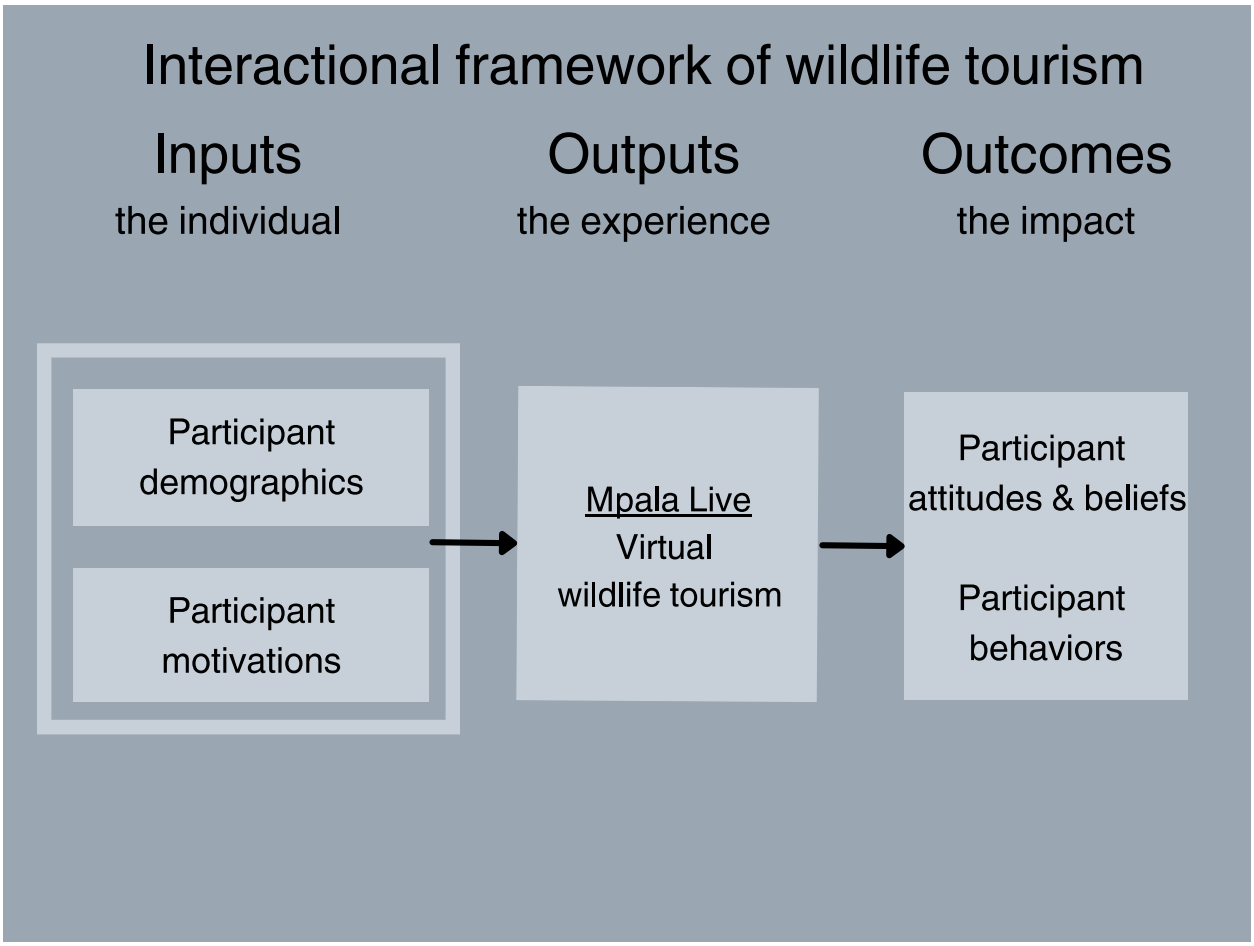

Figure 3.1. The interactional framework of wildlife tourism applied to MpalaLive

Objectives

In short, wildlife tourism is out of reach for many people and can be detrimental to local wildlife and destinations. Webcams may offer an alternative to travel, while providing some of the benefits of nature tourism, including economic benefits to conservation and webcam hosts, and meeting the motivations of traditional nature tourists. During this study, we surveyed virtual African webcam viewers to learn more about their experiences and motivations for participating in virtual wildlife tourism, along with how their attitudes, beliefs, and behaviors compared to those of traditional nature tour participants. We aimed to understand the role of multispecies wildlife webcams in nature tourism, conservation outreach, and habitat protection. We hypothesize that viewing African wildlife webcam footage, similar to traditional travel, is motivated by appreciation for nature, social interaction, and a desire to escape the mundane. We also hypothesized that participants would have high levels of environmental concern (conservation caring and connection to nature), and that conservation behaviors are likely to increase with time spent viewing webcam footage.

Methods

Site

Explore.org is a multimedia organization that provides live webcams and video content from locations around the world to promote environmental awareness and conservation. The organization was founded in 2005 by philanthropist Charles Annenberg Weingarten with the goal of using media to inspire people to make a difference in the world. Explore.org has a variety of live webcams that allow users to watch live footage of wildlife and natural landscapes, as well as educational videos and documentaries on a variety of environmental topics. The organization also supports a number of conservation and research projects, and partners with other organizations to promote environmental awareness and conservation efforts. Explore.org's

partnership with Mpala Research Centre includes the platform for live streaming called MpalaLive which allows users to explore the wilds of Africa from the comfort of their own home. It is a live streaming platform that offers real-time views of multiple species of wildlife and their habitats in the Mpala Research Centre and Conservancy in Kenya. Users can watch live footage of animals such as elephants, lions, and giraffes, as well as learn about the research and conservation efforts being carried out at the Mpala Research Centre.

Explore.org offers a large collection of live webcams. MpalaLive was selected for this study because it does not focus on a specific species so viewers are likely to observe a variety of species each time they visit the site. This provides a contrast to some previous studies of wildlife webcams which targeted viewers of specific species (e.g., eagles, brown bears). This study explored what draws viewers to a webcam where they have the opportunity to be surprised by the species in view and are less likely to recognize individual animals. This may impact the connection the participant feels to the animals.

Survey

After obtaining an IRB exemption (KSU protocol #IRB-10624; Appendix A), an anonymous link to an online questionnaire in Qualtrics was posted to the Mpala Live explore.org webcam pages from January through April 2022. While the number of annual viewers is unknown, the researcher chose a target sample size of 246 based on a population of 1 million for a 95% confidence interval, ± 5% sampling error, and a 80/20 split (Vaske, 1999). The questionnaire collected information about the participants demographics, background, and viewing habits, as well as their attitudes, beliefs and behaviors (Appendix A). Five motivations of virtual wildlife tourists were measured: reward and escape as utilitarian functions, building personal relationships and nature appreciation as knowledge functions, and an ego-defensive function (Lee et al., 2014). Additionally, participants were asked to write the most important

reason they decided to view Mpala.org. The inclination to participate in three specific conservation behaviors was measured, and participants were asked if that behavior had changed since participating in a virtual safari (Larson et al., 2015). Participants' sense of connection to nature was measured using three items (Nisbet & Zelenski, 2013) and conservation caring was measured using seven items (Skibins & Powell, 2013). Participants' demographics were collected, and four open-ended questions were asked concerning their perceived benefits, likes, and dislikes from the viewing the African wildlife webcams.

Statistical analysis

Internal consistency reliability was estimated using Cronbach's alpha (Gliem & Gliem, 2003) for the motivational functions, connection to nature, and conservation caring scales with reliability assumed for a value greater than 0.70 (Vaske, 1999). Backwards stepwise linear regression (VCE ROBUST) was used to identify possible predictors of the three wildlife tourism outcomes: conservation behaviors, conservation caring, and connection to nature. For each of the dependent variables, independent variables in the full model included the inputs demographics (age, gender, country, income, education) and motivations (reward, relationship, escape, nature) along with the outputs of the experience (session length, number of years viewing, frequency of viewing, device viewed on). At each step, variables were eliminated based on a p-value, and inclusion in the final model was based on a p-value threshold of 0.05. We tested for collinearity using variance inflation factor (VIF).

Results

Demographics

Participants (514 partial and 325 completed questionnaires) ranged in age from 20 to 84 (Table 3.1). Over three-quarters (76.9%) of participants identified as female and 58.7% have completed a graduate degree (MS, PhD, MD, Esq., etc.). Most participants estimated their income level to be average (44.5%) or slightly above average (28.1%) for the region where they

live (Table 3.1). Participants were from 23 countries with the majority from the US (71.5%, Fig.3.2).

Table 3.1. Demographics (age and relative income) of participants

Demographic	Range	Reponses (%)
Age	20-24	7 (2.3%)
	25-29	5 (1.6%)
	30-34	12 (3.9%)
	35-39	18 (5.9%)
	40-44	16 (5.2%)
	45-49	18 (5.9%)
	50-54	33 (10.9%)
	55-59	41 (13.5%)
	60-64	52 (17.1%)
	65-69	39 (12.8%)
	70-74	38 (12.5%)
	75-79	19 (6.2%)
	80-84	6 (1.9%)
Relative Income	Well below average	22 (7.1%)
	Slightly below average	41 (13.2%)
	Average	138 (44.5%)
	Slightly above average	87 (28.1%)
	Well above average	22 (7.1%)

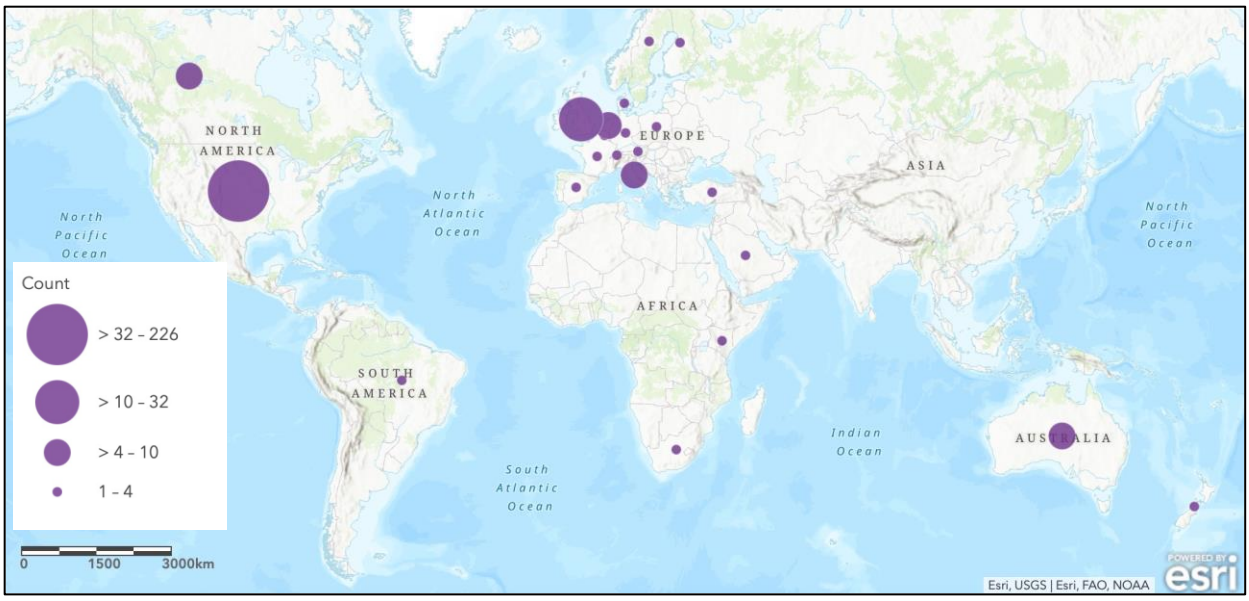

Figure 3.2. Map of the locations of participants. Countries with participants are marked by a purple circle with the size of the circle representing the number of participants.

Viewing habits

The majority reported they began watching MpalaLive.org within the last 1-4 years (61.1%) with 20.6% watching for <1 year and 18.3% watching for 5-8 years. Most participants watch MpalaLive.org daily (52.0%) followed by a few times each week (31.7%) and a few times each month (8.0%) with other watching monthly to less than once a year. Viewing has increased since the start of the COVID-19 pandemic with 27.8% reporting the did not view MpalaLive.org before the pandemic and 26.0% reporting they watch more frequently since the beginning of the pandemic. Only 2.6% reporting decreased viewing since the pandemic and 43.6% reported no change in viewing habits. Typical viewing session length ranged from less than 1 hour (60.0%), 1-2 hours (27.1%), 2-3 hours (6.5%), 3-4 hours (1.5%), to over 4 hours (4.9%). Most participants (63.1%) reported viewing MpalaLive.org actively as the focus of their attention while 36.9% reported viewing MpalaLive.org passively while completing other activities. MpalaLive.org is most frequently viewed on a computer monitor or laptop (35.8% and 34.3%, respectively). In response to the question “What about MpalaLive.org could be improved?”, 33% of the 200 participants who wrote something answered they like it as it is (Fig. 3.3). Other responses

concerned a desire for more camera sites (16%), improved image or sound quality (15% and 9%, respectively), and more outreach and interpretation (11%).

