Sustainable Outdoor Recreation in Canyon Country: An Analysis of the Impacts and Management Challenges of Outdoor Recreation on Bureau of Land Management Land in Southeast Utah

By

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Abstract

The Canyon Country region of southeastern Utah has quickly become one of the most popular recreation destinations in the country with over 3.5 million visitors recreating on Bureau of Land Management land each year. While many often associate conservation and outdoor recreation as being synonymous, outdoor recreation can have significant physical impacts on public lands especially when visitation is high. Land managers can work to mitigate the impacts of outdoor recreation through the use of proper management techniques to ensure that the impacts of outdoor recreation are kept to a minimal level. This study researches the impacts of outdoor recreation and management challenges of the Bureau of Land Management Canyon Country District as visitation has increased. Through visitation data and interview analysis, this study found that visitation in Canyon Country has increased significantly over the past decade (2009-2019) and as visitation has increased, so have the impacts of outdoor recreation. Through interviews, six perceived physical impacts of outdoor recreation were identified as the most prominent impacts as visitation has grown. The six perceived physical impacts that were identified are soil crust disturbance, vegetation disturbance, cultural and archaeological artifact disturbance, poor air quality, off road/trail travel, and human waste. Additionally, five management challenges the BLM Canyon Country District faces in managing outdoor recreation sustainably were identified by interviewees. Management challenges include staffing shortages, inadequate funding, reactive policy, administrative processes, and education of visitors. Ultimately, this study finds that the increase in visitation and impacts of outdoor recreation exceed the BLM Canyon Country District management capacity, and the identified management challenges make it difficult for the BLM Canyon Country District to manage outdoor recreation sustainably.

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1.0 Introduction

Outdoor recreation has long been an important part of the American identity and, in recent decades, the number of Americans participating in outdoor recreation has increased (2020 Outdoor Participation Report, n.d.). Outdoor recreation allows people to engage with nature, disconnect from the distractions of modern life and explore public lands around the country. Since many people recreate in wilderness settings, outdoor recreation activities are often thought to be synonymous with conservation and sustainable land use practices (Flather & Cordell, 1995). However, outdoor recreation can have significant impacts on public lands including disturbance to the soil, vegetation, and wildlife (Flather & Cordell, 1995; Hammitt et al., 2015). Proper management practices by land management agencies are important to ensuring that these impacts on public lands are mitigated to acceptable levels (Flather & Cordell, 1995; Hammitt et al., 2015).

As participation in outdoor recreation increases, some public lands across the country have seen nearly exponential growth in their visitation. The southeastern corner of Utah has become particularly popular among outdoor recreationalists and tourists alike for its unique desert recreation opportunities. This region, known as Canyon Country, has millions of visitors a year and millions of acres of public lands on which to recreate. While outdoor recreation has brought a bustling recreation-based tourism industry to the region, land management agencies have struggled to effectively manage the impacts of increased visitation. They face various challenges that make it hard for them to achieve their goal of managing outdoor recreation on public lands sustainably.

The concept of managing outdoor recreation sustainably is situated in the field of ***recreation ecology***. The field of recreation ecology focuses on understanding the impacts of

outdoor recreation and exploring the relationships among outdoor recreation impacts and land management practices (Hammitt et al., 2015). While there has been significant research to investigate these relationships, recreation ecology is a relatively new field of research. Broad theories of recreation impacts and management have been developed and additional place-based research has become prevalent in the field as public lands exist across a spectrum of ecoregions. Yet, there has been little research on the study of outdoor recreation in Canyon Country specifically, leaving land managers to apply broad recreation ecology concepts to their unique desert landscape.

