

Exploratory mixed methodology to understand visitor use and perceptions at a National
Grassland

by

Katharina Bremser

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Approved By:

Major Professor:
Dr. Brian A. Peterson

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Abstract

Despite their importance to local communities, National Grasslands are an often overlooked and understudied part of the United States Forest Service. This exploratory study used mixed methodology to better understand visitor perceptions and use regarding National Grasslands by exploring experiences at Cimarron National Grassland. Given the research aim, this study used semi-structured interviews with managers to construct surveys with a combination of quantitative and qualitative data. Then distributed these surveys via social media (n=209). Spectus mobile device data was used to understand visitor spatial use, and semi-structured visitor interviews (n=6) were used to gain richer data on visitor experiences. Principal component analysis identified four components that were used to further analyze visitor perceptions across activity types, showing that the natural environment was rated the highest on a five-point Likert Scales among visitors while conditions of developed facilities was the lowest. These components were used in a multiple linear regression analysis to understand influencers of nature relatedness and quality experiences. It was found that the natural environment positively influences nature relatedness and positively influences visitor quality experience. Visitor use was analyzed using a spatial survey question and mobile device data to identify the most used sites as well as visitor patterns at those sites. Six interviews were conducted with local visitors to gain a better understanding of visitor perceptions of developed facilities. These interviews revealed trail and pond maintenance would be beneficial, and site selection was influenced by activity type, developed facilities, and accessibility. This study is beneficial for CNG managers because it specifies visitor preferences and use, which were not well understood, and demonstrates that visitor survey data collection can successfully be achieved at similar Grassland units.

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Chapter 1 - Chapter 1 - Introduction

Thesis Format

This thesis is written in article format and contains three chapters. Chapter I will introduce the problem and the resulting research. Chapter II contains an introduction, literature review, study objectives, methods, results, and discussion and is written in journal article format, ready for submission to the Journal of Outdoor Recreation and Tourism. Chapter III provides an overview of what was learned during the thesis process, including challenges, successes, discoveries, and advice to students and researchers.

Introduction to the Problem and the Overall Significance

In 1954 approximately four million acres of land purchased through the Bankhead-Jones Farm Tenant Act were transferred into the care of the United States Forest Service (USFS) (Olson, 1997). These lands, comprised of restored prairie, became the National Grasslands (Lewis, 1985). Despite being considered USFS land for 70 years, National Grassland visitation rates are poorly understood, and due to the aggregation of data in the National Visitor Use Monitoring (NVUM) program it can be hard for researchers and managers to distinguished between different management areas (English et al., 2020), for example Cimarron National Grassland (CNG) data is mixed with the Comanche National Grassland, and due to this, managers have limited information about who specifically visits CNG, their motivations for visiting, and their desired resources. Without properly understanding the desires and needs of visitors, it can be difficult for managers to make informed decisions. However, CNG is in a remote area and receives low visitation with the Cimarron-Comanche Grasslands NVUM estimating 66,000 total site visits between both National Grasslands (U.S. Forest Service, 2016).

Both low visitation and remote location can create a challenge for researchers (King et al., 2014), making it difficult to collect data from a representative sample for social science research. These sites are important to local communities, many coming from within 50 miles of the sites (U.S. Forest Service, 2016). These are large open spaces for recreation that might otherwise be limited due to private land and agriculture (Johansen et al., 2021). Therefore, understanding visitor use and perceptions of the sites is important when making sound managerial decisions at these locations. Due to the lack of information concerning CNG, an exploratory mixed method study was conducted to help inform managers about who was visiting CNG, where they were going, what activities they preferred, and the desired resources.

Exploratory studies are implemented for topics with little known information (Swedberg, 2020). These studies have been conducted in recreational social science before using quantitative surveys (Alkhalaf & Orams, 2021) and have also been used with qualitative studies (Smythe et al., 2020). These studies generate initial knowledge into a novel subject and form a backbone for future research to take place, they are flexible and can be used with mixed methods (Mbaka & Isiramen, 2021), as was done with this study.

This study used a mixed-methodology approach. Two semi-structured interviews were conducted with managers at CNG who had been working there for at least a year, these results helped to generate a survey which combined both qualitative and quantitative questions and was distributed via social media. A total of 536 social media accounts were contacted with 276 surveys being completed (response rate of 48.5%). After cleaning for repeat users, non-visitors, and 40% missingness (Mirzaei et al., 2022), 209 surveys (effective response rate 38.99%) were used for this project. Spectus (Cuebiq Group LLC) mobile device data analysis was also conducted using cell phone data whose users had opted into data collection by their location apps

(Spectus, 2023). Finally, interviews were conducted over zoom with six participants who were regular visitors (returning multiple times a year) to CNG to gain a better understanding of their opinions on the developed facilities on site.

Quantitative survey data was analyzed with principal component analysis (PCA) using a mixture of RStudio (version 2023.03.0-daily+82.pro2) and SPSS (version 29) with results graphed and demonstrated throughout this document. Furthermore, qualitative data were analyzed through both a deductive (Azungah, 2018) and blended approach (Smith, 2021). CNG boundaries were placed into the automated Spectus dashboard to generate the visitor use pattern maps seen in this document.

The mixed-method approach shown in this study demonstrates an efficient method for managers and researchers to conduct an exploratory study at remote locations with low visitation. Through the utilization of these methods, finding potential participants and a sufficient sample size within a limited timeframe becomes possible. Social media survey distribution is a low-cost method which could help managers at other sites survey their visitors without extracting additional resources. Meanwhile, Spectus mobile data analysis can give supplemental data for patterns of site visitation for sites already identified via the survey. By understanding visitor preferences and perceptions, managers can better meet the needs of their visitors and increase their overall positive perception of the location (Abrams et al., 2020). This in turn could increase nature relatedness and stewardship (Jain & Singh, 2023), among visitors through indirect management methods.

Research Questions

This research addresses the following problems:

Grassland managers have limited information about who visits, visitor use, and perceptions of site conditions due to low visitation, rural locations, and data being aggregated with other National Forest sites (English et al., 2020). This results in managers having information that is not always specific to their sites (U.S. Forest Service, 2023). Furthermore, due to lack of resources, managers are unable to directly manage and monitor visitors themselves, increasing the importance of visitor stewardship on site. Therefore, this project conducted at CNG, developed a visitor use survey that examined visitor experiences, site use, perceptions, and nature relatedness. Site use was further expanded through Spectus data and visitor perceptions of conditions was further explored through visitor interviews. This survey was distributed over social media to test if this approach is transferable to other grasslands and remote forest sites.

Four research questions were drafted for this task:

1. What sites at CNG are used the most by recreationists?
2. How do visitor perceptions vary across activity types?
3. What influences greater intention to behave environmentally?
4. What influences the visitor's experience?

Chapter 2 - Exploratory Mixed Methodology to Understand Visitor Use and Perceptions at a National Grassland

Introduction

In the 1930's, record high temperatures, drought, and years of unsustainable farming practices contributed to the Dust Bowl (Cordova & Porter, 2015). In 1937, the Bankhead-Jones Farm Tenant Act was passed to allow the United States Department of Agriculture (USDA) to purchase distressed farmland and to serve as an economic stimulus for struggling farmers (Lewis, 1985). In 1954, these lands, comprising approximately four million acres, were transferred to the United States Forest Service (USFS) and became known as the National Grasslands (Olson, 1997).

Most National Grasslands are restored prairie with mineral extraction, gas and oil, and graze for cattle being key resources harvested from these sites (Fagin & Wikle, 2012). Whereas National Forests are primarily dominated by forest ecosystems with timber harvest being the primary resource (U.S. Forest Service, 2024). National Grasslands tend to be made up of disconnected units which increases the need for managers to use integrated resource management (West, 1989), meaning that decision-making takes into consideration the many interests and potential issues created by the disconnected geography of Grasslands. This often accommodates tenable rangeland management, neighboring partners, and stakeholders. (U.S. Forest Service, 2024.a).

Most National Grasslands are in rural areas, which are identified as regions that lack development and have low anthropogenic light pollution (Arellano & Roca; 2017), which may contribute to a lower visitation rate. Visitation rates to National Grasslands are not well documented, however, aggregated, both National Forests and National Grasslands received

approximately only 158,747 visitors in 2022 (U.S. Forest Service, 2023). Despite low visitation, Grasslands provide a variety of benefits for local visitors, with the highest percentage of visitors traveling less than 25 miles to a site (U.S. Forest Service, 2023). Grasslands provide a wide variety of recreational opportunities (camping, hunting, angling, hiking, etc.) (U.S. Forest Service, 2024.b) and preserve historically significant sites, for instance, the Santa Fe Trail remnants at Cimarron National Grassland (CNG) (U.S. Forest Service, 2023).

USFS lands are monitored through the National Visitor Use Monitoring (NVUM) program, which has two objectives, estimating recreational visits and describing visitor activity, duration, demographics, and satisfaction (English et al., 2020). However, National Grasslands are not analyzed independently by the NVUM program, with data being aggregated with other USFS lands (U.S. Forest Service, 2023). Additionally, other types of visitor use management research rarely examines National Grasslands because data collection can be resource intensive. Typically, research personnel need to be onsite for prolonged periods to collect visitor data. However, it is possible to use technology-based approaches for data collection. For instance, social media can be used to identify visitors to Grasslands, connect with prospective research participants, and is more cost-effective (King et al., 2014).

Despite the recreational benefit and importance of National Grasslands, they lack visitor use management research. This research could provide managers with key information about visitors that could identify potential problems before it heavily impacts visitor experiences. Therefore, this study's purpose is to understand visitor use, perceptions, and how managers can help visitors achieve quality experiences at CNG.