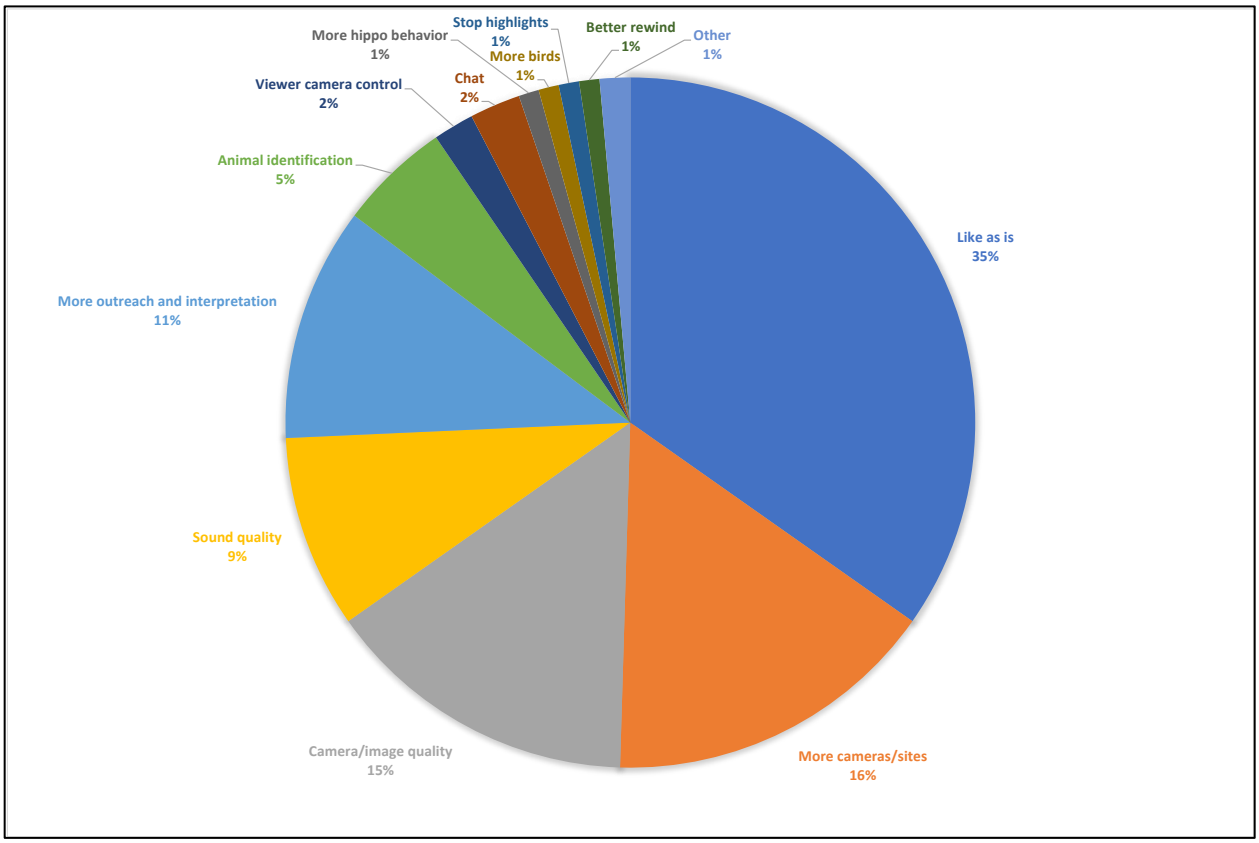

Figure 3.3. Participants were asked, "What about MpalaLive.org could be improved?" Answers from 200 respondents were grouped into 14 categories. Three categories with only one occurrence have been pooled together into "other".

Motivations

Of the motivations measured, viewers reported being most motivated to watch MpalaLive by nature appreciation and least motivated by the potential to build personal relationships (Table 3.2). Participants had the highest consensus regarding the importance of the following as motivations to view MpalaLive: to feel close to nature, to gain a better appreciation of nature, to learn more about nature, and to experience new things. Participants wrote in responses to the question "What is the most important reason to you when deciding to view MpalaLive.org?" and 32% responded with a statement related to the opportunity to see wildlife in their natural habitat

(Table 3.3). Other responses included a general interest in learning (13%), the opportunity to view another part of the world (9%), and the appreciation of nature (8%).

Table 3.2. Respondents' ratings of importance of motivational factors when deciding to view Mpala webcams on a scale of -2 (not at all important) to 2 (very important). The number of responses, mean response value, standard deviation, and rating of PCI_2 values are included where PCI_2 values provide a rating of consensus with 0 being total consensus and 1 being highest potential for conflict or disagreement among respondents based on a bilateral scale and a power of 2.

Motivation category	Statement	Responses (n)	Mean (± stdev)	PCI_2 power 2	Cronbach's Alpha
Utilitarian function: reward	To experience new things	366	0.86 (± 0.98)	0.09	0.74
	To develop my personal interests	363	0.64 (± 1.07)	0.12	
	To create good memories	363	0.37 (± 1.21)	0.19	
	To have fun	361	0.77 (± 1.07)	0.13	
Knowledge function: building personal relationships	To meet people with similar interests	364	-1.23 (± 1.10)	0.16	0.78
	To share an exciting experience with others	362	-0.64 (± 1.33)	0.26	
Utilitarian function: escape	To take a break from crowds of people	363	-0.41 (± 1.51)	0.40	0.85
	To be away from daily stress	365	0.72 (± 1.30)	0.27	
	To escape from routine	363	0.31 (± 1.42)	0.34	

Knowledge function: nature appreciation	To feel close to nature	366	1.48 (± 0.80)	0.05	0.86
	To gain a better appreciation of nature	363	1.48 (± 0.78)	0.05	
	To learn more about wildlife and nature	365	1.55 (± 0.75)	0.05	
Utilitarian: contribution	To contribute to global wildlife conservation efforts	365	0.71 (± 1.21)	0.20	0.93
	To support research efforts	363	0.60 (± 1.22)	0.20	
Safety or convenience	To enjoy a safe and convenient safari experience	359	0.66 (± 1.30)	0.26	

Table 3.3. Participants were given the opportunity to write-in the answer to the question "What is the most important reason to you when deciding to view MpalaLive.org?" The 248 responses were categorized into 14 themes with each theme having at least 2 comments. Some comments included more than one theme.

Most important reason for viewing	Number of comments
Wildlife in habitat	141
Knowledge/Interest	58
See another part of the world	41
General nature	33
Live footage	32
Relax	30
Exotic animals	27
Escape	21
Love animals	16
Nostalgia/Revisit Africa	15
Routine/Ritual	10
Existential	10
Hippos	4
God's creation	2

Participant attitudes and beliefs

Participants reported having high levels of conservation caring and connection to nature and strongly agreed that wildlife should be conserved for future generations (Table 3.4).

Table 3.4. Results from Connection to Nature, Conservation Caring, and Wildlife Value Orientation questions. Five-point scale: -2 Strongly disagree, -1 Somewhat disagree, 0 Neither agree nor disagree, 1 Somewhat agree, 2 Strongly agree. Also included is a rating of PCI_2 values, where PCI_2 values provide a rating of consensus with 0 being total consensus and 1 being highest potential for conflict or disagreement among respondents based on a bilateral scale and a power of 2.

Scale	Statement	Responses (n)	Mean (± stdev)	Cronbach's Alpha
Connection to nature	I always think about how my actions affect the environment.	330	1.12 (± 0.80)	0.80
	My relationship to nature is an important part of who I am.	329	1.47 (± 0.76)	
	I feel very connected to all living things and earth.	328	1.35 (± 0.82)	
Conservation caring	I am deeply concerned about the well-being of the animals I see on MpalaLive.org	329	1.16 (± 1.06)	0.82
	I need to learn everything I can about the animals I see on	330	0.76 (± 1.00)	

	MpalaLive.org		
	Wildlife conservation is very important to me	330	1.54 (± 0.68)
	Wildlife protection should be one of society's highest priority	329	1.53 (± 0.77)
	Wildlife should be conserved for future generations	330	1.84 (± 0.53)
	I feel a special connection to the places I have seen while watching MpalaLive.org	330	1.32 (± 0.83)
	The places I have seen while watching MpalaLive.org mean a lot to me	327	1.33 (± 0.85)
Wildlife value orientation (utilitarian)	The needs of humans should take priority over fish and wildlife protection	330	-0.69 (±1.23)

Viewing correlations

Of 330 responses, 76.1% (251) reported an increased connection to Africa since viewing MpalaLive.org and of 329, 57/1% (188) reported an increase in the amount they care about wildlife conservation. No one reported a decrease. A total of 20.7% (68 of 260) have participated in a live safari. Reported likelihood of participating in a live safari was distributed across the following categories: extremely unlikely (18.6%, 61 of 328), unlikely (20.4%, 67 of 328), not sure (27.1%, 89), likely (15.6%, 52), and extremely likely (18.0%, 59). Likelihood to participate in a live safari since viewing Mpala has decreased for 7.7% (25/326), not changed for 53.4% (174/326), and increased for 38.9% (127/326) of respondents. Pertaining to conservation behaviors, most participants reported being likely or extremely likely to donate money to support wildlife conservation causes (60.1%), educate others about wildlife conservation issues (73.5%), and alter their own lifestyle and behavior to help wildlife and the global environment (71.9%). Many reported an increased likelihood of engaging in conservation behaviors and no one reported a decreased likelihood (Table 3.5).

Table 3.5. Participants reported how likely they were to participate in three conservation behaviors on a scale of 1 to 5 with 1 being extremely unlikely and 5 being extremely likely. No one reported a decrease in conservation behavior after viewing MpalaLive.org.

Item	Respondents (n)	Mean (±SD)	After Mpala increase	After Mpala no change
Donate money to support wildlife conservation causes	356	3.63 (± 0.98)	32.6%	67.4%
Educate others about wildlife conservation issues	356	3.87 (± 0.95)	43.5%	56.5%
Alter lifestyle and behavior to help wildlife and the global environment	356	3.88 (± 0.94)	42.1%	57.9%

Interactive model of virtual wildlife tourism

We examined correlations of virtual wildlife tourists' attitudes, beliefs, and behaviors with experience, in this case viewers of MpalaLive webcams, using predictive models based on the interactional model of nature tourism (Powell et al., 2009). Based on p-values, the best models for describing the factors correlating with participants conservation behavior, connection to nature, and conservation caring were selected (Table 3.6). Demographics (country and age) were included variables in the final model for conservation behavior. All three selected final models included some combination of viewing habits and motivations (Table 3.6).

Table 3.6. Linear regression selected interactive models of virtual wildlife tourism based on lowest p-value threshold.

Dependent Variable	Independent variables	F	R_2	Mean VIF
Conservation behavior	Country, Age, Viewing Session Length, Motivation Nature, Motivation	(4, 296) = 20.17	0.23	1.06

	Relationship			
Connection to nature	Years of viewing, Motivation nature, motivation escape, motivation reward, motivation relationship	(5, 305) = 15.75	0.24	1.25
Conservation caring	Frequency of viewing, motivation reward, motivation nature, motivation relationship	(4,308) = 33.33	0.28	1.24

Discussion

Viewers of MpalaLive generally have high levels of conservation caring, a connection to nature, and intentions to engage in conservation behaviors. Our hypothesis that viewing live Mpala Research Centre webcam footage, similarly to traditional travel, is motivated by appreciation for nature and a desire to escape the mundane was supported based on the positive scores by participants in those motivational categories. Our other hypothesis was also supported as participants rated themselves as having high levels of environmental concern and many reported their conservation behaviors had increased with time spent viewing MpalaLive footage.

A small number of participants specified viewing MpalaLive to see a specific species of wildlife (1% hippos), but many more were interested in viewing wildlife in its natural habitat and learning about unfamiliar species (Table 3.3). This may indicate that viewers of MpalaLive have different motivations than viewers of other cams on explore.org (e.g. bears at Katmai National Park), many of whom are interested in viewing specific species (Skibins & Sharp, 2019). However, viewers of MpalaLive are similar to the viewers of other cams in that there were high levels of conservation caring and indicated a willingness to alter their own behavior to benefit

the wildlife they view (Skibins & Sharp, 2019). MpalaLive viewers were similar to viewers of an eagles' nest webcam in that both groups indicated knowledge and learning about wildlife as a reason for viewing. A high percentage of eagle webcam viewers (79.88%) indicated feeling connected to the eagles as a reason for viewing (Johnson-Pynn & Carleton, 2019).

Beyond the connection viewers mentioned feeling with the wildlife, the interactional models of virtual wildlife tourism highlighted some patterns in what inputs and outputs correlate with connection to nature, conservation caring, and conservation behaviors. In this study, demographics (country of residence and age) were significantly correlated with conservation behaviors, but relative income and education level were not significant factors in any of the three models examined. Previous studies have noted a positive correlation in income and education with mutualism wildlife values, sometimes interpreted as an increased social connectedness with wildlife (Manfredo et al., 2020). Participants in this study had high ratings of connection to nature and conservation caring. These findings indicate income and education may not be important factors in shaping the impacts of virtual wildlife tourism. While age and country of origin were significantly linked to the likelihood to engage in conservation behaviors, these demographic items may be more related to social norms and the example conservation behaviors included in the questionnaire.