This thesis seeks to understand the impacts and management challenges of outdoor recreation on Bureau of Land Management land in the Canyon Country region as visitation increases. It is important to understand the impacts of outdoor recreation in the context of Canyon Country as the desert landscape is unlike many other public lands across the country. By understanding the impacts and management challenges in this region, Bureau of Land Management managers can better manage for the longevity of recreation in the region, avoid recreation impacts at a large scale, ensure resource and ecological protections and generally manage recreation more sustainably. In an effort to explore these relationships in Canyon Country, I investigate the following questions:

1. How has visitation in Canyon Country changed over the last 10 years?
2. What are the perceived impacts of outdoor recreation on Bureau of Land Management land in Canyon Country as visitation has increased?
3. What challenges does the Bureau of Land Management face in achieving sustainable outdoor recreation in Canyon Country?

Through the analysis of visitation data and stakeholder interviews, this thesis seeks to understand how increased visitation relates to the physical impacts of outdoor recreation and land management on Bureau of Land Management land in southeastern Utah.

2.0 Background Information

The Canyon Country region of southern Utah has unique ecological and cultural characteristics, both of which play an important role in recreation and management in the region. This section will provide an overview of these characteristics of Canyon Country to give a holistic view of the region's history and present status in regards to outdoor recreation.

2.1 What is Canyon Country?

Canyon Country is an area in southeast Utah that encompasses a large portion of the state's desert landscape. It often invokes images of massive sandstone towers, impressive canyons, and a sparse dry landscape. While Canyon Country is a popular name used by tourists and locals alike to describe the region, Canyon Country also is the name of the Bureau of Land Management (hereafter referred to as BLM) district in this region. The Canyon Country BLM District encompasses two field offices: the Moab Field Office and the Monticello Field Office (*Canyon Country District Office | Bureau of Land Management*, n.d.). Together, these two field offices manage 3.6 million acres of public land (*Canyon Country District Office | Bureau of Land Management*, n.d.). The BLM oversees the majority of public lands in southeast Utah. The extent of the Canyon Country District in southeast Utah is shaded blue in Figure 1. Canyon Country also includes Bears Ears National Monument, which is jointly managed by the Monticello Field Office, the Bears Ears Inter-Tribal Coalition and the U.S. Forest Service (*Bears Ears National Monument*, 2021).

Canyon Country comprises two counties: Grand County and San Juan County. The region is fairly remote with only about 15,000 local residents (*U.S. Census Bureau QuickFacts*, n.d.-a; *U.S. Census Bureau QuickFacts*, n.d.-b). Together the two counties comprise over 7 million acres of land, making the population density of the region 1 person for nearly every 500

acres of land (*Grand County Resource Assessment | NRCS Utah*, n.d.; *San Juan County Resource Assessment | NRCS Utah*, n.d.). However, tourist hotspots like Moab bring a large number of visitors to the region, with hopes of visiting National Parks or exploring the other recreation opportunities. Over the course of the year, the tourist population increases the Canyon Country population by around 23,000 percent. Canyon Country is home to other public lands including Arches National Park, Canyonlands National Park, and Dead Horse State Park, which are managed through different land management agencies.