Literature Review

Grassland Ecosystem Services

National Grasslands are managed for multiple sustained use with a focus on scientifically based management practices that support ecosystem services. Management centers on water conservation, wildlife habitat, agriculture, mineral extraction, and recreation (U.S. Forest Service, 2024.a). Managing grazing regimes in Grasslands is key for creating a more heterogenous habitat which has an overall positive affect on wildlife and plant species, resulting in increased species diversity (Ahlering & Merkord, 2016). Managing for this diversity is important for maintaining the health of the grassland which in turn benefits wildlife, native plants, water systems, and visitors (U.S. Forest Service, 2024.b). Increased diversity can boost the psychological benefits among visitors to these spaces (Fuller et al., 2007), increasing nature relatedness, which in turn might increase stewardship among visitors (Jain & Singh, 2023). Because managerial resources can be limited, understanding how to boost or maintain stewardship among visitors might contribute to the conservation of these areas.

The 2022 NVUM master report, which analyzed data from all National Forests and Grasslands, found that the primary activities were hiking (49.6%), viewing natural landscapes (38.3%), relaxation (30.2%), and wildlife (26.9%) (U.S. Forest Service, 2022). The 2016 NVUM Cimarron-Comanche Grasslands report, which aggregated data for the two grasslands located 90 miles apart, found that the primary activities were viewing natural features (35%), fishing (18%), and hiking/walking (15%). Both reports identified that most visitors were traveling within 50 miles of the site. Although total visitation is low, Grasslands are an important recreational resource for locals, with most people enjoying recreational opportunities that might otherwise be limited in their area due to agriculture or private land ownership (Johansen et al., 2021). Therefore, managers should understand the recreational needs of their visitors to better boost visitor perceptions and conserve these spaces for visitor use.

Visitor Perceptions

Human experiences and beliefs are shaped by their perceptions (van Prooijen et al., 2018). Perceptions influence how people interpret empirical stimuli which can result in varying interpretations of the same conditions (Colley & Craig, 2019), and visitors' perceptions often vary across conditions, including how visitors perceive management of parks and protected areas (PPAs) (Weiler et al., 2017). At Grasslands, visitor preferences and expectations are influenced by factors including cultural, economic, individual needs, and access (Tindale et al., 2023). Factors such as increased litter, poor signage, and poor road conditions might result in negative perceptions. Additionally, education can influence visitors' perceptions of conditions and acceptable behaviors (Abrams et al., 2020). For instance, Steele (2020) found that first time visitors at Dakota Prairie National Grasslands were often surprised to find cattle on site and visitor education resulted in increased acceptance of cattle.

Outside of managerial control, visitor perceptions can be influenced by a variety of factors including social media (Hausmann et al., 2020). Additionally, research has found that the perceived value of a location is an indicator for whether a person would recommend it to others (Carrascosa-Lopez et al., 2021). This highlights the importance of maintaining good visitor perceptions. However, due to research scarcity, many Grasslands do not have a baseline measurement of visitor perceptions.

Nature Relatedness

Nature relatedness is the level to which different individuals connect with the natural environment (Kövi et al., 2023). Generally, people with high nature relatedness tend to have higher levels of happiness, positive affect, and life satisfaction (Sadowski et al., 2022). These people also tend to show increased eco-centric concerns and pro-ecological behavior (Jain &

Singh, 2023). At PPAs, particularly those with limited resources, it is important for managers to boost visitors' proconservation behaviors. Increased stewardship can contribute towards limiting and mitigating recreational impacts, which managers can leverage through indirect strategies (Taff et al., 2022). As nature relatedness increases, people will likely behave more sustainably (Jain & Singh, 2023).

Nature relatedness can be measured through the short-form Nature Relatedness Scale (NR-6), which is a 6-item scale comprised of questions from the "self" and "experience" dimensions (Nisbet & Zelenski, 2013). The "self" dimension measures the individual's sense of identity (e.g., "I feel very connected to all living things and the earth."). The experience dimension measures contact with nature (e.g., "I take notice of wildlife wherever I am."). Research has tested the NR-6 for consistency, and it was found to be highly correlated with other nature relatedness scales including the NR-21 (the long-form scale) and the Inclusion of Nature in Self Scale (Nisbet & Zelenski, 2013). Bartholomew et al. (2023) found no evidence of measurement inequivalence or item bias by gender or age and found that the NR-6 showed strong internal consistency and predictive value for positive affect. Aruta & Pakingan (2022) tested the NR-6 among Philippine undergraduate students, whose responses demonstrated that all six items were strong indicators for Nature Relatedness. Similarly, Kövi et al. (2023) tested citizens across Hungary, India, South Korea, and Canada and found that correlations among the six questions stayed consistent. Across students in Germany and Ecuador, higher NR-6 scores were linked with self-transcendence and greater environmental concern, demonstrating that the measurement works across people from vastly different ecological conditions (Dornhoff et al., 2019). Therefore, nature relatedness can be successfully measured and is an important indicator of whether visitors will act as stewards.

Social Media

Grasslands along with National Forests and parks can pose a challenge for social science data collection because of low visitation, multiple entry/exit sites, and typically remote/rural locations. Therefore, Grasslands could benefit from social media data collection, as social media allows researchers to gain access to otherwise difficult to find participants (King et al., 2014). Social media has successfully been used to aid in social science data collection and augment information gathered for an exploratory study (Lehdonvirta, et al., 2021). Huai et al. (2023) collected data onsite and online for park visitation and satisfaction at 102 different parks and found a strong relationship between onsite and online surveys. Social media is shown to be an effective approach for overcoming challenges associated with collecting data at rural PPAs (Da Mota & Pickering, 2020). For instance, Freeman et al. (2021), used a combination of a modified Dillman method and web-based surveys, to achieve a response rate of 63% for hikers on the Appalachian Trail. Furthermore, Wood et al. (2020) found that social media can help understand visitor estimations at unmonitored sites.

An effective approach is non-probability river sampling, which refers to placing a link to a survey in an area of internet traffic where the target population is likely to find it (Lehdonvirta, et al., 2021). Alternatively, there are panel surveys which rely on commercial non-probability online panel providers to distribute the survey through ads on social media, websites, and newsgroups. However, this can lead to an increase of self-selection bias among the population that generally responds to commercial survey panels (Chauvenet et al., 2020). Also, panel samples are more likely to be distributed to individuals outside of the target demographic (Lehdonvirta, et al., 2021).

It is important to understand the limitations of social media data collection when interpreting the results. Popularity of social media sites and access to data can fluctuate with time and it can be difficult to ensure data is representative (Da Mota & Pickering, 2020). Therefore, care should be taken when gathering (e.g., connecting with prospective research participants and pre-identification of target populations) and interpreting the data. Self-selection bias can cause internet surveys to skew towards certain demographics and risks losing some of the broader applications of the study (Lehdonvirta, et al., 2021). However, despite limitations, social media data collection allows researchers to target specific populations and it is flexible and cost-effective.

Study Objectives

Grasslands are challenging for visitor experience studies because they receive low visitation, have many entry/exit locations, and are often located in rural areas. These challenges are reflected in past NVUM research that does not analyze data at each Grassland unit individually but aggregates it with other sites. Additionally, National Grasslands and Forests often do not have managerial resources to actively monitor and manage visitors. Therefore, the purpose of this study was to understand visitor use, perceptions of conditions, how visitor stewardship could be boosted, and identify how managers could provide opportunities that help visitors achieve quality experiences. Additionally, this study tested a social media approach used for data collection that was designed to have transferability to other Grasslands.

Methods

Study Area

Located in Morton County in southwest Kansas, CNG is the largest protected public land in the state (108,175 acres) and is the state's only federally managed land (U.S. Forest Service, 2023) (Figure 1). CNG is comprised of several detached areas and is surrounded by private

farms, ranches, and homesteads. There is a total of 11 designated recreation sites at CNG, mostly along the sandy and dry Cimarron River, with three fishing ponds, seven-day use areas, and one designated campground, though dispersed recreation and camping is allowed. CNG has the only accessible public fishing ponds in Morton County and offers space for hunting, exploring the Santa Fe Trail, angling, hiking, ORVs, photography, picnicking, horseback riding, cycling, and birding (U.S. Forest Service, 2024.c). Despite its size, recreation opportunities, and historic setting, CNG is relatively unknown outside of the nearby locals (U.S. Forest Service, 2016). CNG contains many access points, and its main office is detached, located in Elkhart, resulting in a lack of primary locations where most visitors congregate.