What was highlighted by the interactional models of virtual wildlife tourism is the potential significance of participant motivations and the exposure to the webcams (time and frequency) in relation to conservation behaviors, connection to nature, and conservation caring (Table 3.6). This revealed the importance of motivations and viewing habits of participants when designing programming with specific impacts in mind. These results demonstrated the potential dependence of the impact of a virtual wildlife tourism experience on the combination of the individual motivations and several factors of the experience itself. Webcams give the flexibility

for participants to control more of the experience (e.g., frequency of viewing, length of session) without the financial or temporal confines of physical travel. The knowledge motivation of appreciation for nature was significant for all three models perhaps confirming a common assumption that tourists with these motivations are more likely to be positively impacted by a wildlife tourism experience towards increases in these three areas. It is encouraging that virtual wildlife tourism has these potential impacts with fewer financial and physical barriers of many traditional tourism experiences. Virtual wildlife tourism through webcam viewing is able to provide a higher frequency of experiences for participants. Some respondents reported they tune in daily as an escape from the workday or home stressors driving home the important service explore.org and MpalaLive are bringing to the lives of their international audience. While headlines often warn that technology is disconnecting people from nature, this appears to be an exception where webcams may be the most accessible option for many to feel connected to nature and wildlife more often than would be possible otherwise.

We did not ask specifically about connecting to the wildlife, but MpalaLive viewers did indicate feeling close to nature is an important motivation for viewing. Results of this study suggests viewers of webcams with many species experience motivations and conservation caring like webcam viewers of single species with both formats resulting in positive impacts on viewers' intentions to engage in conservation behaviors. This study reveals the importance of considering participants' motivations and viewing habits when designing virtual wildlife tourism programming with specific impacts in mind. By understanding the factors that influence participants' behaviors and attitudes towards nature conservation, virtual wildlife tourism providers can design experiences that more effectively promote conservation behaviors and a greater connection to nature.

Limitations

Study limitations were included potential bias, short timeframe, and a language barrier. The survey respondents were limited to Mpala wildlife webcam viewers who chose to voluntarily participate in the survey. As a result, the survey results may not be representative of the larger population. The survey data is self-reported and may be subject to recall bias, social desirability bias, and other forms of response bias. Additionally, respondents may have provided inaccurate information intentionally or unintentionally. The survey was only available for three months, which may have limited the number of responses and potentially biased the results. Furthermore, the limited time frame may not have allowed for seasonal variations in wildlife viewing behavior to be adequately captured. While the anonymous nature of the survey was intended to encourage honest responses, it also meant that the researchers were unable to verify the identity of the respondents or follow up with additional questions. The survey was only available in English, which may have excluded non-English speaking respondents and potentially introduced language barriers for some participants. As the survey was conducted online, respondents were required to have internet access, potentially limiting the participation of individuals who lacked internet access or digital literacy.

Future directions

Future studies should explore how virtual wildlife tourism fits within an interactional model of wildlife tourism and how different combinations of participant motivations, demographics, and characteristics of the virtual experiences interact to produce changes in participants' behaviors and sense of connection to the wildlife they view. This can include exploring how participant motivations, such as a desire for escapism or a desire to learn about wildlife, interact with the features of the virtual experiences, such as the type of webcam or device used, the location of the webcam, and the guided or unguided nature of the virtual tour, to affect their behaviors and connection to nature.

Additionally, demographic factors such as age, gender, and previous wildlife tourism experience should also be considered in future studies as they have been shown to influence tourists' motivations and behaviors related to wildlife tourism. By considering these interactions and factors, future studies will be able to provide a more comprehensive understanding of the impact of virtual wildlife tourism and how to best design virtual experiences that promote conservation behaviors and a greater connection to nature.

Other concepts worth investigating are the role of social media in virtual nature tourism, specifically how virtual nature tourism experiences shared on social media influence participants' motivations to engage in virtual nature tourism and their conservation attitudes and behaviors, and an assessment of the effectiveness of virtual nature tourism as an educational tool, for example, examining the impact of virtual nature tourism experiences on participants' knowledge of conservation and their understanding of the issues facing natural environments. Moreover, it would be interesting to explore the long-term effects of virtual wildlife tourism, such as whether the connection to nature and conservation behaviors that are established during the virtual experience persist after the experience is over.

Summary

This study provides valuable insights into the motivations and behaviors of MpalaLive webcam viewers and the potential impact of virtual nature tourism on conservation efforts. The findings suggest that watching live webcam footage has a profound impact on viewers, connecting them to nature and evoking a strong sense of conservation caring. This connection to nature, in turn, leads to an increased intention to engage in conservation behaviors. The study supported the hypothesis that the appeal of virtual nature tourism lies in its ability to offer a connection to nature, social interaction, and a much-needed escape from the mundane. It also supported the findings of Skibins and Sharp (2019) that webcams increase the opportunity for

people to feel more connected to places and wildlife through the higher number of hours they can spend viewing the webcams compared to the often more limited time spent people have available to spend outside in these locations. Over 80% of respondents reported visiting the webcam site multiple times per week. Tourists to exotic locations may have only a few hours total at the site while webcam viewers can visit daily.

The results also indicate that MpalaLive viewers are interested in viewing wildlife in its natural habitat and learning about unfamiliar species, which may set them apart from viewers of other webcams that focus on specific species. This finding highlights the importance of considering the specific motivations and behaviors of webcam viewers when designing and promoting virtual nature tourism experiences.

The study's results also suggest that both webcams with many species and those with a single species can have a positive impact on viewers' conservation behavior intentions. This highlights the potential for virtual ecotourism to make a meaningful contribution to conservation efforts, regardless of the type or focus of the webcam.

In conclusion, this study makes a significant contribution to the growing body of research on virtual nature tourism and underscores the importance of understanding the motivations and behaviors of webcam viewers in the context of conservation and education. By providing insights into the potential benefits of virtual nature tourism, this study can inform future research and support the development of effective strategies for promoting conservation and education through virtual experiences.

Chapter 4 - Sharing the trail: Effect of outdoor recreation on mammal communities

To be submitted to: Human-Wildlife Interactions

Abstract

This study examines the impact of outdoor recreation frequency and type on the assemblage of mammals on trails and roads in a national forest. Trail cameras were placed at various locations along a network of trails and roads to capture images of mammals in their natural habitats. Data was collected over four seasons (12 months) and analyzed to determine the relationship between outdoor recreation frequency and type, and the presence and diversity of mammal species. Results indicate that there may not be a significant impact of outdoor recreation frequency and type on the assemblage of mammals on trails and roads in Carson National Forest at the current outdoor recreation tourist levels. However, it was found that areas with higher levels of non-motorized outdoor recreation activity (such as hiking, skiing, and mountain biking) had fewer ungulate detections than areas with lower levels of non-motorized activity. The results of this study provide important information for the management of national forests and other protected areas and can inform decisions on trail and road construction and maintenance, as well as educational campaigns to raise awareness of the impacts of outdoor recreation on wildlife.

Introduction

Outdoor recreation can negatively impact wildlife communities, though it is unclear how various types of recreation impact mammal assemblages. For a large portion of the history of the National Park Service (NPS) in the United States (US), protection of wildlife and the ecosystem within National Parks was secondary to recreational tourism (Lunney, 2017). Support for

National Parks, both political and financial, depends on visitation which can illicit ne negative environmental impacts (Wolf et al., 2019). Understanding these impacts, including effects on wildlife populations, is key to balancing management of both visitors and protected natural resources.

While many studies examined potential impacts of recreation on wildlife populations, most were confined to one or two types of recreation during a single season and limited to assessing impacts on a single species (Knight et al., 1995). Recreational and seasonal effects on tmammal communities are is poorly understood (Larson et al., 2016). Some taxa may be more sensitive to human disturbance than others, thought how sensitivities vary between species and recreational activities within a protected area is unclear (Larm et al., 2021; Muhly et al., 2011; Wolf & Croft, 2012). The main research question this study addresses is: How do outdoor recreation activities affect the assemblage of mammals in the vicinity of the activities? The author compared mammals detected near multiple activities with varying intensities. This includes a skiing and mountain biking area, nonmotorized multiuse trails with high use (multiple groups of hikers/day), nonmotorized multiuse trails with low use (<1 group of hikers/day), off-road vehicle trails, areas open and closed to hunting, and unimproved private property with no outdoor recreation which all occur in the same ecosystem within and near Carson National Forest.

Impacts of recreation on wildlife

Knowing how mammal communities are affected by different recreational activities could inform management decisions by improving predictions of indirect impacts of those activities on the landscape. For example, ungulate densities can increase in areas with increased human activity likely because human activity provides refuge from predation (Lesmerises et al., 2017). Additionally, predators will avoid areas with greater human activity though prey species

prey species in these areas may be more abundant (Muhly et al., 2011). When this increased density leads to increased browsing or grazing pressure in concentrated areas, it can compound the impact of the human activities and result in decreased habitat quality for multiple species (Beschta & Ripple, 2012; Yovovich et al., 2021). If this is occurring, managers can consider options of concentrating visitor activities to limit the region of intense habitat change, implement periodic ungulate exclosures in highly impacted areas to allow the plant communities to readjust, or periodically close trails/activities to humans to stop them from serving as a refuge from predators and redisperse the herbivores. Another study found prey species were more likely to avoid humans than coyotes and avoidance of humans increased when they were accompanied by dogs (Parsons et al., 2016). This study emphasizes the importance of considering a protected area's mammal populations in the decision of when and how (e.g., leashed) domestic dogs will be permitted on trails.

The goal of outdoor recreationist is generally not to disturb wildlife (Curtin, 2010; Curtin & Kragh, 2014), and many show high conservation caring (Teisl & O'Brien, 2003). By collecting data on the bigger picture of outdoor recreation activities' impacts on mammals, managers can design more effective educational materials that tell visitors a more complete story and help recreationists understand how they can improve their experience while minimizing the potential for negative impacts of their specific activity. For example, mule deer had a shorter distance to alertness and flight in response to mountain bikers than hikers (Taylor & Knight, 2003). This could be because mountain bikers move more quickly through the landscape and can be quieter than hikers, which gives present animal less of a warning time to flee. This could increase human-wildlife conflicts for bikers. If this is the case, managers could advise bikers to equip their bikes with a noisemaker to serve as an alert system to wildlife or design biking areas so that wildlife is more likely to expect fast human activity in the area, which is likely the case in

the designated downhill mountain biking areas. More information is needed to understand how disturbance varies with different types of outdoor recreation tourism.

Studies measuring of disturbance of outdoor recreation tourism on wildlife have also found variations in disturbance within species. The impact of bear viewing has been well-studied and demonstrates the complexity of mode of viewing and the animals. While negative effects have been documented such as aerial brown bear viewing decreasing the number of bears utilizing a salmon stream (Deacy et al., 2019) and humans resulting in a landscape of fear for brown bears (Støen et al., 2015), other studies have documented more varied responses to humans. For example, researchers have found male brown bears to be more sensitive to the presence of humans than female brown bears (Rode et al., 2006). Even more complex is the difficulty in distinguishing between habituation, such as when bears approach humans for food, versus instances of energetic needs overriding a bear's instinct to avoid humans, as is often the case during salmon runs (Herrero et al., 2005).

National Forest Management

Understanding the interface of outdoor recreation and wildlife will inform managers of not only potential human-wildlife conflict, but the design of this study can also inform the management of spatial and seasonal patterns of recreationists in National Forests. This will be important for predicting changes in use patterns as the changing climate further impacts tourism. In many national forest, climate change is predicted to shift the water balance by increasing rain in winter, spring, and fall while winter snowfall decreases leading to more runoff in high elevation recharge zones coupled with increased aridity (Bennett et al., 2020). Carson National Forest is no exception to this predicted shifting pattern. This change not only increases the threat of high intensity wildfires but will also alters patterns in the tourism industry which is an important economic force in many rural regions.

While tourism provides a potentially evergreen income source to the area as opposed to the boom-and-bust nature of their natural resource-based industry (e.g., logging), intense wildfires will interfere with summer tourism and decreased snowfall will negatively impact ski tourism. Understanding outdoor recreation in the area provides one more piece of information to understand the broader impacts of climate change on the economy, and a potentially large segment of the economy in this case.

Another important consideration for the safety of both wildlife and visitors within protected areas concerns road impacts on wildlife. A survey of 106 National Park Service units across the US revealed that over 50% are dealing with transportation at or above capacity and nearly half of surveyed managers believed road-related mortality to wildlife was negatively impacting populations (Ament et al., 2008). This study highlighted the lack of research surrounding the impact of roads on wildlife within protected areas.

Objectives

Nature-based tourism, including outdoor recreation, is beneficial to human health and is important to the local economies, particularly in rural locations that are otherwise dependent on the economic boom and bust cycles of natural resource extraction such as logging (Correia, 2007). The impacts of outdoor recreation on wildlife is a poorly understood topic. This study aimed to understand how a variety of outdoor recreation activities alter the assemblage of mammals in the same ecosystem. This study answers the question how do outdoor recreation activities affect the assemblage of mammals on the same trail/forest road as the activity? The results of this study will inform managers about spatial and seasonal patterns of recreation in Carson National Forest. This is important for predicting changes in use patterns as the changing climate continues to impact protected areas.

Methods

Site

Northern New Mexico is shaped by the southern stretch of the Rocky Mountains known as the Sangre de Cristo range. The area of interest includes land in Colfax and Taos counties known as the Enchanted Circle extending to the Rio Grande River on the west. Elevations range from 6,000 ft by the river to over 13,000 ft. The river valley is primarily semidesert shrubland with sagebrush and as the elevation increases ecosystems shift to conifer woodlands of pinon pine and juniper, then montane forest with large ponderosa pines, thinning out higher to subalpine forest of spruce and fir, and finally alpine tundra near the mountain peaks (DeBuys, 1985). This area of Carson National Forest includes Wheeler Peak Wilderness, Hondo-Columbine Wilderness, and Latir Peak Wilderness.