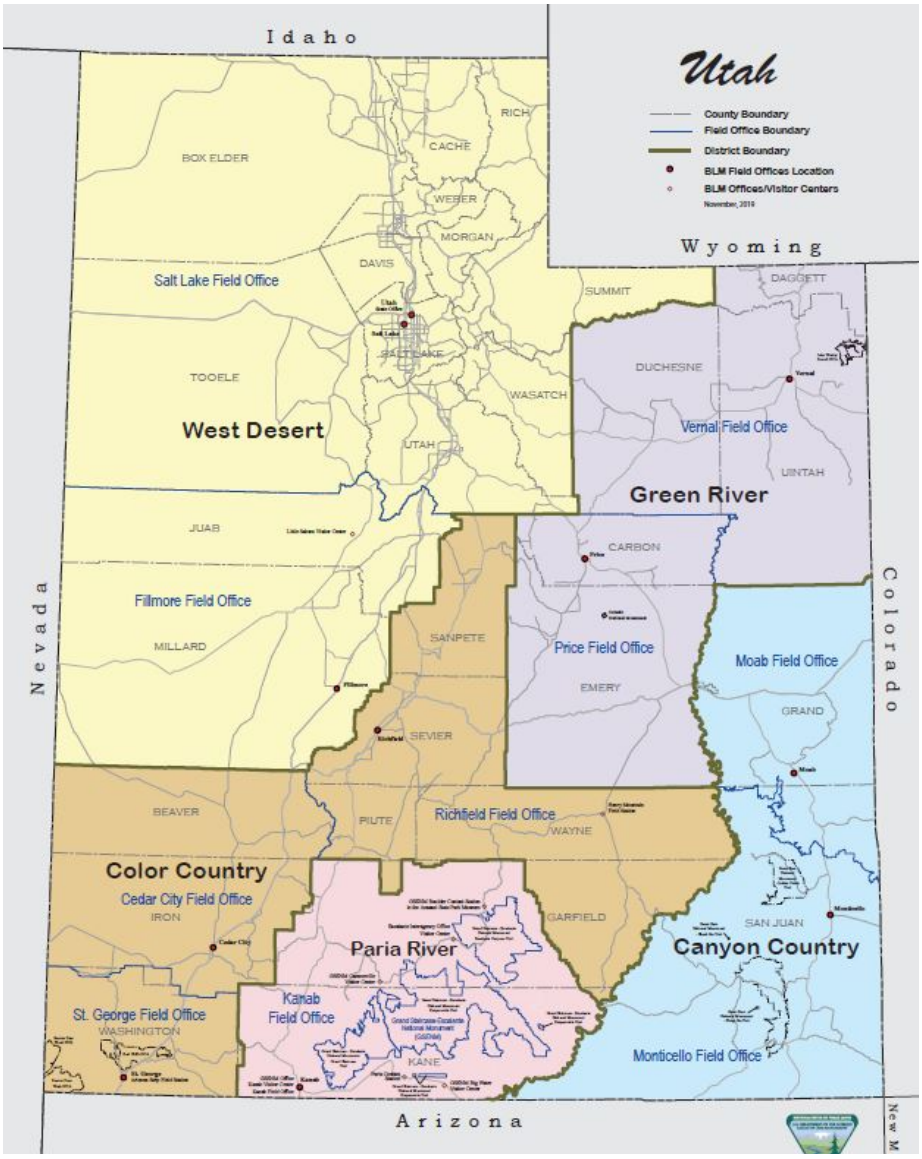

Figure 1. Map of Bureau of Land Management districts in Utah. (*Canyon Country District Office | Bureau of Land Management*, n.d.)

2.2 Bureau of Land Management

The Bureau of Land Management is one of the United States federal land management agencies. The agency was established in 1946 and it manages public lands in the western United States (*About Us | Bureau of Land Management*, n.d.). The BLM was created to manage all of

the remaining public lands that were not being managed by other agencies. BLM public lands were not considered to be the crown jewels of America's public lands, but instead were meant to be used productively for the benefit of the country as a whole. Today, BLM manages more land than any other federal land management agency, managing around 245 million acres nationwide (*About Us | Bureau of Land Management*, n.d.).

The BLM mission is "to sustain the health, diversity, and productivity of the public lands for the use and enjoyment of present and future generations" (*About Us | Bureau of Land Management*, n.d.). They achieve this by managing through their multiple use framework. Under this framework, the BLM manages their land for uses such as oil and gas development, timber harvesting, mining, livestock grazing and outdoor recreation (*About Us | Bureau of Land Management*, n.d.). They are required to balance these multiple uses with the conservation of the natural landscape. This creates a complex system of management as the BLM is responsible for finding the ideal balance between all of these uses.

BLM lands have become particularly popular in the outdoor recreation community. Unlike other agencies, the BLM is relatively lenient on managing outdoor recreation. BLM lands are relatively undeveloped and have significantly less rules and regulations compared to other public lands like National Parks. Recreationalists enjoy the BLM's lands as they typically have more freedom to do as they please; they can disperse camp, hike off trail, and choose their own adventure more easily. Due to the BLM's multiple use framework and their overall management style of outdoor recreation, the BLM offers a unique management style to study when looking at the impacts of outdoor recreation. For this reason, and that the BLM manages the most land in Canyon Country, the BLM was chosen as the land management agency to study in this thesis.