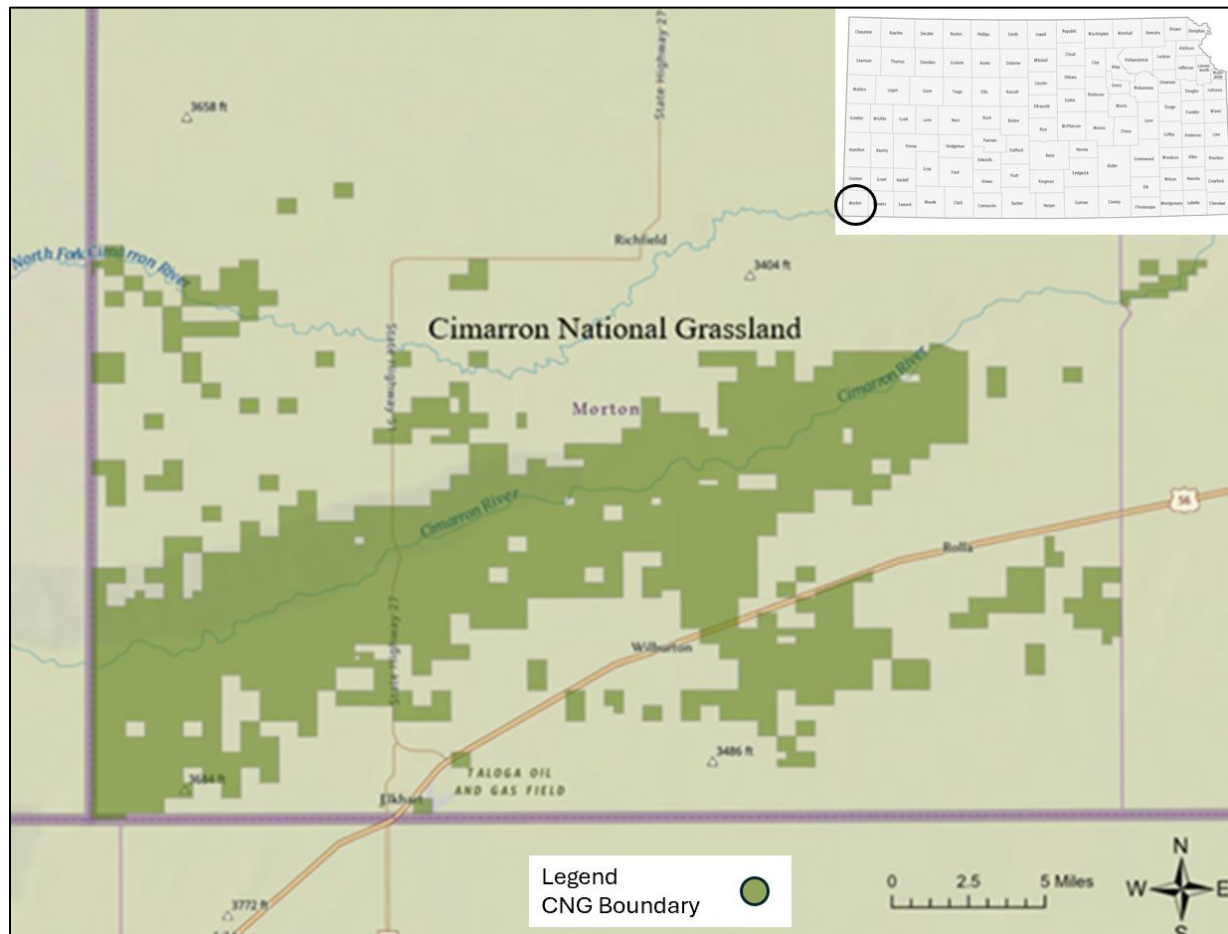


Figure 1. *Cimarron National Grasslands located in southwest Kansas.*

Survey Instrument

As part of the survey development process, semi-structured interviews were conducted with district rangers who had been managing CNG full-time for at least a year ($n = 2$; $M = 33$ -36 min). Interviews were designed to understand drivers of visitor experiences. These interviews were coded through deductive analysis and results were included in the survey (Azungah, 2018). The visitor survey examined participants' past use history, primary activity, primary motivation, where they recreated, and included 5-point Likert scale questions (1 = Strongly Disagree; 5 = Strongly Agree) to understand CNG visitor perceptions of conditions, impacts to their experience, and nature relatedness (using the NR-6 scale). This was followed by open-ended questions to understand positive and detracting experiences and how managers could assist with boosting experiences. The survey concluded with standardized demographic questions based on Qualtrics's database of questions. It was submitted for IRB approval and tested by graduate student and professor volunteers at Kansas State University before being administered to participants on social media.

Social Media Distribution

The social media data collection approach consisted of nonprobability convenience sampling followed by snowball sampling (Mauldin, 2020). Surveys were distributed from 19 June 2023 to 2 November 2023 using Qualtrics, an experience management company which manages and monitors surveys. The social media sites chosen for distribution were (in order of distribution success rate i.e. highest number of completions) Facebook, Instagram, TripAdvisor, and YouTube. These sites were chosen because of the users' ability to tag their location on posts. Potential participants were identified as those who had posted about visiting CNG and were at least 18 years old. They were contacted using a modified Dillman method (Dillman et al., 2014).

All potential participants were contacted through private messaging, with an initial message informing the participant about the survey and asking if they would be interested in receiving the survey web-link. Additionally, this message double-checked that they had visited CNG. Due to private accounts not, all potential participants were able to receive the initial contact and were taken from the contact list. Reminders were sent out once a week, until there was a response or until the fifth contact message was sent. A message template was created for each scheduled contact attempt. These templates were uniform across platforms. When participants responded affirmatively to a contact message, they were sent a weblink or QR code to the survey, dependent on user preference. After agreeing to take the survey, research participants were asked to identify other people they knew who had visited CNG, were adults, and had a social media account.

Once direct messaging of CNG visitors was exhausted on the initial gathered list, an additional strategy using social media was conducted. By implementing questions to prevent repeat takers and non-visitors, it was possible to contact Facebook groups related to CNG and ask to post a weblink and QR code to the survey. A second message template was constructed based on the first series of templates with an imbedded link and QR code. No other announcements were made after that. A total of 536 social media accounts were contacted, and 276 surveys were completed (response rate of 48.50%).

Visitor Interviews

Primary findings from the survey were further explored and validated by conducting interviews with CNG visitors. Interview questions were tested during a mock interview with students and professors at Kansas State University. The research team aimed for representation from primary visitor activity types identified by the survey. These participants were recruited

through Facebook town group chats based on the four most common zip codes reported in the survey. A flyer was constructed and posted to these groups, with an accompanying message that asked for volunteers. Interested participants were asked to send a contact email so they could receive a consent form and schedule the interview. A total of five interviews were conducted with six participants virtually, during participant specified times to increase participant ease. For one interview, two participants attended and were interviewed together. Upon consent, all conversations were recorded and transcribed.

Mobile Device Data Collection

Mobile device data were provided by Spectus (Cuebiq Group LLC), a location intelligence platform that provides aggregated mobility data (Spectus, 2023). Data is collected from anonymized users who have opted-in to data collection by location applications. Spectus allowed our research team to query anonymized, aggregated, and privacy-enhanced data following guidelines for responsible data sharing through a Data Cleanroom environment. The CNG boundary was imported into an automated Spectus dashboard to identify visitor use patterns from 1 January 2022 to 31 December 2022. These dates were chosen because they were the most recent provided by Spectus and there was large variation of when survey respondents had visited CNG.

Data Analysis

Surveys were removed from analysis that had more than 40% missingness (Mirzaei et al., 2022), were from repeat participants, and filled out by people who had never visited CNG. Quantitative data cleaning began with Little's Test of Missingness, which found that data were missing completely at random (Little, 1988). Next, survey data were checked for extreme

responding patterns by assessing for Z-scores greater than 3.29, no patterns were detected (Tabachnick & Fidell, 2013). Descriptive statistics were then calculated for each variable.

Analysis was conducted using a mixture of RStudio (version 2023.03.0-daily+82.pro2) and SPSS(version 29). To boost the interpretability of the survey findings, principal components analysis (PCA) was conducted (Taff et al., 2022). As a prerequisite to PCA, we ran a Kaiser-Meyer-Oklun (KMO) test of sampling adequacy followed by Bartlett's test of Sphericity (Shrestha, 2021). We performed PCA with a varimax rotation (Taff et al., 2022), and accepted Components as valid if they explained more than 50% of the variance (Shrestha, 2021) and included factor loadings greater than 0.5 (Sisneros-Kidd et al., 2021). Next, we used Cronbach's alpha to test the reliability of each component that consisted of more than two items. Values of $\alpha \geq 0.7$ were considered acceptable (Vaske, 2008) along with corrected item-correlations greater than 0.3. For a two-item component, we used Spearman-Brown coefficient, with $\rho \geq 0.80$, being considered acceptable (Vaske, 2008). Next, component items were used to form a mean index for each component. The components were used to identify influencers of nature relatedness and visitor experience were analyzed using a multiple linear regression and missing data was removed pairwise.

Qualitative survey question analysis was conducted deductively to organize a list of codes around a theme of recreation, developed conditions, managerial suggestions, and visitor use (Azungah, 2018). All codes were built with rationale and example comment included. Summary statistics were used to understand mean values, percentages, and standard deviations of each code.

For interview analysis, a blended approach was conducted (Smith, 2021). Transcripts were generated and manually coded using initial themes. As transcripts were analyzed, if new

themes emerged, additional codes were generated. Coding was deemed complete when no new themes emerged (Esterberg, 2002). Trustworthiness was ensured through data triangulation of qualitative survey and interview data and through member checking by professors (Stahl & King, 2020).

Results

Summary Results

After data cleaning, 209 surveys were analyzed for an effective response rate of 38.99%. The average age of respondents was 44 years old, most respondents were female (52.89%), self-identifying as white (86.60%), having completed at least a bachelor's degree (62.14%), with a median household income bracket that showed variability across categories from \$25,000 (14.75%), \$50,000 (18.03%), \$75,000 (11.48%), \$100,000 (19.67%), and finally \$150,000 (20.22%) a year. Most were from Morton County (29%) and on average, visitors reported visiting CNG for 12.4 years (SD=15.16) with a maximum of 65 years. 34.48% of visitors returned within the last month of taking the survey and 71.56% returned within the last year. The top five motivations for visiting CNG were scenery (28.29%), nature (13.17%), peace (13.27%), solitude (9.23%), and social (6.83%). The most common primary activities at CNG were camping (16.90%), hunting (14.98%) Exploring the Santa Fe Trail (11.59%), fishing (9.18%), and hiking (8.70%).

Visitor Perceptions and Activity Type

PCA showed sufficient KMO (0.853) and Bartlett's test of sphericity ($p < 0.001$) (Table 1). This resulted in the creation of four components which were named in accordance with, the items that were loaded: Natural Environment, Nature Relatedness Scale, Primary Activity, and Developed Conditions. One item was omitted due to not meeting a sufficient Cronbach's alpha

(“My ideal vacation spot would be a remote natural area”) and two items were omitted due to not meeting a sufficient Spearman-Brown coefficient (“Number of cattle that you encountered” and “Number of gas and oil wells that were visible”).