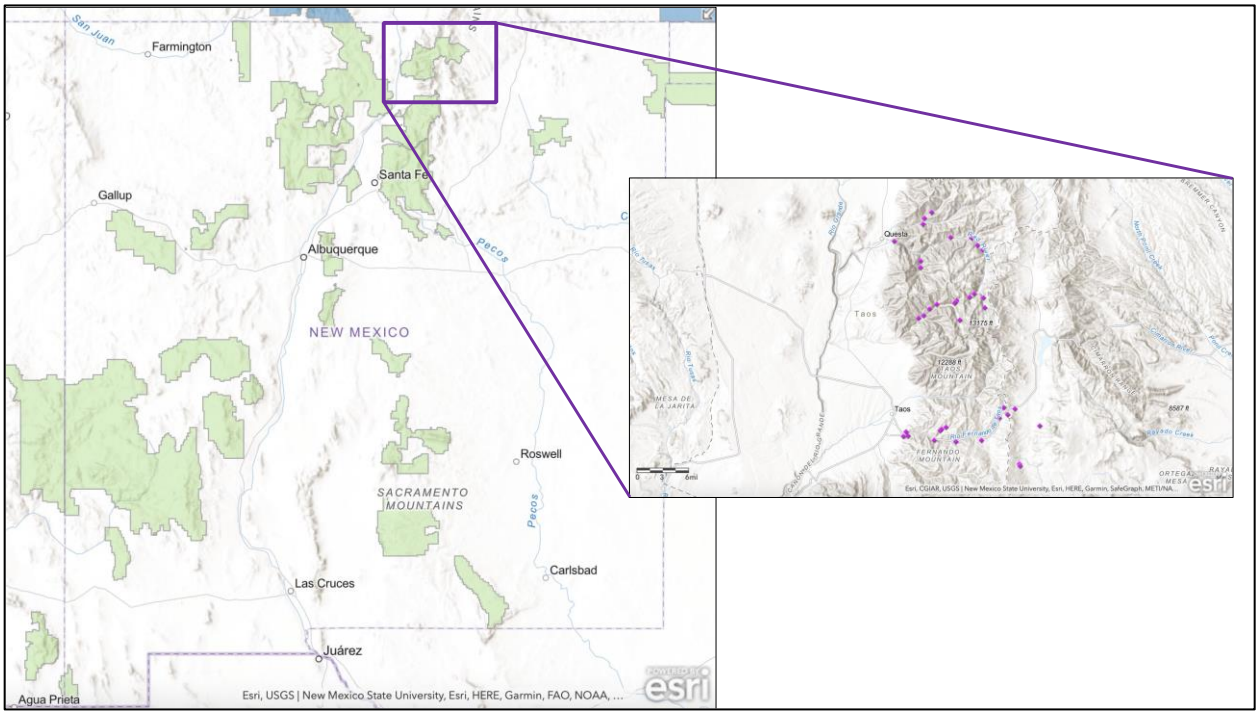

Figure 4.1 Map of New Mexico with US Forest Service land in green and enlarged area showing camera sites in and near Carson National Forest.

Motion-triggered trail cameras in protective lock boxes (Bushnell Trophy Cam HD) were set at 36 sites in Carson National Forest in northern New Mexico, USA (Fig. 4.1) to capture a variety of outdoor recreation uses and species of mammals. Cameras were separated by a mean

Euclidian distance of 25,028 m (SD = 14,751; range = 1111 – 14751 m). Cameras were placed in October 2021 and remained until October 2022. Carson National Forest receives an estimated 1 million visitors/year and trail use is the most popular dispersed recreation activity (*Assessment Report of Ecological, Social, and Economic Conditions, Trends, and Sustainability*, 2015). Sites were all within 7,192 to 10,050 (mean 8471 ± 1515) ft elevation and scrub brush/alpine habitats at either end were avoided to keep camera sites within similar mixed conifer habitat. Sites included rural recreation areas within Carson National Forest with varying use levels including ski and downhill bike runs, along hiking/horse/bike trails, and Off-Highway Vehicles (OHV) sites. The number of sites selected was the total number of accessible trails and forest roads in the target habit within the Questa and Camino Real Ranger Districts. This was considered an acceptable number of sites for our study based on the small decrease in root mean square error for most species observed by Shannon et al. when increasing the number of sites above 30 for a camera study duration of 120 days using occupancy modeling for mammal species (Shannon et al., 2014). Trail cameras were aimed 30 cm height (Fidino et al., 2021) across trail or road to capture human activity and a wide range of mammal species. While direct observation is the most common method used in studies of the impacts of outdoor recreation on terrestrial wildlife, the use of camera traps is growing (Marion et al., 2020). Trails and roads are ideal monitoring locations to examine relative occurrence of wildlife and humans (Muhly et al., 2011) and crucial to this study's focus on trail use. We did not use lure because we wanted to capture the actual use of roads and trails by these mammal species without attracting animals that would usually avoid the trail/road. With this design we were able to focus on mammals using the trails/roads and how that specific use may be impacted with increased human activity. Human activity is likely to only be detected on trails and the detection probability of many species is higher for cameras placed along trails (Reilly et al., 2017). Cameras were checked every three months and images tagged as

they were collected. Permits for this research were secured through Carson National Forest and the project was exempt from KSU IACUC (Appendix A).

Photo analysis

Photos were manually tagged using the free software digiKam because of the ability to quickly apply tags to the photos Exchangeable Image File Format (exif) data and options to check categories for errors (version 7.3.0, www.digikam.org, KDE Community). Exif data includes information about images including the camera settings, date and time, and tags. Tags included species of mammal (or unknown if unidentifiable), type of recreation, count of people if on foot, presence of domestic dogs and if they were leashed or unleased. A complete list of tags is in Table 4.1. After tagging each folder of photos, we used digiKam to review all photos for each tag and check for errors. Photo metadata including the date of photo, time of photo, and applied tags, were compiled into csv files using ExifTool by Phil Harvey (version 12.49, exiftool.org).

Table 4.1. List of detections categories (mammal species, recreation type, domestic animals).

Wild mammals	Photo Count	Recreation	Photo Count	Domestic Animals	Photo Count
Badger, *Taxidea taxus*	1	Off-Highway Vehicle (OHV)	4,292	Cat (feral and leashed)	31
Bear, *Ursus americanus*	124	Bike	1,068	Cattle	335
Bighorn sheep, *Ovis canadensis*	21	Dirt bike	59	Dog	22,395 2,215 off leash
Bobcat, *Lynx rufus*	201	Fishing	228	Goat	3
Mountain cottontail, *Sylvilagus nuttalli*	513	Hiking	81,439 Two: 1,320 Three:55 Four: 31	Horse	898
Coyote, *Canis latrans*	709	Horseback riding	898	Llama	50

Elk, *Cervus canadensis*	1,009	Hunting	167
Gray fox, *Urocyon cinereoargenteus*	314	Skiing	439
Marten, *Martes sp.*	3	Snowmobile	425
Mountain lion, *Puma concolor*	44	Snowshoeing	880
Mule deer, *Odocoileus hemionus*	1,589	Passenger Vehicle	17,342
Porcupine, *Erethizon dorsatum*	7		
Raccoon, *Procyon lotor*	69		
Spotted skunk, *Spilogale gracilis*	1		
Albert's Squirrel, *Sciurus alberti*	76		
Striped skunk, *Mephitis mephitis*	79		
Misc. rodent sp.	89		
Unidentified sp.	130		

Statistical analysis

Most of the statistical analysis was completed in Stata (version 16.1, StataCorp, College Station, Texas). Mixed effects regression was used to analyze variation in the relative frequency of mammal observations summarized as the total number of images per month per site. Fixed effects in the full model included frequency of people, type of recreation, month, and distance from water. Water bodies were identified using the EPA WATERSKMZ Tool (WATERSKMZ v2.0, 9-20-2022, https://www.epa.gov/waterdata/viewing-waters-data-using-google-earth). Distance to nearest water body was measured in Google Earth Pro (v7.3.6.9285, 11-7-2022) as meters from the camera site to the nearest surface water feature (i.e., Stream or Waterbody) in the EPA WATERSKMZ layer. Models included individual site as a random effect to account for

repeated measures. I used the robust Huber/ White sandwich estimator (Huber, 1967; White, 1980) to relax assumptions of normal distribution and homogeneity of variances for mixed-model regressions (Rabe-Hesketh and Skrondal, 2010). Model coefficients were compared with zero using a z test and examined fixed effects with post hoc Wald tests, both at $P < 0.05$. Fixed effects were sequentially removed from the model when coefficients and post hoc tests were not significantly different from zero.

Occupancy modeling was completed in R using the package unmarked (Fiske, 2011). Detection histories were modeled monthly over 12 months and detection covariates included human activity (total number of images per site per month), dogs (total number of images of dogs per site per month) and off leash dogs (total number of images of off leash dogs per site per month). Due to low naïve occupancy for some species, three groups of species (ungulates, mesopredators, and large carnivores) were each modeled using single species occupancy models (Table 4.2). Occupancy modeling was provided as a comparison with the mixed effects linear regression. Due to the low frequency of wildlife detections each month was condensed into a sample. Assumptions of closure were violated as it is known some species migrate seasonally away from some resources and the trails and roads are connected so it is very likely the same individual mountain lion could travel to more than one site within the study during a month.

Table 4.2. List of species included in each species group used for occupancy models.

Ungulates	Mesopredators	Large Carnivores
Bighorn sheep *Ovis canadensis* Elk *Cervus canadensis* Mule deer *Odocoileus hemionus*	Badger *Taxidea taxus* Bobcat *Lynx rufus* Coyote *Canis latrans* Gray fox *Urocyon cinereoargenteus* Marten *Martes sp.* Raccoon *Procyon lotor* Spotted skunk *Spilogale gracilis* Striped skunk *Mephitis mephitis*	Black bear *Ursus americanus* Mountain lion *Puma concolor*

Results

After equipment theft and failure, 31 cameras collected 349,433 photos during a total of 10,062 camera days. Photo tags included 16 species of wild mammals, 10 types of recreation, and 6 species of domestic animals (Table 4.1; Figures 4.2 - 4.6). More photos captured outdoor recreation than mammals (Table 4.1).

44.3

Figure 4.2. Ungulates. Clockwise from top: Elk, Mule Deer, Bighorn Sheep

Figure 4.3. Mesopredators. Clockwise from top left: Coyote, Spotted Skunk, Bobcat (with cottontail), Gray Fox

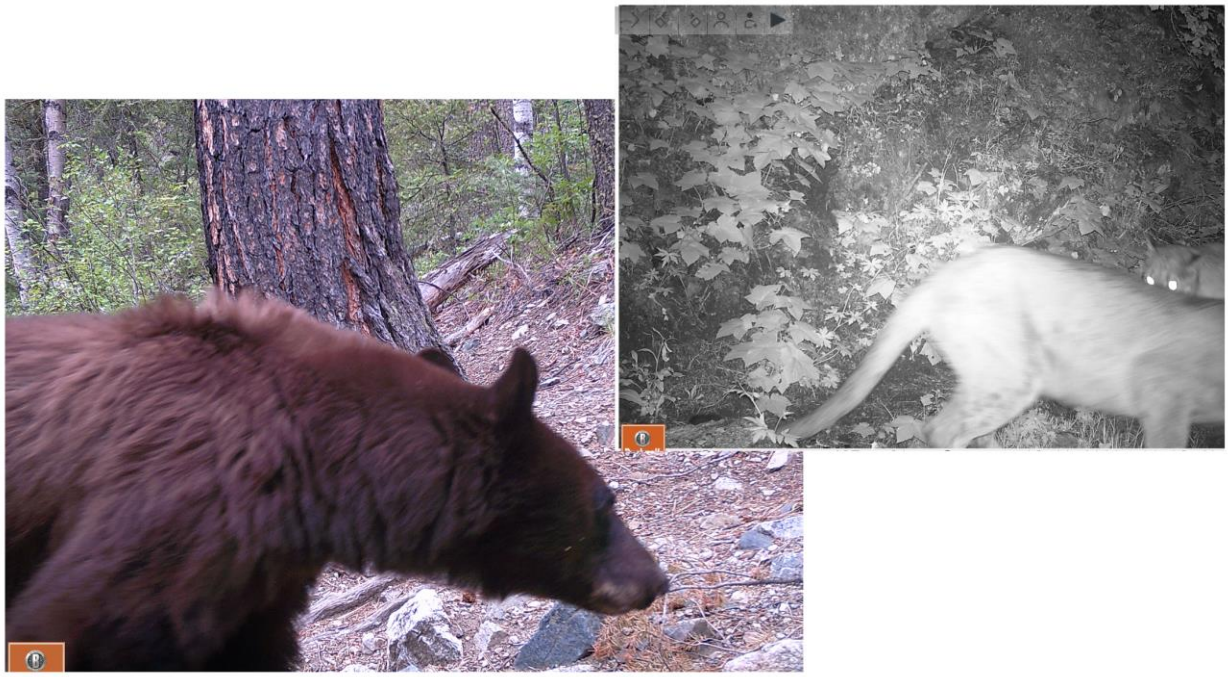

Figure 4.4. Large carnivores. From left: Black Bear, Mountain Lion

Figure 4.5. Outdoor Recreation Tourism. Clockwise from top left: Snowshoeing, Fishing, Off-Highway Vehicle, Biking