2.3 Ecological Landscape of Canyon Country

Despite often being perceived by visitors as a barren desert, Canyon Country has a diverse and interesting ecological landscape. Canyon Country is situated within the greater Colorado Plateau, which describes the four corners region of the southwestern US where Arizona, Colorado, New Mexico and Utah touch. Canyon Country is described as a cold desert, meaning that it experiences large temperature variations and little precipitation, receiving only around 9 inches of rainfall annually (Lin et al., 1996; Schwinning et al., 2008). Within Canyon Country, elevation varies widely, from 2,461 ft above sea level at canyon bottoms to 12,300 ft above sea level at mountain peaks (*The Colorado Plateau (U.S. National Park Service)*, n.d.). The region is well known for its remarkable geological formations such as buttes, mesa, canyons, and basins. These features are remnants of a notable geological history that eroded away layers of sedimentary rock over millions of years.

In addition to the impressive landscape itself, Canyon Country is also known for its high level of biodiversity. Given the arid nature of the region, plants have undergone significant evolutionary adaptations to be successful in this cold desert environment. Many plants have developed intricate root systems, water storage strategies, or lay dormant during hot parts of the year to ensure their survival in this harsh environment (*Plants - Arches National Park (U.S. National Park Service)*, n.d.). Vegetation in the region varies, depending on the elevation. In low lying regions, vegetation primarily consists of shrubs and grasses (Schwinning et al., 2008). Common flora include blackbrush (*Coleogyne ramosissima)*, saltbrush (A*triplex* spp.), and Indian Ricegrass (*Stipa hymenoides*) (Schwinning et al., 2008). At higher elevations, vegetation begins to shift to pinyon-juniper forests, and eventually to mixed-conifer forests (Schwinning et al., 2008).

One of the primary ecological characteristics of this region is biological soil crusts. Biological soil crust is a living crust that forms over the top of soil as a result of microbial activity (Belnap & Lange, 2003). The biota responsible for producing these crusts are cyanobacteria, algae, microfungi, lichens, and bryophytes (Barger et al., 2006; Belnap & Lange, 2003). These microbial biota live on or near the surface of the soil and interact with soil particles (Belnap & Lange, 2003). As these interactions take place, soil is aggregated and a layer of crust is formed on the surface of the soil (Belnap & Lange, 2003). While there are several varieties of biological soil crust, all play an important role in arid ecosystems like Canyon Country. In cold desert environments, wind and water erosion are prominent issues because there is little vegetation to hold soils down (Belnap & Gillette, 1998). Biological soil crusts help to reduce erosion by creating a protective layer over soil (Belnap & Gillette, 1998). Likewise, biological soil crusts help to establish important nutrients into the soil (Barger et al., 2006; Belnap & Lange, 2003). Some biological soil crusts are capable of converting nitrogen into usable forms for other vegetation through nitrogen fixation (Belnap & Lange, 2003; Zhao et al., 2020). These microbial communities help to regulate carbon cycles as well (Belnap & Lange, 2003; Zhao et al., 2020). Additionally, biological soil crusts help to trap moisture in the soil and germinate seeds making it significantly easier for plants to grow in such an arid region (Belnap & Lange, 2003; Warren & St. Clair, n.d.). However, biological soil crusts take time to form and these can be easily disturbed by human, vehicle, or animal traffic (Figure 2.) (Barger et al., 2006; Belnap & Gillette, 1998). Even a light footprint can disturb biological soil crusts. Once disturbed, these crusts can take several years to decades to regrow (Belnap & Lange, 2003; Warren & St. Clair, n.d.). Preservation of biological soil crust is critical to ensuring the Canyon Country ecosystem remains intact.

Figure 2. Photo of a trail going through a patch of biological soil crust. (Warren & St. Clair, n.d.)