Table 1. *Results of PCA and Reliability Analysis*

Component	Variables	Factor Loading	Mean (SD)
Natural Environment $\alpha=0.819$			4.45(0.78)
	Ecological integrity of Cimarron National Grassland	0.688	4.42 (0.82)
	Flora and fauna of Cimarron National Grassland	0.641	4.46 (0.81)
	Overall sustainability of Cimarron National Grassland	0.577	4.47 (0.91)
	The natural sounds of Cimarron National Grasslands	0.620	4.39 (0.72)
	A sense of community and safety within Cimarron National Grassland	0.505	4.14 (0.96)
	Scenery	0.420	4.71 (0.57)
	The night sky at Cimarron National Grasslands	0.504	4.57 (0.70)
Nature Relatedness Scale $\alpha=0.841$			4.38(0.82)
	I always think about how my actions affect the environment.	0.783	4.5 (0.65)
	My connection to nature and the environment is a part of my spirituality.	0.772	4.06 (1.08)
	I take notice of wildlife wherever I am.	0.682	4.74 (0.58)
	My relationship to nature is an important part of who I am.	0.603	4.45 (0.81)
	I feel very connected to all living things and the earth.	0.561	4.16 (0.95)
Primary Activity $\alpha=0.918$			4.29(0.86)
	For my primary activity, I was able to access the area I wanted to go to.	0.779	4.39 (0.74)
	Other visitors were polite and allowed me to recreate without issues.	0.747	4.44 (0.81)
	I found adequate space to achieve my primary activity.	0.752	4.41 (0.83)
	I was able to achieve my primary activity for visiting Cimarron National Grassland.	0.748	4.42 (0.84)
	I was able to spread out and get away from other visitors/groups if I wanted to.	0.704	4.09 (0.89)
	Other visitors behaved as stewards while visiting Cimarron National Grassland.	0.699	4.15 (1.04)
	There were enough resources for me to complete my primary activity.	0.798	4.43 (0.72)
	The natural sounds were easy to hear at Cimarron National Grassland.	0.632	3.99 (0.99)
	Cimarron National Grassland was free of litter.	0.582	4.29 (0.85)
Developed Conditions $\alpha=0.909$			3.91 (0.96)
	Trail Conditions	0.651	3.96 (0.88)
	Interpretive Displays	0.736	3.67 (0.98)

Recreation Information Availability	0.735	3.91 (0.93)
Signage Adequacy	0.658	3.60 (1.08)
Road Conditions	0.701	3.60 (1.08)
Parking Lot Conditions	0.642	4.04 (0.98)
The Condition of the Developed Facilities	0.686	3.69 (1.04)
The Trails are Easy to Find	0.573	3.71 (1.05)
The Condition of the Environment	0.694	4.21 (0.90)
Parking Availability	0.535	4.34 (0.85)
Restroom Cleanliness	0.525	3.52 (1.05)
Feeling of Safety	0.579	4.44 (0.75)

¹ Measured on a scale of 1-Strongly disagree and 5-Strongly agree; ² KMO=0.853; Bartlett's test of sphericity, $p<0.001$.

Figure 2 demonstrates how each of these activity groups responded to the questions within the four components. For Natural Environment, Santa Fe Trail enthusiasts (n=24) had the highest averages while anglers (n=19) were the lowest. For Nature Relatedness, campers (n=35) had the highest averages while hikers (n=18) had the lowest. For Primary Activity, Santa Fe Trail enthusiasts had the highest averages while anglers had the lowest. Finally, for Conditions of the Developed Facilities, hikers had the highest averages while hunters (n=31) had the lowest.

Component Means Divided by Visitor Activity

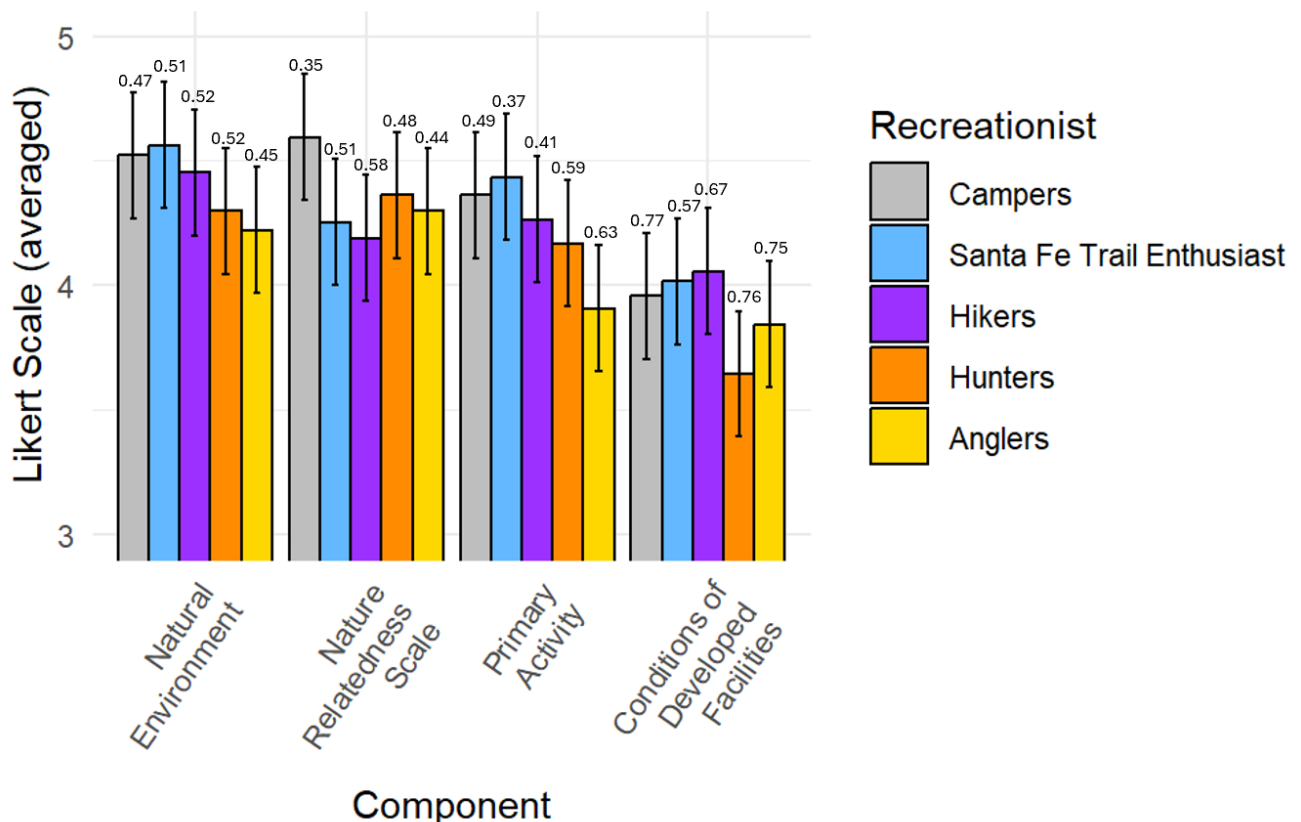


Figure 2. Visitor perceptions of components with standard deviation and error bars based on primary activity type.

Multiple Linear Regression

A multiple linear regression analyzed how the four components influenced nature relatedness. Collinearity was not detected (All VIF < 4.0 [range 1.46 to 1.66] and Tolerance > 0.10 [range 0.60 to 0.68]). Overall, the model was statistically significant ($F(3, 198) = 27.07$, $p < 0.001$, $R^2 = 0.29$). This finding was statistically significant for developed facilities ($\beta = -0.23$; $t = -3.01$; $p = 0.003$) and for natural environment ($\beta = 0.57$; $t = 7.89$; $p < 0.001$). This suggests that with nature relatedness is positively correlated to natural environment and negatively correlated to developed facilities.

A second multiple linear regression analyzed if the four components influenced visitors enjoying their visit. Collinearity was not detected (All VIF < 4.0 [range 1.41 to 1.93] and Tolerance > 0.10 [range 0.52 to 0.71]). Overall, the model was statistically significant ($F(4, 197) = 67.51$, $p < 0.001$, $R^2 = 0.58$). This finding was statistically significant for primary activity ($\beta = 0.69$; $t = 11.49$; $p < 0.001$). Demonstrating that visit enjoyment was positively correlated with primary activity.

Site Visitation

According to the survey, the three most visited sites were Point of Rocks (42.10%), Middle Springs (27.75%), and the campground (25.84%). Participants were able to select all sites they had visited during their stay. Using Spectus data, visitation patterns were identified at these locations (Figure 3). Point of Rocks is a popular location for its scenic vista. Most people tended to stand near the edge of the overlook. Middle Springs is a day use area with picnic sites near the road where people tend to gather. The campground has two large point clusters labeled A and B in Figure 2. A is located at the official overnight campground and B is at a popular

fishing pond. According to Spectus analysis, CNG sees more visitation on Saturday (19.67%) with most visitors being on site around 5pm (8.23%) and staying on site between 0-50 minutes (42.75%).



Figure 3. Visitation pattern density analysis using Spectus mobile device data.

Qualitative Survey Questions

The qualitative survey questions resulted in a count of 558 comments from 143 participants, sorted into 17 different codes drawn from previous research on visitor satisfaction (U.S. Forest Service, 2022) using deductive analysis (Azungah, 2018). These codes were then separated into three broader categories, Detracting Conditions (46.59%), Enhancing Conditions (28.14%), and Managerial Suggestions (23.66%). Detracting Conditions of Facilities and Developed Recreational Areas (Table 2) were the most common codes with facilities being mentioned the most.

Table 2. *Detracting Conditions of Facilities and Developed Recreational Areas qualitative analysis codes.*

Detracting Conditions of Facilities and Developed Recreational Areas			
Category	Rationale for Category	Example (verbatim)	Percent (n)
Facilities	All detracting built or developed for recreational use areas, i.e. restrooms, bathrooms, trash removal, trails, and access (roads)	<i>"Some of the roads were partially washed out and rough and weeds grown up to the road scratching my vehicle."</i>	24.8 (139)
Missing Signage or Information	missing trail, map, or rules informational signage either on site or unable to access through cell service while on site.	<i>"There aren't maps from what I have seen and so I didn't know how to get to the next place I wanted to go so we just skipped it."</i>	11.3 (63)
Controllable Natural Resources	resources that could potentially be added to enhance visitor experiences.	<i>"Keep ponds stocked with catfish and other natural fishes and keeping out invasive species. Keep ponds clean and free of cattails and tumble weeds."</i>	6.6 (37)
Missing Educational Opportunities	missing interpretive information	<i>"Maybe some interpretive signage to learn about the history and flora and fauna there."</i>	5.2 (29)
Uncontrollable Natural Resources	uncontrollable natural events	<i>"Hot weather"</i>	2.7 (15)
Other Visitors	The Recreation activity or the presence of another visitor causing detracting conditions.	<i>"Sketchy visitors when I was there with a group of students."</i>	2.5 (14)
Gas and Oil	Mentions of gas and oil as a detracting from the natural resources/	<i>"Oil truck traffic"</i>	1.6 (9)

Interviews

Interview questions were constructed to gain a better understanding of current visitor's thoughts about developed facilities, because this Component received the lowest ratings, and detracting conditions were the most common code identified by qualitative survey questions. Six themes emerged that are centered around developed conditions with associated codes (Table 3). All participants expressed enjoyment in their time at CNG even when discussing detracting conditions. For instance, in Navigation Signage, most participants were confident with their ability to find their desired locations, and only suggested additional information was needed when asked if a newcomer would be able to navigate the area.