Figure 4.6. Domestic Animals. Clockwise from left: Off Leash Dog, Cow, Cat

4748

In general, outdoor recreation in Carson National Forest did not seem to impact which species were using which trails, however, some recreational types did show a slight but statistically significant negative correlation with recreation on trails. The overall trend for monthly mammal activity per site on trails in relation to monthly human activity was a positively correlated ($F = 4.97(1, 317)$, $p = 0.0265$, $R^2 = 0.0154$; Fig. 4.9). While there is a positive correlation of activity spatially, the temporal component suggests humans are most active when ungulates, mesopredators, and large carnivores are not on the trails (Fig. 4.10-4.13)

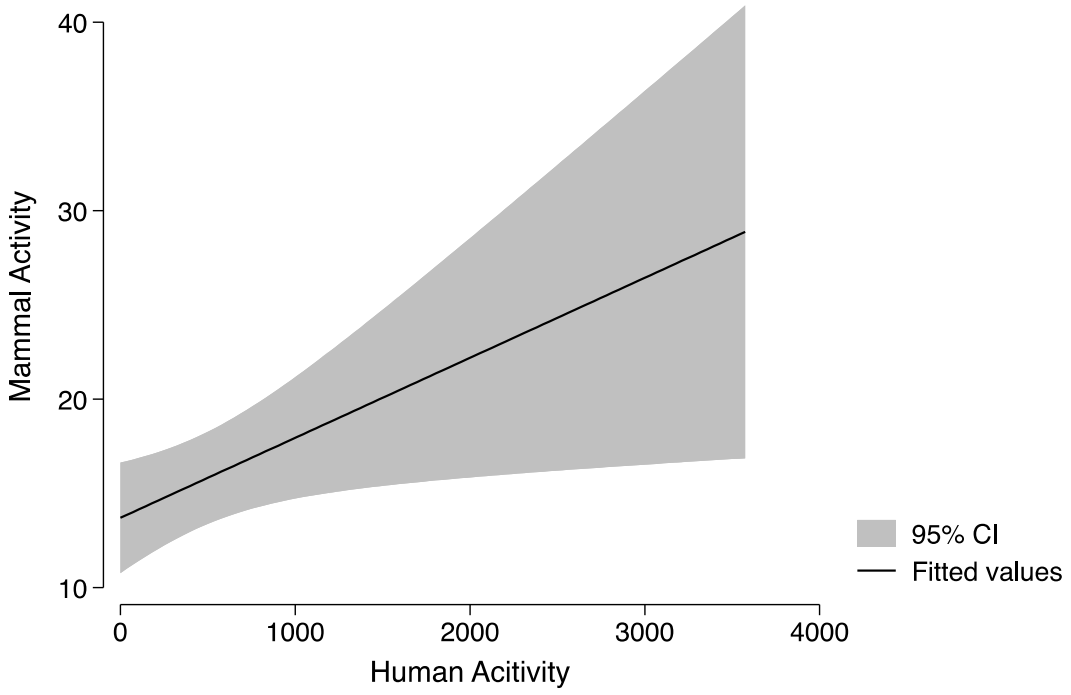

Figure 4.9 Monthly Mammal vs Human activity averaged across sites

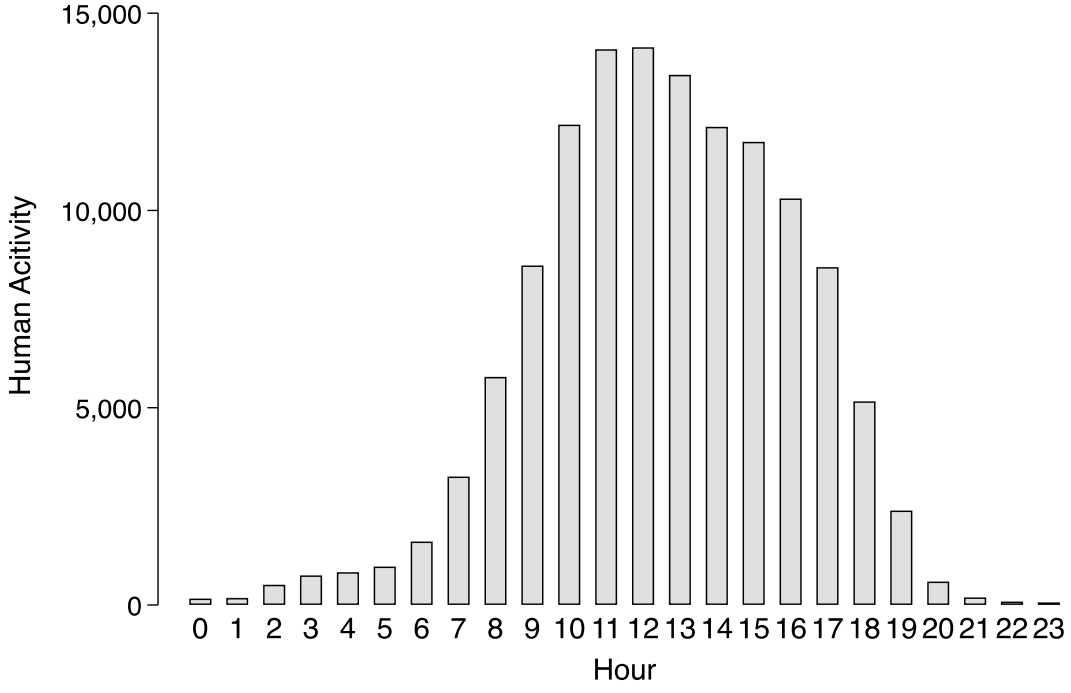

Figure 4.10 Hourly activity of humans across sites

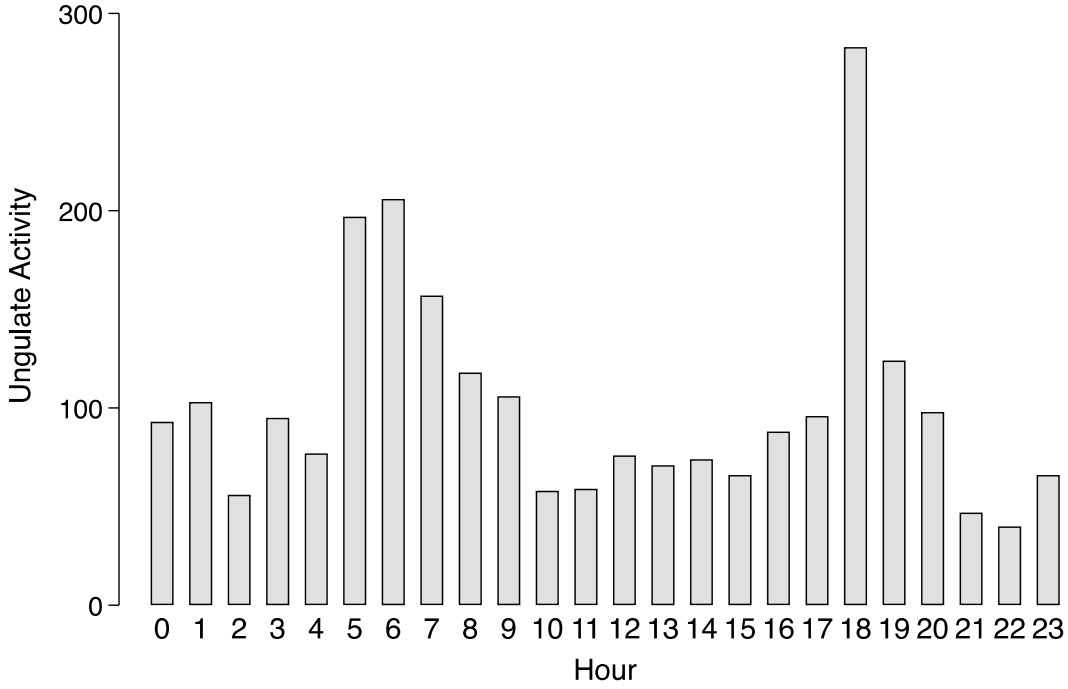

Figure 4.11 Hourly activity of ungulates summed across sites

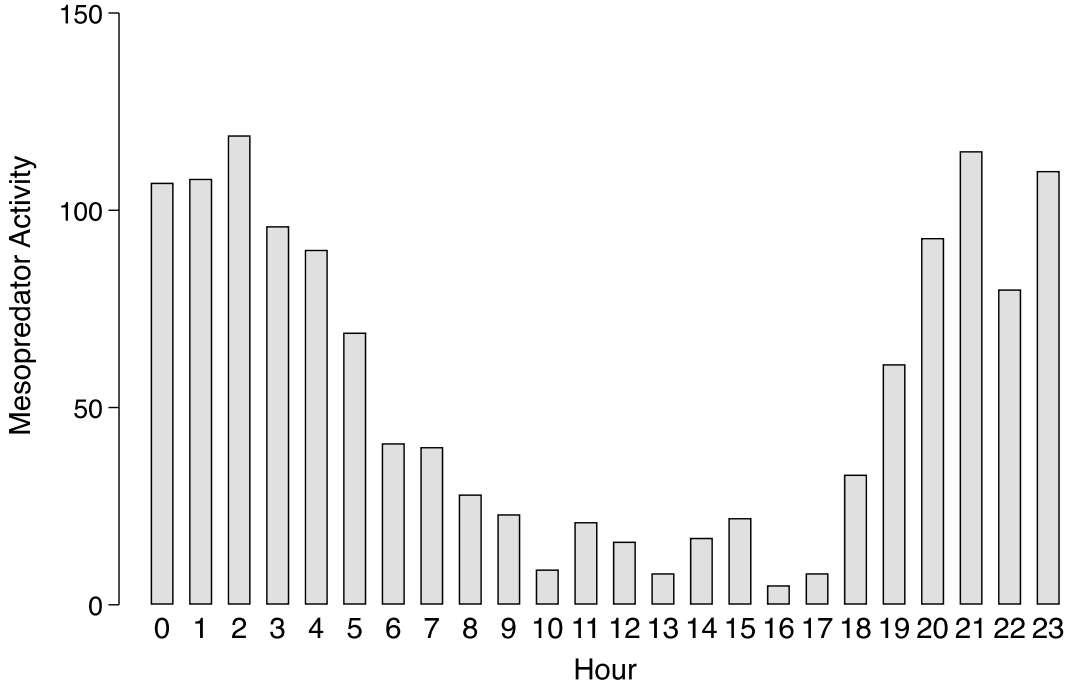

Figure 4.12 Hourly activity of mesopredators summed across sites

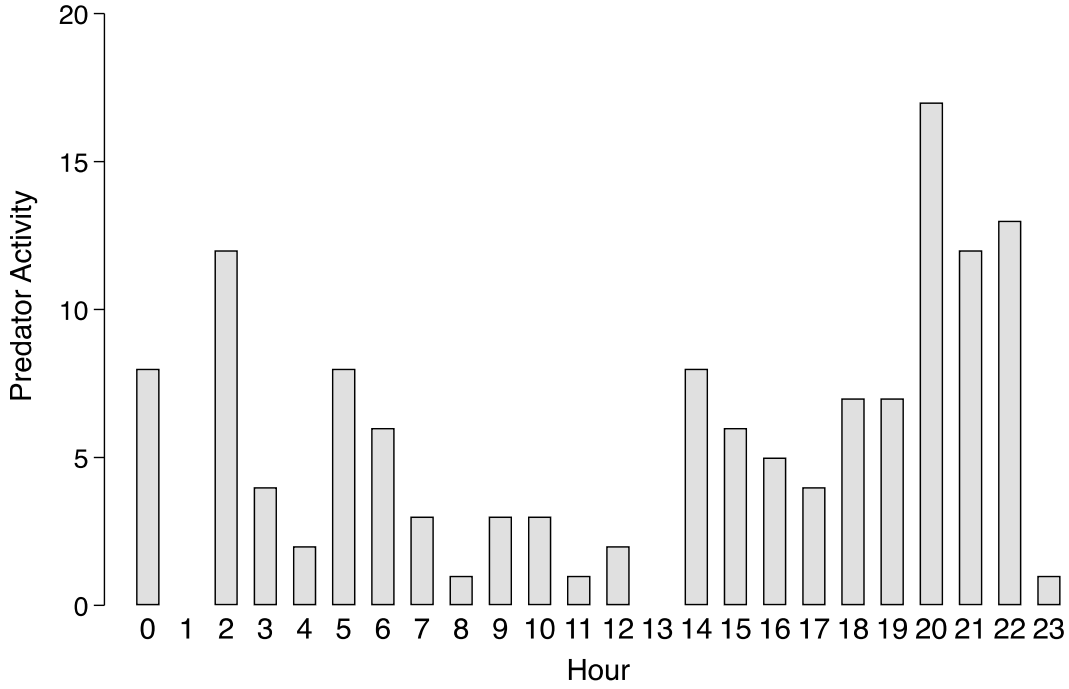

Figure 4.13. Hourly activity of large carnivores summed across sites

While there was not a significant negative correlation between monthly human activity on trails and monthly detections of large carnivores, there was an interesting pattern of more large carnivore detections on trails during June when outdoor recreation tourism was low due to wildfires in the area (Figs 4.14 & 4.17). Ungulate and mesopredator activity was more evenly distributed through the year but also higher in June than in May or July (Figs 4.15 & 4.16).