2.4 Cultural History of Canyon Country

One of the most unique aspects of Canyon Country is its rich and diverse cultural history. This region is known as one of the most significant cultural sites in the world for its dense collection of cultural artifacts and spiritual ties to the land (Doelle, n.d.). Within the Canyon Country region, especially in Bears Ears National Monument, there are over 100,000 cultural and archeological sites (Doelle, n.d.). For thousands of years, Indigenous cultures have inhabited the region. Archeological evidence suggests that Clovis people were living in this region as early as 11,000 years ago (McPherson, 1995). While physical evidence suggests that people began inhabiting the region around 11,000 years ago, many indigenous cultures' histories suggest people were in this region for much longer (Doelle, n.d.). Since then, there have been over 9 indigenous cultures that are recognized as having ties to this region (Renninger, n.d.). Most notably, the Ancestral Puebloans inhabited the area from AD 750-AD 1300 (Doelle, n.d.;

McPherson, 1995). During their time in the region, they built elaborate cliff dwellings and pueblos around the region (McPherson, 1995). They used stone, wood, and adobe to construct these structures. Despite being over 700 years old, full dwellings or remnants of structures can still be found throughout Canyon Country today. Areas like Cedar Mesa are popular locations for visitors to come and see the history of the Ancestral Puebloans in person.

After the Ancestral Puebloans left the region, the Navajo, Hopi, Paiute and Ute people resided in the region (Doelle, n.d.). These indigenous groups brought a new way of life to Canyon Country (McPherson, 1995). They brought new languages, new building practices, and new art styles to the region (McPherson, 1995). Like the Ancestral Puebloans and other Fremont indigenous groups, the Navajo and Ute people left behind their story on the land through rock art (McPherson, 1995). Throughout Canyon Country it is common to see rock art or petroglyph panels. In many places, a visitor can see Ancestral Puebloan and the earlier Fremont people art side by side with Navajo or Ute art. These panels are of great spiritual and cultural importance as they offer a view into the past (Doelle, n.d.). Rock art panels attract many visitors to the region, so it is no surprise that Newspaper Rock, one of the most concentrated and intricate panels, is one of the most visited sites within the Monticello Field Office. Unlike other archeological sites around the country, the sites in Canyon Country are relatively undeveloped. This gives visitors the opportunity to get up close and personal with sites, for better or for worse. Sites typically have little protection or stabilization from visitors.

Many of the Indigenous tribes mentioned above still live in the surrounding Canyon Country region today. For those tribes and others who have since left the region, the spiritual, historical, and cultural ties to the land in Canyon Country remain strong (Doelle, n.d.; Renninger, n.d.). The archeological sites in the region preserve indigenous history and help to give context

about those who came before us. Protection of these archeological sites is vital to the preservation of indigenous culture and spirituality.

2.5 Outdoor Recreation in Canyon Country

Canyon Country is one of the largest meccas for outdoor recreation as it offers world class recreation opportunities. Canyon Country's unique geological formations make it a prime destination for rock climbing, base jumping, and canyoneering. Additionally, the Green River and the Colorado River, which run through the region, offer rafting, canoeing, stand up paddle boarding, and other water activities. Most notably, mountain biking and OHV enthusiasts flock to the area for its single track mountain biking and OHV routes. Both mountain biking and OHV communities host several events a year in Canyon Country. Canyon Country also attracts hikers and backpackers to the region as there are hundreds of miles of trails in the area. Trails often lead to beautiful arches, rock art panels, or archeological sites, which make them even more appealing to visitors.

Moab, the largest town in Canyon Country, acts as the central hub for all of these recreation activities. Moab offers a variety of services to accommodate tourists pursuing these experiences including 80 different outfitters who specialize in taking visitors on outdoor adventures and the demand for outdoor recreation and outdoor recreation based services is very high. Moab has satisfied this demand by building a strong recreation-based tourism industry. Not only is outdoor recreation at the heart of the Moab culture, but it is also at the heart of its economy. Maintaining sustainable outdoor recreation is important to the longevity of the Moab community and its economic success.