Table 3. *Developed condition themes and codes with select quotations.*

Theme	Codes	Quotation
Trail Conditions	Detracting Conditions	• <i>"But it basically just looked like a big pasture, and you couldn't really tell well where's the trail supposed to be, so that was disappointing..."</i>
	Positive Conditions	• <i>"You rarely see people on the trail (Turkey Trail) but when you do they have similar interests."</i>
Education Signage	Missing Information	• <i>"I have a file of information and when I pull it out they say "I wish they had some of those for us" I think that they would increase knowledge and use of the area."</i>
	On Site Information	• <i>"When you first drive into the ponds or any place. Everything's, right there and visible for you."</i>
Ponds	Maintenance Suggestions	• <i>"The Forest Service is not taking care of it, and they need to."</i> (Point of Rock Ponds)
	Use	• <i>"You know a better experience rather than fishing elbow to elbow to everybody in one little circle or whatever."</i> (Campground pond)
Navigation Signage	Missing Information	• <i>"When you pull into Elkhart and you might even see their office but it doesn't occur to some people that. Hey, there's where you need to get the information to know what to see out on the grasslands. Some people might think well we just drove through it I saw grass, and it's like you missed the trails the ponds the points the springs. Yeah, they missed all the exciting stuff."</i>
	Accessible Information	• <i>"If someone put all the information that people want (in CNG), the whole place would be filled with maps."</i>
Roads	Detracting Conditions	• <i>"The road alongside the river is washboard and sometimes it's really bad. Even though I go very slow I am worried about it."</i>
	Positive Conditions	• <i>"I mean what they've got is perfect for what is it wouldn't be the National Grasslands if had pavement everywhere."</i>
Facilities	Detracting Conditions	• <i>"With restrooms, sometimes they're not kept very suitable and they're getting older."</i>
	Positive Conditions	• <i>"Lots of changes over there in 55 years using out there. And what we have over there now is a tremendous advancement forward for access and visitor usage."</i>

All six participants were regular visitors (returning multiple times a year) to CNG who participated in a range of activities, including angling, hunting, hiking, camping, and exploration of cultural sites such as the Santa Fe Trail. Interviewees cited developed facilities like restrooms and trail markers were generally cited as beneficial for completing activities or as contributing factors for using a particular site. For instance, one participant would typically use the

campground for fishing as this site had restrooms closest to the ponds and the handicapped fishing dock.

“But like I'm an old lady so if there's not a bathroom there pretty close or I'm assured that there is nobody within several miles, I'm not going to spend much time there because I mean I need to use the bathroom.”

While another participant preferred to hike in Middle Springs because she felt the trails were better marked than the larger Companion Trail. When referring to the Companion Trail:

“There was a gate and there was a little sign and like the trail journal booklet, but you couldn't tell where the trail was supposed to be so that was kind of disappointing and that has discouraged us from going out there again.”

Other participants prefer less managed areas for their primary activity and would select locations away from these developed sites.

“I just kinda take off and do my thing and so we might start out on something that's marked as a trail and within oh a 100 yards I'll be off doing something completely (different). There's more to see then what is right there on the trail to me. I think this is one of the nice things about Cimarron You kinda get that freedom.”

Discussion

The purpose of this study was to understand visitor use, perceptions of Grassland conditions, how to boost visitor stewardship, and to identify how managers could provide opportunities that help visitors achieve quality experiences. This was accomplished using a mixed method exploratory process that included social media data collection. Limitations must be kept in mind when working with social media data, gathering a representative sample might prove challenging. However, in low visitation and rural sites, these methods could help managers gain some knowledge of visitors.

Results from this study showed that Point of Rocks, Middle Springs, and the campground saw the most visitors. The quantitative results reveal that visitors generally rated experiential items highly, while the qualitative results demonstrated that many visitors had negative perceptions of the developed conditions of the facilities. By interviewing local visitors at CNG, it was found that they enjoyed their visit to CNG and that their site selection is influenced by activity and developed facility conditions. Due to the small sample size it is not feasible to make managerial decisions, however, understanding these perceptions could help managers gain a better understanding of visitors at CNG, with future research expanding on these topics.

Exploratory Studies

Exploratory studies are typically conducted for topics with little known information and are often paired with multi-method approaches to gain data (Swedberg, 2020). These types of studies can give researchers necessary flexibility in collecting, analyzing, and interpreting data, allowing for focus to shift to different topics within the research subject (Mbaka & Isiramen, 2021). CNG has had scarce research conducted on site, resulting in limited understanding of visitor perceptions and ideals. In alignment with past exploratory research, this study collected different data types. Data collection began with semi-structured interviews with managers to inform survey construction, which influenced the decision to include both quantitative and qualitative questions. Results revealed that people rated developed facilities the lowest which aligned with responses to qualitative survey questions. These results were explored by conducting interviews with visitors to gain a better understanding of why the results appeared unaligned. Furthermore, exploratory studies can generate starting points for future research (Alkhalaf & Orams, 2021). This study helps researchers and managers gain insight into visitor

uses and perceptions at CNG assisting in creating a springboard into more in-depth studies in the future that focus on specific aspects of the visitor experience.

Spatial Data

This study found that Point of Rocks, Middle Springs, and the campground were the most used sites. Point of Rocks' popularity potentially stems from the most cited motivation "Scenery" and the third most popular activity "Santa Fe Trail Enthusiast." Point of Rocks provides an expansive vista of the short grass prairie and a view of the wagon ruts left over from the Santa Fe Trail. As can be seen from Spectus analysis (Figure 2) most visitors tended to cluster around the edge of the location, likely observing the scenery, the historic trail, and reading the educational signs. Another potential reason for Point of Rocks' popularity is that it is an easily accessible stopover site, with a road that leads directly up to the viewpoint. Not far from Point of Rocks is Middle Springs the second most popular location, with most visitors either driving past it to reach Point of Rocks or only needing to take a short detour to access this area. It is popular for exploration, picnicking, and hiking, with established trails and developed facilities such as restrooms and tables, which are unavailable at Point of Rocks. However, Middle Springs is not open for camping, nor does it have an active fishing spot. The third most popular site is the campground. Spectus shows a split between people clustering around the camping area and the fishing ponds. Despite CNG having fishing ponds and dispersed camping in other areas, the campground has developed facilities, including a handicap dock, restrooms, water faucets, trashcans, and is more easily accessed off the main road. This site is ideal for members of the community that might want to enjoy their primary activity (camping or fishing) at a convenient location with access to amenities. By understanding visitor use and

patterns, managers see which sites might need more maintenance and which areas within these sites could see the most traffic.

Visitor Perceptions

Perceptions of the four components (Natural Environment, Nature Relatedness Scale, Primary Activity, and Conditions of Developed Facilities) varied across the five main visitor activity types (Campers, Santa Fe Trail Enthusiasts, Hikers, Hunters, Anglers). However, all visitor types rated the components positively with none going below a neutral rating of 3.

Natural Environment and Nature Relatedness were the two components that ranked the highest respectively. This connects to the finding that ratings of the natural environment positively impact ratings of nature relatedness. As many respondents were nearby locals that return to CNG regularly for their activities they are likely spending an increased amount of time in the natural environment and as a result increasing their nature relatedness (Nisbet et al., 2009). Managers could continue to foster this connection through educational programs that help draw attention to the natural environment (Sadowski et al., 2022) and offer events designed for visitors to interact with the environment. This is important because this will likely increase visitors' nature relatedness and research suggests that people with higher nature relatedness will exhibit pro-ecological behavior (Jain & Singh, 2023). This is crucial at CNG where management resources could be limited.

Across activity types, Conditions of Developed Facilities were rated the lowest, which was supported by the qualitative responses where "Facilities" was the most common detracting condition. In general, people seem to be satisfied with their visit, but facilities falling into disrepair or looking neglected could decrease satisfaction and lead visitors to believe that the site is not being well maintained (Colley & Craig, 2019). Managers could boost visitor experiences

by conducting more consistence maintenance, such as for trails, restrooms, and the handicapped dock at fishing sites. These maintenance strategies could increase accessibility to the natural environment which could increase nature relatedness.

Nature Relatedness Influences

Nature relatedness was found to be negatively influenced by developed conditions but positively influenced by the natural environment. Nature relatedness tends to increase with nature exposure (Dornhoff et al., 2019) and individuals with higher nature relatedness typically spend more time looking at natural features, like trees, than developed conditions (Chen et al., 2022). Therefore, visitors to CNG with high nature relatedness scores are more likely to enjoy the natural environment when compared to people with lower nature relatedness scores.

Conversely, lower nature relatedness scores were linked with people looking more at buildings (Chen et al., 2022), this results in these individuals likely paying less attention to the natural environment overall, resulting in decreased perceptions. Because nature relatedness is linked to pro environmental and sustainable behaviors (Aruta & Pakingan, 2022), at CNG, where managerial resources are limited, using indirect strategies to increase nature relatedness might increase stewardship of visitors without needing to increase staff presence on the site. As nature relatedness can be increased with time spent outdoors and education (Sadowski et al., 2022) managers could potentially facilitate an increase in nature relatedness by increasing educational material onsite such as educational signs, easily access brochures, and educational programs.