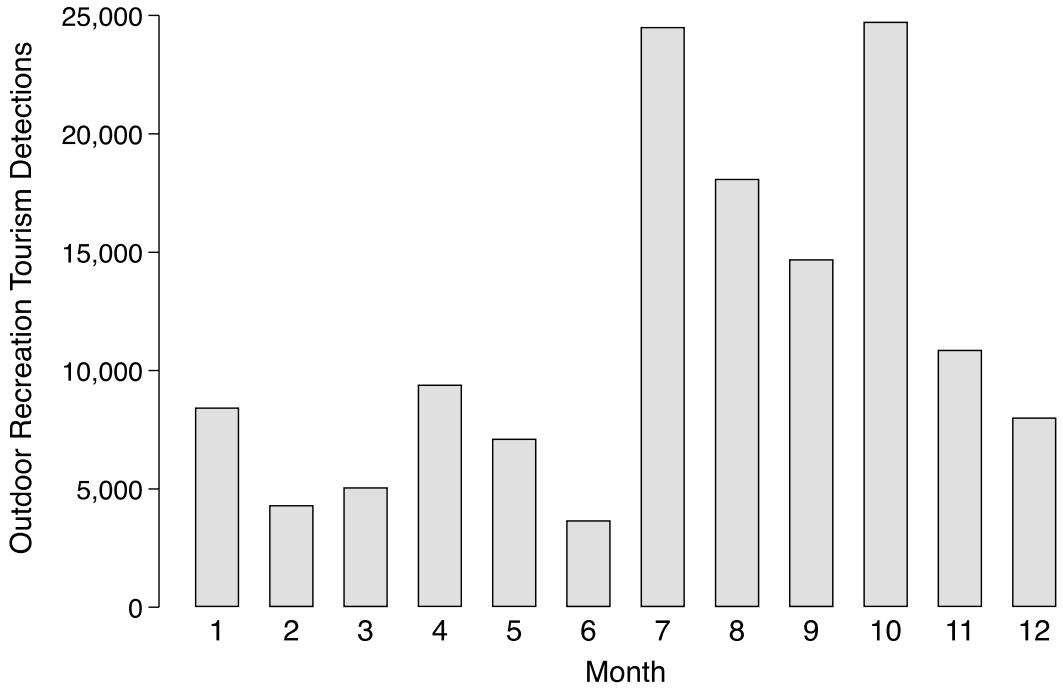

Figure 4.14. Human activity detected by month.

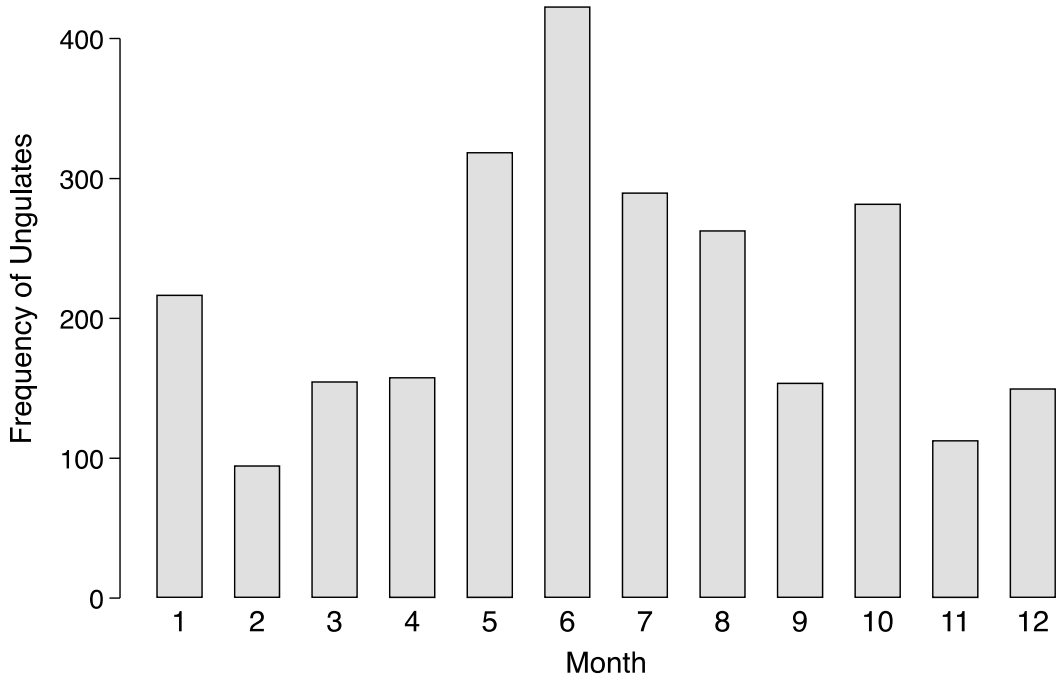

Figure 4.15. Ungulate activity detected by month.

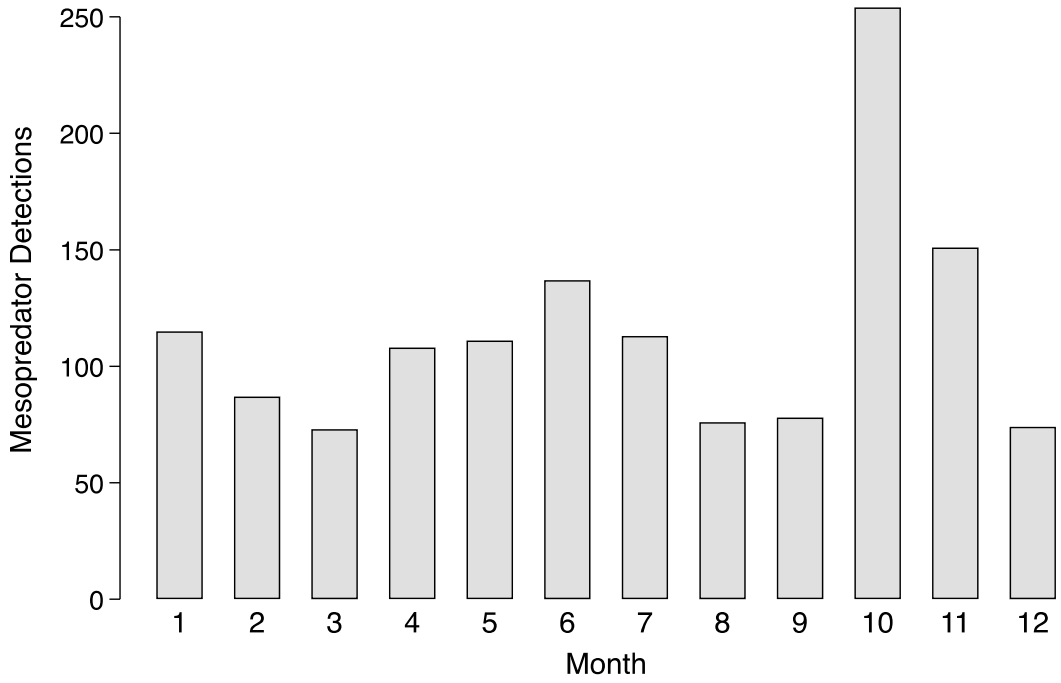

Figure 4.16. Mesopredator activity by month.

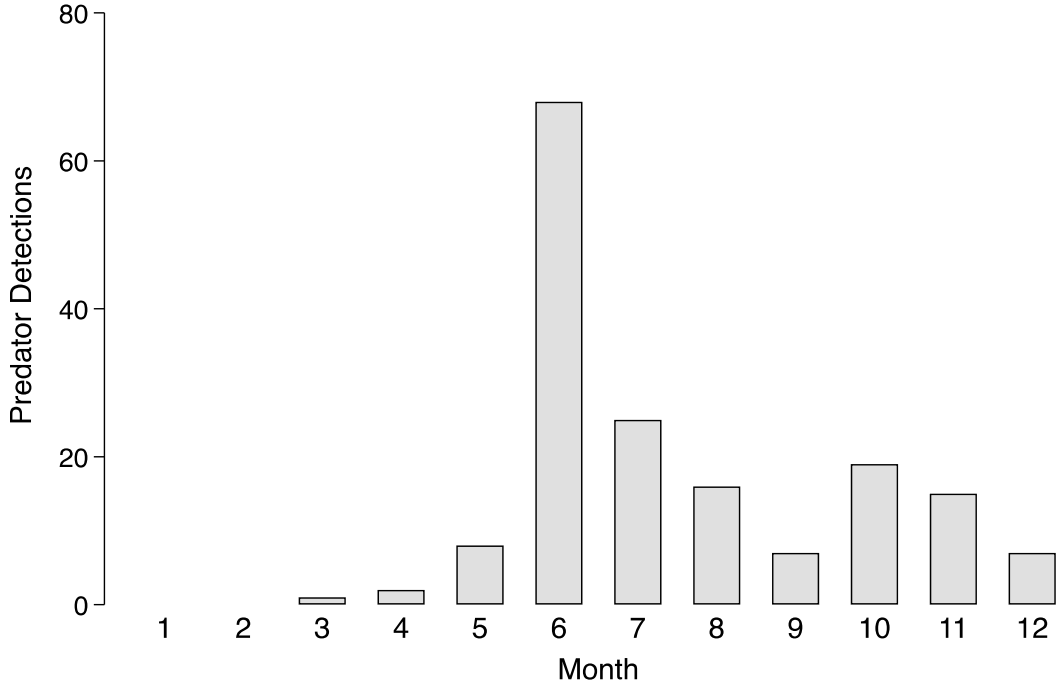

Figure 4.17. Large carnivore activity detected by month.

Ungulate monthly activity by site had a small negative correlation with nonmotorized human activity on trails and forest roads (β = -0.007, *SE* = 0.0025, *z* = -2.75). All other mixed effect models were insignificant. Based on AICc, occupancy modeling found no significance effect when humans or dogs were included in the detection models (Table 4.4). The detection model with the lowest AICc for mesopredators was the model including off leash dogs (Occupancy estimate = 15.4, *SE* = 392), however, the confidence interval for off leash dogs overlapped zero. The occupancy models with the lowest AICc for all groups was also the null model. Occupancy covariates included lat/long, distance to water, and elevation.

Table 4.4. Detection models with AICc, model weight, and log likelihood

Mammal group	Observation Detection covariate	K	DAICc	Model weight	-2LogLike
Ungulate	*null*	2	0	0.02	0.99
	Human	3	2.45	0.01	1.00
	Total dogs	3	2.19	0.14	0.97
	Dogs off leash	3	1.83	0.83	0.83
Mesopredators	*null*	2	7.55	0.49	0.49
	Human	3	8.95	0.14	1.00
	Total dogs	3	3.52	0.16	0.86
	Dogs off leash (CI overlapped zero)	3	0	0.20	0.69
Large carnivores	*null*	2	0	0.51	0.51
	Human	3	1.99	0.19	0.70

Total dogs	3	2.46	0.15	1.00
Dogs off leash	3	2.45	0.15	0.85

Discussion

While significant differences were not detected in the assemblage of mammals using trails and forest roads in relation to human activity, there were differences in the time of day when activity was highest. Without more data on mammal activity times on trails when humans are not present, it is not clear if that is the time those species are most active regardless of human activity or if the peak in human activity altered the time of day animals used the trails. It is likely that increases in human activity in the evenings and early mornings would have more of an impact.

While this study cannot determine that human activity was driving the time of mammal activities, other studies have found this to be the case. For example, an Orange County study involved setting trail cameras along dirt roads and major game trails and comparing measures of relative activity for coyote, mule deer, bobcat, humans, and domestic dogs along with percent daytime activity for the coyote, mule deer, and bobcat. Results indicated bobcat responded to high recreation activity levels through spatial and temporal displacement and coyote exhibited spatial displacement to a lesser degree (George & Crooks, 2006). Due to our low sample size, we did not examine how larger carnivore activity related to mesopredator activity, however a study involving mountain lions and foxes in a human landscape in Argentina found presence of mountain lions tended to be negatively correlated with mid-sized mesopredators and positively correlated with small mesopredators (Curras et al., 2022). Similar to results in Carson National Forest, the study in Argentina also observed human and domestic dog activity to be primarily

during the day while all large carnivore and mesopredator activity was observed at night (Curras et al., 2022). Division of daily activity peaks between wildlife and humans may be the deciding factor for how likely human-wildlife conflict will become an urgent management issue.

The results of this study indicate that overall, outdoor recreation in Carson National Forest did not seem to have a significant impact on which species were using which trails. However, some recreational types, such as mountain biking and hiking, did show a slight but statistically significant negative correlation with ungulates on trails. This suggests that while hiking may not greatly affect the presence of different species on trails, it may slightly reduce the presence of certain species. While not statistically significant, the pattern of monthly detections of large carnivores compared to monthly detections of human activity is striking. It does appear that large carnivores were using trails more in the spring when tourists' numbers were lower than usual. The lack of statistical significance could be due to the low sample size of large carnivore detections. It would be useful to know how this year's results compare to a year when tourists number were not suppressed in June due to wildfire activity.

The overall trend for monthly mammal activity on trails in relation to monthly human activity was positively correlated. This indicates that locations with high human activity also had high mammal activity. This positive correlation suggests that the presence of humans on the trails may not necessarily deter wildlife from using the trails, but the mammal and human activity is likely related to natural resources (e.g., rivers) and the ease of travel on trails attractive to both wildlife and outdoor recreation tourists.

The majority (68.6%) of studies examining the impact of domestic dogs on wildlife have been focused on birds (Weston et al., 2014). Our site with the highest rate of off-leash dogs had less mammal detections than a nearby site with fewer off-leash dogs (For example: Site A off leash dog detections = 353, bear detections = 0, raccoon detections 0; Site B off leash dog

detections = 22, bear detections = 8, raccoon detections = 10). Like humans, domestic dogs may contribute to a landscape of fear, changing the natural behaviors of wildlife (Fardell, 2021).