2.6 Increase in Outdoor Recreation

Since the 1950s, there has been a steady increase in participation in outdoor recreation activities in the US (Flather & Cordell, 1995). The end of World War II sparked the beginning of America's move to the outdoors (Flather & Cordell, 1995). As the economy recovered from the war, the average American began to receive paid vacation time, an increased disposable income and more leisure time than they had before (Flather & Cordell, 1995). This encouraged more people to take advantage of their local outdoor recreation opportunities as well as opportunities further away like National Parks (Flather & Cordell, 1995). This upward trend in participation in outdoor recreation has continued into the 21st century (White et al., 2016). Today, over half of the American population participates in outdoor recreation at some point during the year, and the participation rate for nearly every outdoor recreation activity (e.g., hiking, rock climbing, walking, biking) has increased over time (2020 Outdoor Participation Report; Bricker et al., 2010). Over the last 70 years, outdoor recreation has not only become more popular as a pastime but it has also gained massive popularity as an attraction for tourists (Bricker et al., 2010). This increase in popularity both as a pastime and as an attraction has led to higher traffic on public lands around the country (2020 Outdoor Participation Report; White et al., 2016).

2.7 Sustainable Outdoor Recreation

As outdoor recreation began to gain popularity in the 1950s and 1960s, the conservation movement began to gain momentum as well (Flather & Cordell, 1995). Since outdoor recreation and conservation began to gain popularity around the same time, outdoor recreation was thought to be compatible with conservation values and practices (Flather & Cordell, 1995). However, outdoor recreation can contradict conservation practices as it can cause degradation on the public land on which it takes place (Flather & Cordell, 1995; Hammitt et al., 2015). These impacts include the disturbance and displacement of wildlife, water pollution, soil erosion and

compaction, increase in fire risks, reduction in vegetation, as well as vandalism and noise pollution (Flather & Cordell, 1995; Hammitt et al., 2015). Consequently, as outdoor recreation participation increases it is common to see the environmental impacts of outdoor recreation on public lands increase as well (Flather & Cordell, 1995). Proper management practices by land management agencies can help to mitigate the effects of outdoor recreation on public lands (Hammitt et al., 2015). However, land management agencies often struggle to adjust management practices as quickly as visitation increases and lack the resources to manage outdoor recreation sustainably (Thomas & Reed, 2019).

As visitation and environmental degradation continue to increase as a result of the rising popularity of outdoor recreation activities, it will be critical for land managers to oversee outdoor recreation in a way that is sustainable for recreation and the public lands on which it takes place. The concept of sustainable outdoor recreation recognizes that public lands have a carrying capacity for outdoor recreation activities and aims to find a way in which outdoor recreation can exist while conserving landscapes and ecosystems and minimizing degradation (Bricker et al., 2010). When sustainable outdoor recreation is achieved, it allows for outdoor recreation to continue indefinitely. To successfully achieve sustainable outdoor recreation, land managers need to evaluate both the recreational carrying capacity and the social carrying capacity of the land. Traditionally, the term carrying capacity refers to the number of animals that can exist in one particular habitat (Manning, 2002). The term has since been used in many other fields to describe the level of use a resource can take. In recreation ecology literature, this concept of carrying capacity is applied to both ecological and human dimensions. Recreation carrying capacity refers to the amount of degradation caused by outdoor recreation activities that a landscape can handle indefinitely (Hammitt et al., 2015; Manning, 2002). Recreation carrying capacity is left to the

discretion of land managers and it will depend on what the land managers have determined to be the acceptable level of use for that particular area. In a similar vein, social carrying capacity refers to the amount of visitors that can participate in outdoor recreation before the wilderness experience is diminished by the amount of other people nearby (Hammitt et al., 2015; Manning, 2002). Social carrying capacity impacts typically include crowding and conflict between user groups. Social carrying capacity is often difficult to achieve as it is based on people's values, which can differ drastically. Land managers must account for both of these when seeking to manage outdoor recreation sustainably, especially as visitation continues to increase. Sustainable outdoor recreation is likely to look different on different public lands as their recreational and social carrying capacity will differ.