Visitor Enjoyment

Visit enjoyment was positively influenced by achieving primary activity. The more visitors felt they were able to achieve their primary activity at CNG the higher they rated their experience. As noted by this study and the NVUM 2016, many of CNG's visitors are locals and

repeat users. CNG is surrounded by private land and is perhaps the only area where people can enjoy their preferred outdoor recreational activity. Therefore, it makes sense that the degree of visitor enjoyment and activity are linked. By fostering this link and working to maintain ease of access and visitor satisfaction, visitors will likely continue to return to CNG. For instance, in the visitor interviews, all six participants expressed how beneficial CNG was for their activity, with one noting *“Proximity is an attractive feature.”* This in turn could increase enjoyment linked with the site itself and not just because CNG is the only accessible option; potentially leading to increased stewardship and pride in the location.

Therefore, it is important to understand the perceptions of current visitors. Across all six interviews, participants were interested in increased trail and pond maintenance; however, there was response heterogeneity regarding level of maintenance. This could be a potential issue for management as some interviewees preferred a less maintained site while others were unable to use certain resources for their activities due to accessibility reasons.

Therefore, people at CNG may use certain sites more than others, in the case of fishing, people tend to cluster around the handicapped dock and the more easily accessed fishing pond at the campground (Figure. 2). Furthermore, for activities like hiking, some participants might prefer less maintained trails:

“I kinda prefer it to be like a marked trail that you can see somebody's been down there, but it doesn't have to be a well-manicured situation.”

While others were discouraged by poorly maintained trails:

“But it basically just looked like a big pasture, and you couldn't really tell, well where's the trail supposed to be. So that was disappointing...”

Social Media

Due to CNG's remote location and low visitation, social media data collection was conducted. Initial recruitment centered on identifying accounts whose owners had visited CNG in the past. While this process took some time it was ultimately less labor intensive than in-person surveys. Distribution online allowed the researcher more quickly find any potential participants and to send out contacts and respond to participants at any time, giving greater flexibility. A limitation in distribution rate was caused by the anti-spam rules created on individual platforms, meaning limited number of participants could be messaged per day. This slows down the process, but maintaining a distribution schedule and noting when accounts were contacted can make this manageable. Additionally, potential participants could easily ignore incoming messages or messages could be sent to spam boxes.

Initial survey attempts were slow until snowball sampling increased. With river sampling for Facebook groups, links could be left in appropriate CNG groups (e.g., local hunting, fishing, and camping groups) while generally avoiding participants outside of the target population. This method does lessen the precision of population targeting, but additional survey questions can be used to identify those outside the population. This method could be used in similar remote areas with barriers to research and could open more areas to social science data collection. However, care must be taken in social media research to avoid selection bias and to be mindful of populations that might not have ready access to the internet (Chauvenet et al., 2020).

NVUM

While the NVUM has been a useful tool for understanding National Forests and National Grasslands visitation (English et al., 2020), aggregating data between sites can skew information towards the more popular sites and cause site specific information to go undetected. For specific locations like CNG this information loss could impact management decisions. When compared

to the 2022 NVUM master report this study shows that CNG has a unique visitor base, with camping being the most popular activity. Hiking on the master report was the most popular and fishing did not make the top five (U.S. Forest Service, 2023) however, it was ranked fourth on this study. Though fishing does appear on the 2016 Comanche-Cimarron report, camping does not, and hiking is ranked as the third most popular activity (U.S. Forest Service, 2016). The NVUM also loses the ability to ask about site specific features, for instance Santa Fe Trail Enthusiast ranked third on this study with no comparable statistic in the NVUM, even when narrowing the focus down to the Comanche-Cimarron group.

Future Research

National Grasslands such as CNG have been understudied in the past. Future research at CNG could expand on knowledge gained from this study by conducting online surveys of non-visitors to gain a better understanding of the difference between those that have visited CNG and those that have not. Additionally, in-person surveys could be beneficial to gather onsite and more timely impressions from visitors about site conditions. Also, this information could be used to test the effectiveness of data collection at specific social media sites, such as Instagram, Facebook, and Chatbox. Further research could also expand on signage and educational materials to understand how that influences nature relatedness. This would help to gain additional insight into how effective education is in promoting nature relatedness and what types of educational displays are most impactful. Future research could also try to understand the balance between managed conditions, visitor perceptions, and environment. Understanding this could help with visitor satisfaction while also maintaining the multiple sustainable yield mission of the Forest Service (U.S. Forest Service, 2024.a), an important and potentially transferable knowledge base that could help other National Grasslands or Forest Service sites.

Limitations

When distributing online surveys there was no time limit placed on who could receive a survey, therefore people whose photos and posts were several years old were able to complete the survey. This broad time range allowed for more participants; however, it also increases the risk that respondents might not fully remember the details of their visit to CNG. A further limitation comes from selection bias of those who post about their visit to social media. There was certainly some bias seen in the reports of yearly income. Lastly, more interviews could have been conducted to explore the survey results, with the small number saturation could not be achieved and therefore future research would be needed before managerial decisions are made based on these respondents.

Chapter 3 - Summary and Conclusions

Reflections on Learning

Introduction

The purpose of this section is to review the thesis writing process with a focus on what I have learned throughout the study, the challenges overcome, the successes and discoveries, and finally some advice that I wish to impart to future students and researchers. This chapter is meant to be an honest reflection of the entire process and will hopefully bring insight into my personal journey with this research.

Challenges

Challenges began early in the process. As excited as I was to start with my master's program and to do research relating to CNG I had a hard time finding a focus for my project. My mind can jump from topic to topic and without some form of structure this project likely would have expanded outward until it had become unmanageable. With advice from my advisor and a built-up plan I was able to set myself on track for exploratory research at CNG, building up a backbone that I look forward to working from with new ideas.

A major concern was the process of organizing and managing the overall research for this project. I've worked in research in the past, but always as a technician fulfilling the needs of the project as directed by my managers. I'd never designed my own project before and was a bit lost on where to start or what was possible. Working with my advisor, other students in the department, and members of my committee I became better versed in the design process and by leaning on their knowledge I was able to complete this research and gain key new skills that I am excited to use in my future endeavors.

I was also concerned with the statistical analysis of my results. Mathematics and statistics have always been a weakness in my past. Learning StudioR was a challenge that took many hours to overcome, and while I am still learning, I felt satisfied when I reworked some of my old R codes and was not only able to create a new code faster, but I felt far more confident that my code was working as intended. It was also satisfying to see when my results matched those of a more skill PhD student in the lab and it was beneficial to look over his work to see where I had been making mistakes. By talking with fellow students, my professors, and carefully reading and re-reading the results sections of manuscripts I feel more confident in my statistical abilities and more importantly I feel more comfortable simply asking for help when I do not understand a concept.

Distribution of the survey was another hurdle that I overcame. I had little social media experience prior to starting this project and I had to learn how to navigate and most importantly what keywords to search to find my accounts. Additionally, I had to learn how to craft messages that would be professional but not too clinical to gain the trust of potential respondents. This was accomplished thanks to my professors who gave feedback on potential messages and helped guide me into making the perfect templates for the task. This process also taught me to be patient, as I often had to wait for participants or even the social media website itself, before I was able to move onto the next step of my distribution plan.

Another challenge came from the interviews. Setting up for the interviews through social media had become easy by that point, however actually conducting them was another matter. To say that my practice run was a bit rocky is an understatement, but through the advice and comments of my two professors and the additional advice from the two lab members who volunteered for the process, I was able to build confidence and created a script that assisted with

the interviews. By my final interview I felt more capable of going over the questions with my participant and felt that my gathered data was richer for it.

Successes

There were many successes in this project, the most obvious are the results presented in chapter II, however less obvious are successes personal to me. I learned to be flexible when it came to the process, to try new solutions when problems arose and to seek help when I did not understand something. I became better able to manage my own time and break the process down to manageable chunks. Additionally, there was a period of time when I was certain that I would never be able to get the required number of survey participants and that the project would have to move forward with less-than-ideal sample numbers. However, with perseverance and flexible strategies I was able to get the final few surveys that I needed for proper data analysis.

Discoveries

It is exciting to think that this might be one of the first studies to look in-depth at CNG's visitation. While the NVUM has examined CNG in the past, it was always combined with the larger Comanche National Grassland. Therefore, it has been an honor to work with so many excellent people to gather and analyze this data so that it can be of use to managers and other researchers. I hope that more studies will be produced in the future using this as a springboard into even more detailed and excellent work at CNG. These larger discoveries are important; however, I made a few personal ones as well.

I discovered a new set of skills specific to technical writing. This includes being more direct and focused with my writing and avoiding going down every single avenue of a topic and staying within the scoop of the paper. I'm sure I could have written 20 pages on just the history of the National Grasslands alone, however realizing that not every part of that history is

important for people to understand this project and with the guidance of my advisor I was better able to keep my writing focused on the topic at hand.

Advice

My advice to future students and researchers is to not be afraid of challenges and to push into areas of research that might be difficult to approach. Due to CNG's remoteness it was hard to survey in person, but I wanted to do something with the National Grasslands since the McIntire-Stennis grant came with an expectation of research at the grasslands. Therefore, when it comes to taking on challenges it is important to be creative, flexible, and willing to go with the flow.

Admittedly, I am not a fan of social media for my own personal use, however, being open to learning this tool and utilizing it has led to the completion of the project and results that I feel proud of. Being open to new challenges and new ideas is part of being a scientist. It is also important to take care that the research is sound and backed with good data and evidence. There are limitations to social media research, and being aware of those limitations allows me to speak more honestly about the scope of the research and to know when to pull back on a claim and state that more research needs to be done in that area.

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Appendix A - Semi structured Interview Questions

The interviews were constructed and implemented with a modified Seidman approach (Seidman, 2012) This interview breaks into four parts, Initial Questions, Recreational Activity, Desired Recreational Resource Availability, and Summary.