That aside, the daily temporal component shows humans are most active on the trails when mesopredators and large carnivores are not active. This suggests that human activity on the trails may not be disrupting the daily or seasonal patterns of those mammal groups. This point is further supported by the slightly negative correlation between ungulates and non-motorized outdoor recreation tourism numbers which is likely due to the higher proportion of ungulate activity during the day compared to the other mammal species observed (Fig 4.11 – 4.13). Other studies have noted that ungulates avoid human activity. Some researchers observed human recreation had a larger impact on deer use than large carnivores or other herbivores (Visscher et al., 2023). Additionally, researchers have noted elk were most avoidant of motorized recreation (Wisdom et al., 2018). This could be a landscape of fear response due to the physiological stress often induced in ungulates from the presence of humans (Fardell, 2021).

It's important to note that the correlation is weak, and that more research is needed to fully understand the relationship between human activity and mammal activity on trails in Carson National Forest. Furthermore, the study should be replicated in other areas to generalize the findings. Overall, it seems that while human activity may have some small negative effects on certain species, it is not having a major impact on the overall use of trails by mammals. It's important to consider these results in the context of the management plan of the national forest, and in the future, to monitor the changes over time to understand the dynamic of the relationship.

Hikers on the trails at night seem more likely to experience human-wildlife conflict — photo analysis did reveal a hiker with an off-leash dog in the evening followed closely by a mountain lion. Management could use example like that one in educational campaigns to demonstrate the increased risk of hiking with a dog off leash and at night.

Future studies

Future work with this data set will include running more occupancy models on smaller time scales for individual species. Future research could examine how year-round recreation and mammal activity here compares in similar habitats (mixed conifer forest and similar elevations) in other parts of the Rockies to look for latitudinal differences and similarities which may inform expected shifts as climate changes. Within Carson National Forest, future studies could explore the role of visitor education and outreach in promoting conservation behaviors among outdoor recreationist tourists. Furthermore, a survey of outdoor recreationists to understand their motivations for visiting the forest and how these motivations may influence their conservation behaviors would be useful.

The results of this study lead could inform a future study examining the effectiveness of different management strategies (e.g., trail closures, designated campsites, hunting restrictions) in reducing the impacts of outdoor recreation tourism on mammal populations in Carson National Forest. In regard to the ties between the community and Carson National Forest, it would be worth conducting a study evaluating the effectiveness of conservation partnerships between government agencies, non-profit organizations, and local communities in promoting sustainable outdoor recreation and protecting wildlife in the National Forest.

Future studies are needed to address the physiological and nutritional impact of increased recreation on mammals. Specifically, what physiological mechanisms can answer the question of why species do or do not alter their trail use as recreation increases. It is not enough to assume a mammal's presence signals their needs are adequately met in the current conditions.

Limitations

Severe winds in December 2021 made some trails impassible and 2 cameras were lost to wind damage (Fig 4.18). Another camera was on a tree which blew over making resulting in a

data gap. Fires caused many areas to be closed for part of summer 2022 and the official trail closures combined with smoke likely contributed to the low number of tourists/outdoor recreationists in May and June. This study was limited to one year, but ideally data of this nature would be collected for multiple years to help account for variations due to extreme weather and fire events. The researcher had planned to survey visitors, but heavy snow and trailhead lots which were inaccessible made surveying visitors in January difficult as there were not many visitors using monitored trails to accept business cards with survey links. Information from outdoor recreation tourists about their wildlife orientation values and perceived impacts of different activities on wildlife would have rounded out the study.

Conclusion

Current risk of human-wildlife conflict on trails in the study region may be minimal, however, the physiological impact heavy recreational use has on some species remains unknown. This study results revealed ungulate activity on trails decreased as non-motorized recreation increased and fewer mammal species were active on trails with high rates of off leash dogs. Also, while not significant in the current models, the increased mammal activity on trails in June when recreation was minimal due to wildfires supports the theory that mammals decrease activity on trails when human activity is most frequent. These results could signal that as recreation throughout the region increases, mammals will be crowded out of current ranges as areas with lower rates of recreational use become harder to find. These patterns should be closely watched as management continues to adapt to balance public access and natural resources in protected areas.

Figure 4.18. Camera site before and after December 2021 windstorm

Chapter 5 - Conclusion

The purpose of this dissertation was to investigate the potential benefits of virtual nature tourism on participant well-being, stress reduction, and connection to nature. Additionally, the use of trail cameras to monitor mammal populations and assess the impact of outdoor recreation tourism on a national forest was examined. Finally, the study highlighted the importance of managing outdoor recreation tourism to minimize negative impacts on the natural environment.

The management implications of this dissertation suggest that there is a need to better understand the complex relationship between tourism and wildlife in order to make informed decisions that balance conservation and recreation. The author argues that virtual nature tourism has the potential to provide health benefits to participants while reducing the impact on wildlife and suggests that it could play an important role in this balance.

Virtual nature tourism can be an effective tool for promoting both human well-being and wildlife conservation. The findings of this dissertation can inform the development and implementation of virtual nature tourism programs and initiatives.

Some specific management implications include:

1. Encouragement of virtual nature tourism: The dissertation's findings on the benefits of virtual nature tourism for participants can encourage managers and policymakers to promote and invest in virtual nature tourism initiatives.
2. Reduction in wildlife impact: By reducing the impact of human recreation on wildlife, virtual nature tourism can help to conserve wildlife populations and promote sustainable tourism practices.
3. Integration of virtual nature tourism into conservation efforts: The dissertation highlights the potential for virtual nature tourism to play a role in conservation efforts, and

managers can consider incorporating virtual nature tourism into their conservation strategies.

4. Promotion of healthy and sustainable tourism: By promoting healthy and sustainable tourism practices, virtual nature tourism can help to foster a positive relationship between tourism and wildlife conservation.
5. Development of guidelines and best practices: The dissertation's findings can inform the development of guidelines and best practices for virtual nature tourism initiatives, to ensure that they promote both human well-being and wildlife conservation.

In conclusion, the management implications of the dissertation suggest that virtual nature tourism can be a valuable tool for promoting both human well-being and wildlife conservation, and that it should be considered as part of a broader strategy for promoting sustainable tourism practices.

The author also highlights the importance of a zoning approach in protected areas to balance access and protection for tourists and wildlife. This suggests that managers should consider separating areas for wildlife conservation and for human recreation, in order to minimize negative impacts on wildlife and maximize opportunities for sustainable tourism.

Additionally, the findings suggest that there is a need for more research and better understanding of the patterns of wildlife behavior and human recreation. This information can inform management decisions and help to ensure that conservation and recreation are in balance.

In conclusion, the dissertation emphasizes the importance of considering both the benefits and impacts of tourism on wildlife and humans, and calls for a more nuanced approach to management that takes into account the complex relationship between these two elements. The findings and arguments presented in the dissertation can be valuable for protected area managers, policymakers, and others working to promote sustainable tourism and wildlife conservation.

In conclusion, this dissertation presents a comprehensive examination of the complex relationship between tourism and wildlife. Through an exploration of the impact of outdoor recreation on wildlife, the potential of virtual nature tourism to decrease impacts, and the balance between access and protection for both humans and wildlife, the author sheds light on the multifaceted nature of this relationship. The findings suggest that there is a need for better understanding of the patterns of wildlife behavior and human recreation to inform management decisions that balance conservation and recreation. The author argues that virtual nature tourism can play an important role in providing health benefits to participants while reducing the impact on wildlife. The author also highlights the importance of a zoning approach in protected areas to balance access and protection for tourists and wildlife. This dissertation makes a valuable contribution to the field by documenting the variations in benefits and impacts on humans and wildlife and advancing efforts towards a sustainable balance between tourism and wildlife conservation.

Completing a PhD in Park Management and Conservation during the COVID pandemic was a unique and challenging experience. It presented unexpected challenges and uncertainties that required flexibility and resilience to overcome. Despite the challenges, there were also positive aspects of completing a PhD during the pandemic. For instance, the virtual nature of academic conferences allowed me to connect with scholars from all over the world that I may not have had the opportunity to meet otherwise. The topic of virtual nature tourism and webcams was particularly relevant during the social climate of the pandemic. It also enabled me to participate in more conferences than I might have been able to otherwise due to travel and financial constraints. Overall, while it was a difficult time for everyone, many research opportunities presented themselves during these unusual circumstances.

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Appendix A - Questionnaires and Institution Approvals

Figure A.5.1. IRB approval of Proposal Number IRB-10566

KANSAS STATE UNIVERSITY | University Research Compliance Office

TO: Ryan Sharp
Horticulture & Nat Resources
Manhattan, KS 66506

Proposal Number IRB-10566

FROM: Rick Scheidt, Chair
Committee on Research Involving Human Subjects

DATE: 03/18/2021

RE: Approval of Proposal Entitled, "Health benefits of participation in a virtual safari."

The Committee on Research Involving Human Subjects has reviewed your proposal and has granted full approval. This proposal is **approved for three years from the date of this correspondence.**

APPROVAL DATE: 03/18/2021

EXPIRATION DATE: 03/17/2024

In giving its approval, the Committee has determined that:

No more than minimal risk to subjects

This approval applies only to the proposal currently on file as written. Any change or modification affecting human subjects must be approved by the IRB prior to implementation. All approved proposals are subject to continuing review, which may include the examination of records connected with the project. Announced post-approval monitoring may be performed during the course of this approval period by URCO staff. Injuries, unanticipated problems or adverse events involving risk to subjects or to others must be reported immediately to the Chair of the IRB and / or the URCO.

Electronically signed by Rick Scheidt on 03/20/2021 3:54 PM ET

203 Fairchild Hall, Manhattan, KS 66502 | (785) 532-3224 | fax: (785) 532-3278

Appendix A. The six questionnaires completed by participants before and after sessions The sequence of each is indicated in bold as the start of each set of questions.

Complete before first session. Date & Time _____

Age: 18-25 26-30 31-35 36-40 >40

Gender: Male Female Non-binary Other

Time spent in nature for recreation

On a weekday:

On a weekend day:

Time spent watching screens for recreation

On a weekday:

On a weekend day:

Have you traveled to other countries? Yes No

Have you ever been hunting? Yes No

Have you traveled to watch wildlife? Yes No

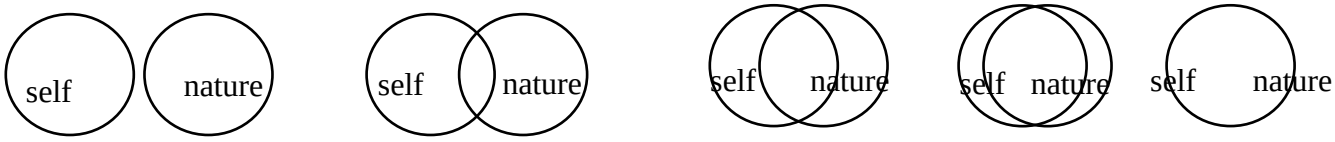
Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly agree

My ideal vacation spot would be a remote, wilderness area.	◯	◯	◯	◯	◯
I always think about how my actions affect the environment.	◯	◯	◯	◯	◯
My connection to nature and the environment is a part of my spirituality.	◯	◯	◯	◯	◯
I take notice of wildlife wherever I am.	◯	◯	◯	◯	◯
My relationship to nature is an important part of who I am.	◯	◯	◯	◯	◯
I feel very connected to all living things and earth.	◯	◯	◯	◯	◯

	Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly agree
In most ways my life is close to my ideal	◯	◯	◯	◯	◯
The conditions of my life are excellent	◯	◯	◯	◯	◯
I am satisfied with my life	◯	◯	◯	◯	◯

So far, I have gotten the important things I want in life	◯	◯	◯	◯	◯
If I could live my life over, I would change almost nothing	◯	◯	◯	◯	◯
I feel happy in general	◯	◯	◯	◯	◯
These days I feel tense, restless, nervous, or anxious	◯	◯	◯	◯	◯

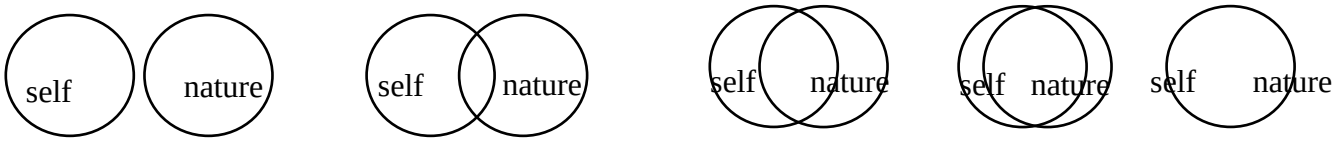
Please put a circle around which diagram best describes how you feel right now about your connection with nature. (Do you currently feel detached [separate circles]; or very connected [overlapping circles])?



Complete after first session.

	Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly agree
I feel happy in general	◯	◯	◯	◯	◯
These days I feel tense, restless, nervous, or anxious	◯	◯	◯	◯	◯

Please put a circle around which diagram best describes how you feel right now about your connection with nature.