3.0 Methods

This study aims to investigate the impacts of outdoor recreation on BLM land in the Canyon Country region as well as identify the challenges the BLM faces as visitation increases. To answer these research questions, I collected visitation data and conducted semi-structured interviews with stakeholders in Canyon Country.

To investigate visitation trends in Canyon Country, I gathered visitation data from two national parks (Arches National Park and Canyonlands National Park), one state park (Dead Horse Point State Park) and the Canyon Country BLM District and field offices. This data was gathered from the corresponding land management agencies websites.

Interviews were conducted with individuals from three primary stakeholder groups: BLM officials, scientists who studied a topic related to outdoor recreation or ecology, and local outfitters. BLM officials were chosen to participate in this study because they are the direct land managers of BLM land. They provided an inside perspective to management challenges and impacts of outdoor recreation. All BLM officials interviewed in this study worked for the Canyon Country District. Scientists were included in this study to survey expert opinion on ecological impacts and recreation management outside of the federal land management agencies. This allowed the study to include unaffiliated opinions and criticisms. All scientists included in this study research either ecology, soil science, or recreational ecology in Canyon Country. Lastly, local outfitters were included in this study because they actively participate in outdoor recreation on BLM land regularly. They provide an on-the-ground perspective of impacts and user experience of following regulations set by the BLM. Additionally, they interact with a large portion of the non-resident recreation population regularly through their business.

Interviewees were identified through internet research and snowball sampling techniques. Interviews were semi structured and were conducted over a one hour period on Zoom. Each group was asked the same general questions as well as questions specific to their role (Appendix A.). Eleven interviews were conducted over the course of the interview process (n=11): BLM officials (n=5), scientists (n=5), and local outfitter (n=1). Local outfitters had the smallest interview sample size as there was little response to invitations to participate in the study.

Upon completion of all interviews, the interviews were coded (Appendix B.). The codebook used to code the interviews was developed through inductive coding (i.e. developing codes as themes emerge in the data). This required multiple reviews of each interview as new codes were added to the code book. After all interviews were coded, similar codes were combined into general themes.

This study received approval from the University of Colorado Boulder's Institutional Board of Review under Protocol 21-0519 and was funded through an Undergraduate Research Opportunity Program (UROP) Grant.

4.0 Results & Discussion

To answer my research questions, I gathered visitation data from various land management agencies in Canyon Country and conducted interviews with stakeholders. After conducting 11 interviews with three stakeholder groups (BLM officials, scientists, and local outfitter) and coding these interviews, primary themes emerged for impacts and management challenges on BLM land in the Canyon Country region as visitation has increased.

4.1 Visitation in Canyon Country

To address my first research question, "How has visitation in Canyon Country changed over the last 10 years?" I gathered visitation data from 2009-2019 for three land management agencies in the region: the Bureau of Land Management, National Parks Service, and Utah State Parks. The data is shown from 2009-2019 because, due to the COVID-19 pandemic, 2020 data was an outlier in the general trend of visitation data overtime and 2021 data was not included as it has not been released by all management agencies at this time. Additionally, I asked the interviewees to share their observations on how visitation in the region has changed. Visitation trends and observational interview data are explained below.