The purpose for these interviews was to gain a better understanding of the types of visitors and their desired resources visiting CNG from managers who had been working at CNG for at least a year.

INITIAL QUESTIONS

1. Do you mind if I record the interview with you?
2. Did you read the consent form I emailed you?

RECREATIONAL ACTIVITY

3. What are the top five most common recreationists at CNG?

DESIRED RECREATIONAL RESOURCE AVAILABILITY

4. What are the desired resources for (Activity 1)
 - A) What resources are there (tangible/intangible)
 - B) What resources are not there (tangible/intangible)
5. What are the desired resources for (Activity 2)
 - A) What resources are there (tangible/intangible)
 - B) What resources are not there (tangible/intangible)
6. What are the desired resources for (Activity 3)
 - A) What resources are there (tangible/intangible)
 - B) What resources are not there (tangible/intangible)
7. What are the desired resources for (Activity 4)

- A) What resources are there (tangible/intangible)
 - B) What resources are not there (tangible/intangible)
8. What are the desired resources for (Activity 5)
- A) What resources are there (tangible/intangible)
 - B) What resources are not there (tangible/intangible)

SUMMARY

9. What types of recreation currently require the most resources at CNG?
10. Are there any conflicts between different visitor typologies?

What resources do you think visitors might want to see in CNG in the future?

Appendix B - IRB Statement



TO: Brian Peterson
Horticulture & Nat Resources

FROM: Lisa Rubin, Chair
Committee on Research Involving Human Subjects

DATE: 11/28/2023

RE: Proposal #IRB-11729, entitled "Visitor Typologies and Resource Use at Cimarron National Grasslands."

MODIFICATION OF IRB PROTOCOL #IRB-11729, ENTITLED, "Visitor Typologies and Resource Use at Cimarron National Grasslands"

EXPIRATION DATE: Exempt

The Committee on Research Involving Human Subjects (IRB) has reviewed and approved the request identified above as a modification of a previously approved protocol. **Please note that the original expiration remains the same.**

All approved IRB protocols are subject to continuing review at least annually, which may include the examination of records connected with the project. Announced in-progress reviews may also be performed during the course of this approval period by a member of the University Research Compliance Office staff. Unanticipated adverse events involving risk to subjects or to others must be reported immediately to the Chair of the IRB, and / or the URCO

It is important that your human subjects activity is consistent with submissions to funding / contract entities. It is your responsibility to initiate notification procedures to any funding / contract entity of any changes in your activity that affects the use of human subjects.

Electronically signed by Lisa Rubin on 11/28/2023 1:29 PM ET

Appendix C - Questionnaire

Visitor Typologies and Desired Resources at Cimarron National Grassland

Survey to understand the variety of users and which resources they use and desire



The purpose of this study is to discover the types of activities visitors are engaging in and the resources needed for these activities. This will help inform managers about which desired resources to offer at Cimarron National Grassland.

Conducted by:



KANSAS STATE
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Park Management and
Conservation



All responses are confidential and anonymous. By completing and submitting this survey you are giving permission for anonymous information in this survey to be used for research purposes.

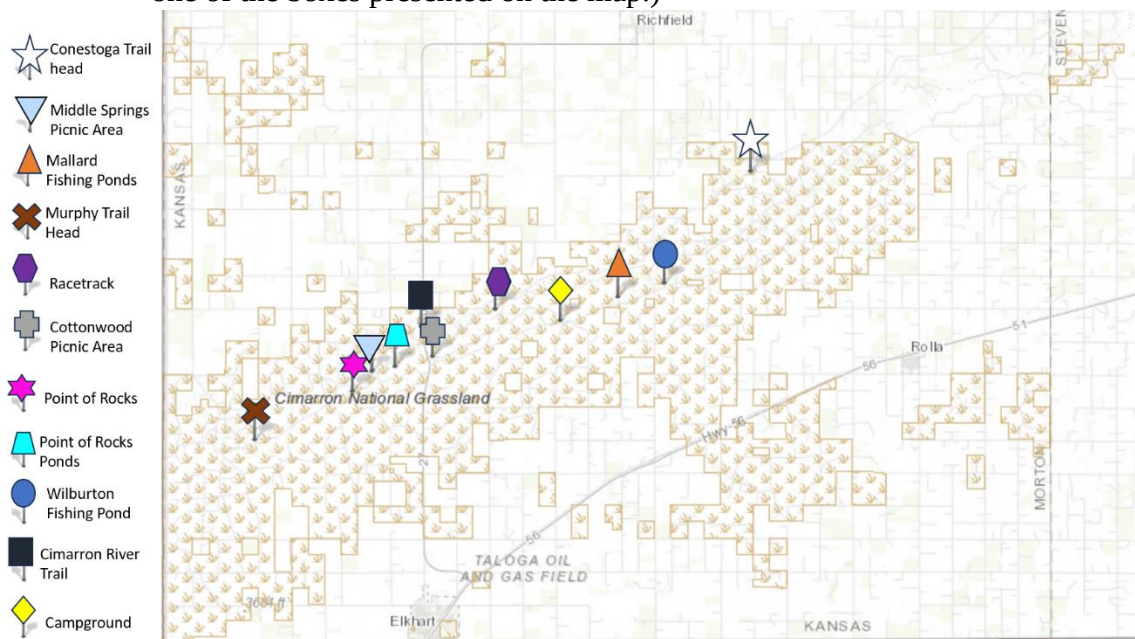
If you have any questions about this survey, please contact the primary investigator Dr. Brian Peterson at Brianpeterson@ksu.edu or 619-990-6708. You may also contact the Research Compliance Office at Kansas State University with questions about the survey at comply@ksu.edu.

SECTION 1: YOUR VISITS TO CIMARRON NATIONAL GRASSLAND

1. Please tell us about your past visit to Cimarron National Grassland.
 - a. Including today, how many **days in the last month** (30 days) have you visited Cimarron National Grassland? _____
 - b. Including today, how many **days in the last year** (12 months) have you visited Cimarron National Grassland? _____
 - c. Including today, how many **years (total)** have you visited Cimarron National Grassland? _____
2. How many people were in your group during your **last visit** to Cimarron National Grassland? (If you traveled alone, please type 1 in the space provided) _____

SECTION 2: YOUR LAST VISIT TO CIMARRON NATIONAL GRASSLAND

1. What were the primary sites you accessed for your last visit? (Please select at least one of the boxes presented on the map.)



2. What activities did you engage in during your last visit to Cimarron National Grassland (Please select all that apply)
 - ☐ Hiking
 - ☐ Backpacking
 - ☐ Exploring the Santa Fe National Historic Trail
 - ☐ Birding
 - ☐ Cycling
 - ☐ Hunting

- ☐ Fishing
 - ☐ Horseback riding
 - ☐ Off-road vehicles
 - ☐ Camping
 - ☐ Picnicking
 - ☐ Other (Please specify): _____
3. What was the primary activity for your last visit to Cimarron National Grassland (Please select one)
- ☐ Hiking
 - ☐ Backpacking
 - ☐ Exploring the Santa Fe National Historic Trail
 - ☐ Birding
 - ☐ Cycling
 - ☐ Hunting
 - ☐ Fishing
 - ☐ Horseback riding
 - ☐ Off-road vehicles
 - ☐ Camping
 - ☐ Picnicking
 - ☐ Other (Please specify): _____
4. What was your primary motivation for your last visit to Cimarron National Grassland?
- ☐ Connecting with nature
 - ☐ Solitude
 - ☐ View scenery
 - ☐ Peace and calm
 - ☐ Learn new things
 - ☐ Develop skills
 - ☐ Escape crowds
 - ☐ Exercise
 - ☐ Social bonding
 - ☐ Other (Please specify): _____
5. What was the reason for your last visit to Cimarron National Grassland? (Select all that apply)
- ☐ Spend time with friends/family
 - ☐ Recreation
 - ☐ Learning about history
 - ☐ Observing wildlife
 - ☐ Game birds
 - ☐ Fishing
 - ☐ Large game
 - ☐ Other (Please specify): _____

1.

On a scale of 1-5 please rate your experience at Cimarron National Grassland						
I enjoyed my visit to Cimarron National Grassland.	1 Strongly disagree	2 disagree	3 neutral	4 agree	5 Strongly agree	N/A
I was able to achieve my primary activity for visiting Cimarron National Grassland.	1 Strongly disagree	2 disagree	3 neutral	4 agree	5 Strongly agree	N/A
I found adequate space to achieve my primary activity.	1 Strongly disagree	2 disagree	3 neutral	4 agree	5 Strongly agree	N/A
There were enough resources for me to complete my primary activity.	1 Strongly disagree	2 disagree	3 neutral	4 agree	5 Strongly agree	N/A
For my primary activity, I was able to access the area I wanted to go to.	1 Strongly disagree	2 disagree	3 neutral	4 agree	5 Strongly agree	N/A
The trails at Cimarron National Grassland are easy to find.	1 Strongly disagree	2 disagree	3 neutral	4 agree	5 Strongly agree	N/A
Cimarron National Grassland was free of litter.	1 Strongly disagree	2 disagree	3 neutral	4 agree	5 Strongly agree	N/A

I was able to spread out and get away from other visitors/groups if I wanted to.	1 Strongly disagree	2 disagree	3 neutral	4 agree	5 Strongly agree	N/A
Other visitors were polite and allowed me to recreate without issues.	1 Strongly disagree	2 disagree	3 neutral	4 agree	5 Strongly agree	N/A
Other visitors behaved as stewards while visiting Cimarron National Grassland.	1 Strongly disagree	2 disagree	3 neutral	4 agree	5 Strongly agree	N/A
The natural sounds were easy to hear at Cimarron National Grassland.	1 Strongly disagree	2 disagree	3 neutral	4 agree	5 Strongly agree	N/A
I would return to Cimarron National Grassland to recreate again.	1 Strongly disagree	2 disagree	3 neutral	4 agree	5 Strongly agree	N/A

2.