Please rate how much you currently feel the following	Very slightly	A little	Moderately	Quite a bit	Extremely
Upset	◯	◯	◯	◯	◯
Hostile	◯	◯	◯	◯	◯
Alert	◯	◯	◯	◯	◯
Ashamed	◯	◯	◯	◯	◯

Inspired	◯	◯	◯	◯	◯
Nervous	◯	◯	◯	◯	◯
Determined	◯	◯	◯	◯	◯
Attentive	◯	◯	◯	◯	◯
Active	◯	◯	◯	◯	◯
Afraid	◯	◯	◯	◯	◯

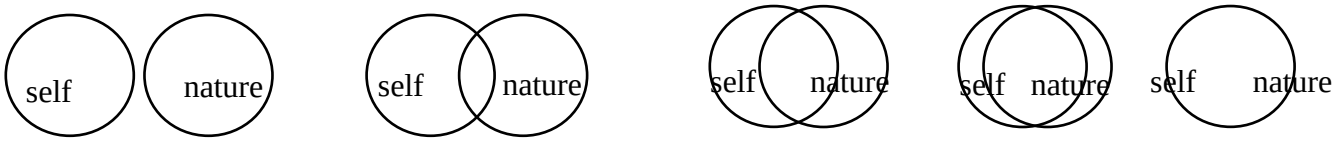
How did watching this make you feel?

Was this a positive or negative experience for you? Explain.

Complete before second session. Date & Time _____

	Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly agree
I feel happy in general	◯	◯	◯	◯	◯
These days I feel tense, restless, nervous, or anxious	◯	◯	◯	◯	◯

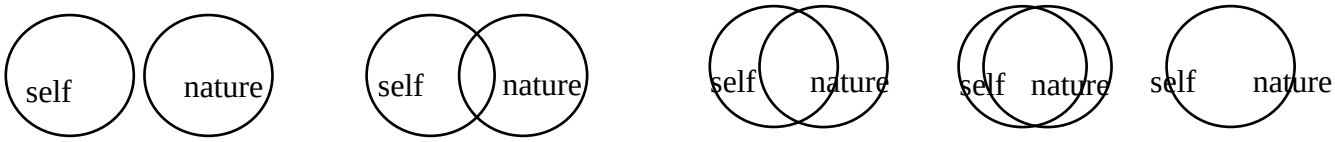
Please put a circle around which diagram best describes how you feel right now about your connection with nature.



Complete after second session.

	Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly agree
I feel happy in general	◯	◯	◯	◯	◯
These days I feel tense, restless, nervous, or anxious	◯	◯	◯	◯	◯

Please put a circle around which diagram best describes how you feel right now about your connection with nature.



Please rate how much you currently feel the following	Very slightly	A little	Moderately	Quite a bit	Extremely
Active	◯	◯	◯	◯	◯
Hostile	◯	◯	◯	◯	◯
Afraid	◯	◯	◯	◯	◯
Ashamed	◯	◯	◯	◯	◯

Inspired	◯	◯	◯	◯	◯
Nervous	◯	◯	◯	◯	◯
Determined	◯	◯	◯	◯	◯
Attentive	◯	◯	◯	◯	◯
Upset	◯	◯	◯	◯	◯
Alert	◯	◯	◯	◯	◯

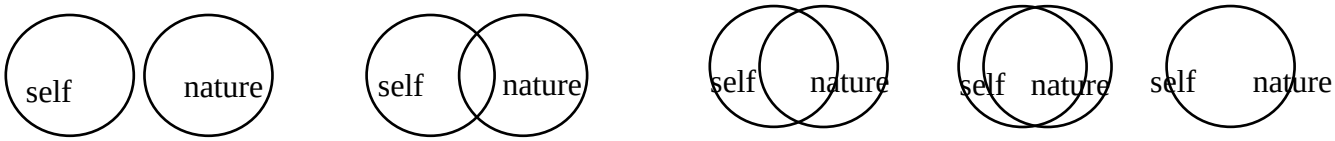
How did watching this make you feel?

Was this a positive or negative experience for you? Explain.

Complete before third session. Date & Time _____

	Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly agree
I feel happy in general	◯	◯	◯	◯	◯
These days I feel tense, restless, nervous, or anxious	◯	◯	◯	◯	◯

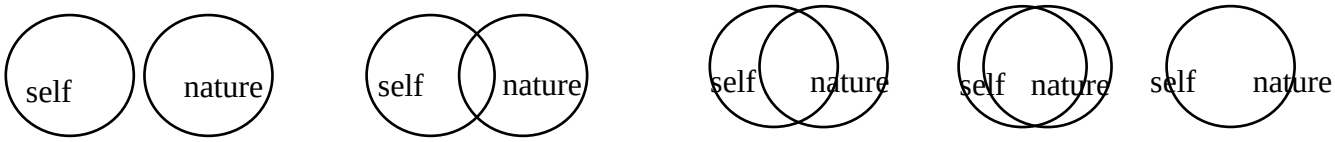
Please put a circle around which diagram best describes how you feel right now about your connection with nature.



Complete after third (final) session.

	Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly agree
I feel happy in general	◯	◯	◯	◯	◯
These days I feel tense, restless, nervous, or anxious	◯	◯	◯	◯	◯

Please put a circle around which diagram best describes how you feel right now about your connection with nature.



Please rate how much you currently feel the following	Very slightly	A little	Moderately	Quite a bit	Extremely
Upset	◯	◯	◯	◯	◯
Hostile	◯	◯	◯	◯	◯
Alert	◯	◯	◯	◯	◯
Ashamed	◯	◯	◯	◯	◯

Inspired	◯	◯	◯	◯	◯
Nervous	◯	◯	◯	◯	◯
Determined	◯	◯	◯	◯	◯
Attentive	◯	◯	◯	◯	◯
Active	◯	◯	◯	◯	◯
Afraid	◯	◯	◯	◯	◯

How did watching this make you feel?

Was this a positive or negative experience for you? Explain.

Which of the three sessions (if any) made you feel:

Happier?

Less stressed?

More connected to nature?

Figure A.2. Exemption for Proposal #IRB-10624, “Motivations for Participation in Virtual Safaris”

KANSAS STATE UNIVERSITY | University Research Compliance Office

TO: Ryan Sharp
Horticulture & Nat Resources
Manhattan, KS 66506

Proposal Number: IRB-10624

FROM: Rick Scheidt, Chair
Committee on Research Involving Human Subjects

DATE: 03/12/2021

RE: Proposal Entitled, “Motivations for participation in virtual safaris.”

The Committee on Research Involving Human Subjects / Institutional Review Board (IRB) for Kansas State University has reviewed the proposal identified above and has determined that it is EXEMPT from further IRB review. This exemption applies only to the proposal - as written – and currently on file with the IRB. Any change potentially affecting human subjects must be approved by the IRB prior to implementation and may disqualify the proposal from exemption.

Based upon information provided to the IRB, this activity is exempt under the criteria set forth in the Federal Policy for the Protection of Human Subjects, **45 CFR §104(d), category:Exempt Category 2 Subsection ii.**

Certain research is exempt from the requirements of HHS/OHRP regulations. A determination that research is exempt does not imply that investigators have no ethical responsibilities to subjects in such research; it means only that the regulatory requirements related to IRB review, informed consent, and assurance of compliance do not apply to the research.

Any unanticipated problems involving risk to subjects or to others must be reported immediately to the Chair of the Committee on Research Involving Human Subjects, the University Research Compliance Office, and if the subjects are KSU students, to the Director of the Student Health Center.

Electronically signed by Rick Scheidt on 03/12/2021 12:28 PM ET

203 Fairchild Hall, Manhattan, KS 66502 | (785) 532-3224 | fax: (785) 532-3278

Table A.1 Questionnaire which was provided to participants as an anonymous link on the explore.org website for Mpala Live webcams.

Question category	Question/Statement
Viewing habits Multiple choice and open-ended answers	How long have you been watching MpalaLive.org? How frequently do you watch MpalaLive.org? How did your MpalaLive.org viewing change during the COVID-19 pandemic? When you tune in for a session of When you watch MpalaLive.org, is this a more passive or active pastime? (Passive means you watch while working on other tasks. Active means MpalaLive.org is the main focus of your attention) MpalaLive.org, how long on average do you usually watch before you stop? What device do you most often use to watch MpalaLive.org?
Motivation (Lee et al., 2014) How important are the following reasons to you when deciding to watch MpalaLive.org ? Five-point scale : 1. Not at all important 2. Slightly important 3. Moderately important 4. Important 5. Very important	(Utilitarian function – reward) To experience new things (Utilitarian function – reward) To develop my personal interests (Utilitarian function – reward) To create good memories (Utilitarian function – reward) To have fun (Knowledge function) To meet people with similar interests (Knowledge function) To share an exciting experience with others (Utilitarian function – escape) To take a break

	from crowds of people (Utilitarian function – escape) To be away from daily stress (Utilitarian function – escape) To escape from routine (Knowledge function – nature appreciation) To feel close to nature (Knowledge function – nature appreciation) To gain a better appreciation of nature (Knowledge function – nature appreciation) To learn more about wildlife and nature (Utilitarian – contribution) To contribute to global wildlife conservation efforts (Utilitarian – contribution) To support research efforts To enjoy a safe and convenient safari experience Other motivation (write-in option with scale)
Most important motivation/reason for participation (open-ended response)	What is the most important reason to you when deciding to view MpalaLive.org?
<u>Conservation behaviors</u> (L. R. Larson et al., 2015) Five-point scale : 1. Extremely unlikely 2. Unlikely 3. Not sure 4. Likely 5. Extremely likely Multiple choice questions were asked about each behavior to gage how participation has influence those behaviors	How likely are you to donate money to support wildlife conservation causes? How did your likelihood of donating money to support wildlife conservation change after watching MpalaLive.org? Decreased, No change, Increased How likely are you to talk to or educate others about wildlife conservation issues? How did your likelihood of talking to or educating others about wildlife conservation issues change after watching MpalaLive.org? Decreased, No change, Increased

	How likely are you to alter your own lifestyle and behavior to help wildlife and the global environment? How did your likelihood of altering your own lifestyle and behavior to help wildlife and the global environment change after watching MpalaLive.org? Decreased, No change, Increased
General experience – open ended	What about MpalaLive.org could be improved? What do you like most about the MpalaLive.org viewing experience?
Connection to nature (Nisbet & Zelenski, 2013) Five-point scale: 1. Strongly disagree 2. Somewhat disagree 3. Neither agree nor disagree 4. Somewhat agree 5. Strongly agree	I always think about how my actions affect the environment. My relationship to nature is an important part of who I am. I feel very connected to all living things and earth.
Conservation caring (Skibins & Powell, 2013) Five-point scale: 1. Strongly disagree 2. Somewhat disagree 3. Neither agree nor disagree 4. Somewhat agree 5. Strongly agree	I am deeply concerned about the well-being of the animals I see on MpalaLive.org I need to learn everything I can about the animals I see on MpalaLive.org Wildlife conservation is very important to me Wildlife protection should be one of society's highest priority Wildlife should be conserved for future generations I feel a special connection to the places I have seen while watching MpalaLive.org The places I have seen while watching MpalaLive.org mean a lot to me

Wildlife Value Orientation (Teel & Manfredo, 2010) Five-point scale: 1. Strongly disagree 2. Somewhat disagree 3. Neither agree nor disagree 4. Somewhat agree 5. Strongly agree	The needs of humans should take priority over fish and wildlife protection
Impact of participation Three-point scale: 1. Decreased 2. No change 3. Increased	How did the amount you care about wildlife conservation change after watching MpalaLive.org? How did you level of connection and attachment to Africa change after watching MpalaLive.org?
Demographics and background	Have you ever participated in a live safari? How likely are you to participate in a live safari? (extremely unlikely, unlikely, not sure, likely, extremely likely) Are you more likely to participate in a live safari since watching MpalaLive.org? What about participating in a virtual safari (viewing MpalaLive.org) is better than traveling to participate in an actual safari? What about participating in a virtual safari (viewing MpalaLive.org) is worse than traveling to participate in an actual safari? Overall, how would you rate your experience with MpalaLive.org? (poor, fair, average, good, excellent) How likely are you to view MpalaLive.org in the future? (extremely unlikely, unlikely, not sure, likely, extremely likely) Do you share MpalaLive.org with others? Do you use the following supplementary

	educational resources on MpalaLive.org (select all that apply)? 1 stories from the bush, 2 field guide, 3 classroom, 4 write-in other, 5 I was not aware of the educational resources Are you an educator? If an educator: Would you use the currently available materials from MpalaLive.org in your classroom? If an educator: If lesson plans catered to meet your region's educational standards were available on MpalaLive.org, would you use the lesson plans in your classroom? (1 definitely would not, probably would not, unsure, probably would, definitely would) If an educator: Have you shared MpalaLive.org with other educators? Age Gender Country of residence Graduate degree completed? Please rate your household income relative to other people in the country where you live.

Figure A.4. Exemption for IACUC Proposal

KANSAS STATE UNIVERSITY | University Research Compliance Office

MEMORANDUM FOR RECORD

DATE: 8/18/2021

TO: Dr. Ryan Sharp
Horticulture & Natural Resources
Kansas State University
Manhattan, KS 66506

SUBJECT: Activity does not require IACUC review

Dear Dr. Sharp,

As described in your August 11th, 2021 IACUC protocol submission to our office, your request to place trail cameras to capture photos, to compare the presence of different mammals along a variety of trails to help land managers understand how different types of outdoor recreation uses impact wildlife, does not fall under the oversight of Kansas State University IACUC and does not require IACUC approval.

Sincerely,

Cheryl A. Doerr
Associate Vice President for Research, Compliance

Cc: Dr. Sally Olson, IACUC Chair