On a scale of 1-5 please rate how important the following are to you.					
Overall sustainability (i.e. this resource will be available for future generations) of Cimarron National Grassland	1 Strongly disagree	2 disagree	3 neutral	4 agree	5 Strongly agree

Encountering very few other visitors at Cimarron National Grassland	1 Strongly disagree	2 disagree	3 neutral	4 agree	5 Strongly agree
The natural sounds of Cimarron National Grassland	1 Strongly disagree	2 disagree	3 neutral	4 agree	5 Strongly agree
The night sky at Cimarron National Grassland	1 Strongly disagree	2 disagree	3 neutral	4 agree	5 Strongly agree
A sense of community and safety within Cimarron National Grassland	1 Strongly disagree	2 disagree	3 neutral	4 agree	5 Strongly agree
Ecological integrity of Cimarron National Grassland	1 Strongly disagree	2 disagree	3 neutral	4 agree	5 Strongly agree
Flora and fauna of Cimarron National Grassland	1 Strongly disagree	2 disagree	3 neutral	4 agree	5 Strongly agree

3.

On a Scale of 1-5 rate how much, if at all, did these items impact your experience.						
Number of cattle that you encountered	1 Extremely dissatisfied	2 Somewhat dissatisfied	3 Neither satisfied nor dissatisfied	4 Somewhat satisfied	5 Extremely satisfied	N/A
Number of gas and oil wells that were visible	1 Extremely dissatisfied	2 Somewhat dissatisfied	3 Neither satisfied nor dissatisfied	4 Somewhat satisfied	5 Extremely satisfied	N/A
Restroom cleanliness	1 Extremely dissatisfied	2 Somewhat dissatisfied	3 Neither satisfied nor dissatisfied	4 Somewhat satisfied	5 Extremely satisfied	N/A
The condition of the developed facilities	1 Extremely dissatisfied	2 Somewhat dissatisfied	3 Neither satisfied nor dissatisfied	4 Somewhat satisfied	5 Extremely satisfied	N/A

Condition of the environment	1 Extremely dissatisfied	2 Somewhat dissatisfied	3 Neither satisfied nor dissatisfied	4 Somewhat satisfied	5 Extremely satisfied	N/A
Interpretive displays	1 Extremely dissatisfied	2 Somewhat dissatisfied	3 Neither satisfied nor dissatisfied	4 Somewhat satisfied	5 Extremely satisfied	N/A
Parking availability	1 Extremely dissatisfied	2 Somewhat dissatisfied	3 Neither satisfied nor dissatisfied	4 Somewhat satisfied	5 Extremely satisfied	N/A
Parking lot condition	1 Extremely dissatisfied	2 Somewhat dissatisfied	3 Neither satisfied nor dissatisfied	4 Somewhat satisfied	5 Extremely satisfied	N/A
Recreation information availability	1 Extremely dissatisfied	2 Somewhat dissatisfied	3 Neither satisfied nor dissatisfied	4 Somewhat satisfied	5 Extremely satisfied	N/A
Road conditions	1 Extremely dissatisfied	2 Somewhat dissatisfied	3 Neither satisfied nor dissatisfied	4 Somewhat satisfied	5 Extremely satisfied	N/A
Feeling of safety	1 Extremely dissatisfied	2 Somewhat dissatisfied	3 Neither satisfied nor dissatisfied	4 Somewhat satisfied	5 Extremely satisfied	N/A
Scenery	1 Extremely dissatisfied	2 Somewhat dissatisfied	3 Neither satisfied nor dissatisfied	4 Somewhat satisfied	5 Extremely satisfied	N/A
Signage adequacy	1 Extremely dissatisfied	2 Somewhat dissatisfied	3 Neither satisfied nor dissatisfied	4 Somewhat satisfied	5 Extremely satisfied	N/A
Trail condition	1 Extremely dissatisfied	2 Somewhat dissatisfied	3 Neither satisfied nor dissatisfied	4 Somewhat satisfied	5 Extremely satisfied	N/A

SECTION 3: Nature Relatedness

On a scale of 1-5 please rate how important the following are to you					
My ideal vacation	1	2 disagree	3 neutral	4 agree	5 Strongly

spot would be a remote, natural area.	Strongly disagree				agree
I always think about how my actions affect the environment.	1 Strongly disagree	2 disagree	3 neutral	4 agree	5 Strongly agree
My connection to nature and the environment is a part of my spirituality.	1 Strongly disagree	2 disagree	3 neutral	4 agree	5 Strongly agree
I take notice of wildlife wherever I am.	1 Strongly disagree	2 disagree	3 neutral	4 agree	5 Strongly agree
My relationship to nature is an important part of who I am.	1 Strongly disagree	2 disagree	3 neutral	4 agree	5 Strongly agree
I feel very connected to all living things and the earth.	1 Strongly disagree	2 disagree	3 neutral	4 agree	5 Strongly agree

Open-ended Questions:

1. What resource, amenity, and/or program (e.g. interpretive talks, community events, etc.) positively contributed to your last visit to Cimarron National Grassland?
2. What (if anything) detracted from your last experience to Cimarron National Grassland?
3. What currently unavailable resources, amenities, and/or programs (e.g. interpretive talks, community events, etc.) might you like to see in the future for Cimarron National Grassland?

4. In what ways can managers assist you with achieving your primary activity and/or reason for visiting Cimarron National Grassland?

5. In what ways can managers further protect the natural resources at Cimarron National Grassland?

SECTION 4: Demographics

1. What is your zip code?
☐ Zip code: _____
☐ Do not wish to answer.
2. What year were you born?
☐ Year: _____
☐ Do not wish to answer.
3. How do you describe yourself?
☐ Male
☐ Female
☐ Non-binary/third gender
☐ Prefer to self-describe _____
☐ Prefer not to say
4. What is the highest level of school you have completed? *(Select one)*
☐ Some high school or less
☐ High school diploma or GED
☐ Some college, but no degree
☐ Associates or technical degree
☐ Bachelor's degree
☐ Graduate or professional degree (MA, MS, MBA, PhD, JD, MD, DDS etc.)
☐ Prefer not to say
5. Are you of Spanish, Hispanic, or Latino origin? ☐ YES ☐ NO

6. Choose one or more races that you consider yourself to be

- ☐ White or Caucasian
- ☐ Black or African American
- ☐ American Indian/ Native American
or Alaska Native
- ☐ Asian
- ☐ Native Hawaiian or Other Pacific
Islander
- ☐ Other
- ☐ Prefer not to say

7. What was your total household income before taxes during the past 12 months?

- ☐ Less than \$25,000
- ☐ \$25,000-\$49,999
- ☐ \$50,000-\$74,999
- ☐ \$75,000- \$99,999
- ☐ \$100,000- \$149,999
- ☐ \$150,000 or more
- ☐ prefer not to say

Thank you for your help! If you have any questions regarding this study, please contact:

Brian Peterson, Ph.D. | Brianpeterson@ksu.edu | 619-990-6708 | Kansas State University



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Appendix D - Interview Questions

ENGAGEMENT QUESTIONS

1. What is your favorite activity to do at Cimarron National Grassland?
2. What is your primary motivation for going to Cimarron National Grassland?
3. What do are you most looking for in a visit to Cimarron National Grassland?
 - a. Why do you enjoy visiting Cimarron National Grassland?

TARGET QUESTIONS

4. What do you know about the trails at Cimarron National Grassland?
 - a. How often do you use the trails?
 - b. How do you like the conditions of those trails? For example, do they need any maintenance?
 - i. If so, which sections?
 - ii. What types of maintenance should be conducted on those sections? For example, mowing, more trail markers, or smoother paths.
 - c. What types of recreational activity most often require the use of those trails?
5. What types of information do you look for when you go to Cimarron National Grassland?
 - a. What types of informational displays (for example: camping rates, bag limits, trail maps) at Cimarron National Grassland are most effective?
 - b. How much information is needed?
 - c. Where should information displays be specifically located?
 - i. Who or what types of activities might benefit from informational displays at those locations?
 - d. What about educational information? Are there any areas lacking in educational information?
 - i. Are these displays lacking in specific types of content?
 - ii. In what areas should educational displays be specifically placed?
 - iii. Who would benefit from these types of educational displays?
 - e. Are there any types of informational displays that are very much needed but are currently lacking?
6. How do you feel about the effectiveness of the signs that are currently set up at Cimarron National Grassland?
 - a. What types of signs are important for navigation but are currently lacking, if at all?
 - b. How many signs are needed?
 - c. Where should there be more signs?
 - i. Who would benefit from these signs?
 - d. What are some of the different types of signs that Cimarron could use immediately?
7. Which developed facilities at Cimarron National Grassland, for example, restrooms, fishing dock, visitor center, do you use?
 - a. How do you use the developed facilities?
 - b. Which of the developed facilities needs maintenance?
 - c. Is there a specific season when these developed facilities seem to need more maintenance?
 - d. How can the developed facilities be upgraded?
 - e. Can you describe any developed facilities that you avoid because they need maintenance or upgrading?

- f. Why do you avoid these facilities?
- 8. Which road sections or parking lots could use maintenance?
 - a. How often, when you visit Cimarron National Grassland, are you unable to find a parking space?
 - b. How would you expand any parking lots, or would you leave the parking lots alone and why?

EXIT QUESTIONS

- 9. Is there anything else about Cimarron National Grassland that you would like to share?
- 10. Thinking back on what we've discussed today, is there anything else that you would like to add?

Appendix E - Chat Group Flyer



WANT TO HELP CIMARRON NATIONAL GRASSLAND?

The purpose of this research is to better understand the people who visit Cimarron National Grassland, what resources they use, and how to provide better visitor experiences. The gathered data will be used by Kansas State University and managers of Cimarron National Grassland.

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ARE YOU A PAST VISITOR TO CIMARRON NATIONAL GRASSLAND?

PLEASE CONSIDER TAKING THIS 10-15 MINUTE SURVEY!

YOUR VOICE MATTERS AND ALL RESPONSES ARE ANONYMOUS AND CONFIDENTIAL!

SCAN THE QR CODE TO GET STARTED!