While Arches National Park, Canyonlands National Park and Dead Horse State Park are not managed by the Bureau of Land Management, they provide context for how visitation on public land in Canyon Country has changed over time. Over the last decade (2009-2019), visitation for each park has increased significantly (Figure 3). In 2009, Arches National Park had just under one million visitors a year. Ten years later, Arches National Park has increased by nearly 700,000 visitors a year, putting their average visitation over 1.5 million visitors a year. Similarly, Canyonlands National Park had just under half a million visitors a year in 2009, and has increased by 300,000 visitors in ten years. Canyonlands National Park has had slightly more

variation in visitation than Arches National Park, and its visitation decreased slightly between 2016 and 2019. In 2019, Canyonlands had around 730,000 visitors a year. Likewise, Dead Horse Point State Park had almost 200,000 visitors a year in 2009, and reached almost one million visitors in 2019. It increased its visitation by 700,000 people in ten years. As can be seen in Figure 3, visitation to each of these parks was steadily increasing between 2009 and 2013. However, after 2013 park visitation began to increase significantly at a rate much higher than 2009-2013 visitation increases would have predicted. Overall, visitation to national parks and state parks in Canyon Country has increased, especially following 2013 when the rate of visitation increased significantly.

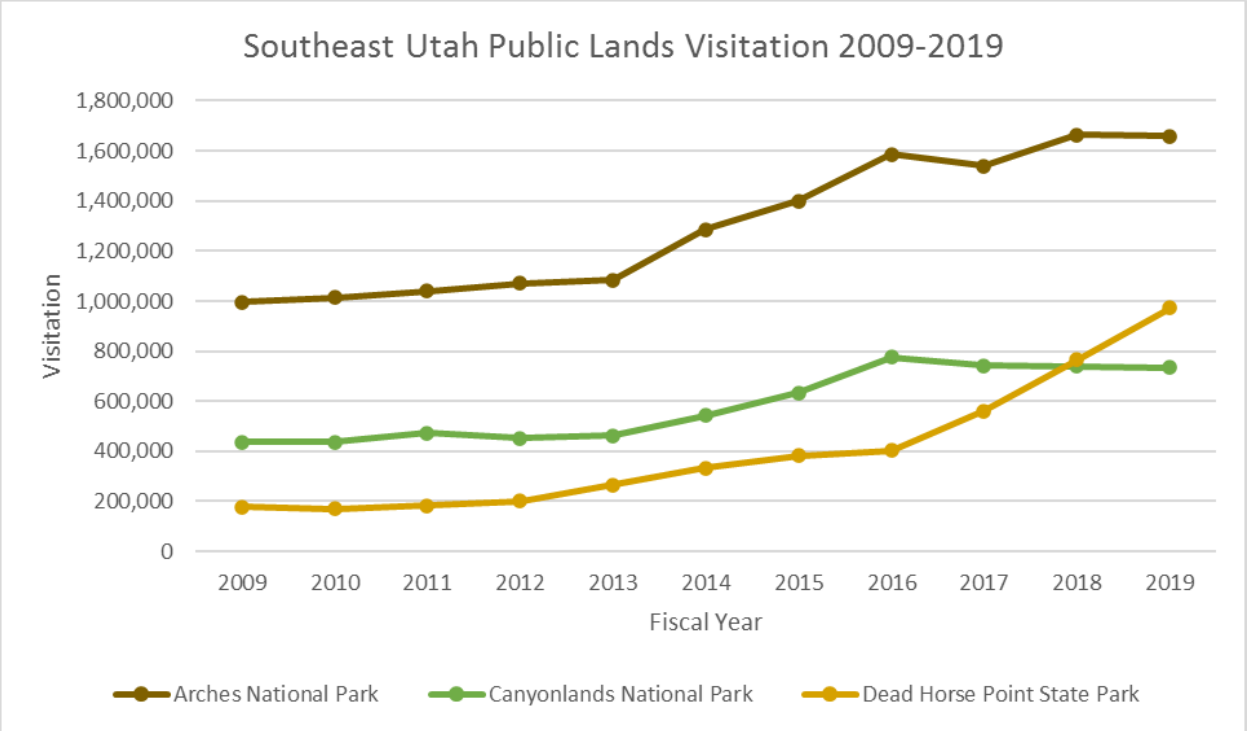

Figure 3. Visitation for Southeast Utah Public Lands including Arches National Park, Canyonlands National Park, and Dead Horse Point State Park from 2009-2019. (*Park Visitation Data*, n.d.; *Stats Report Viewer*, n.d.)

The BLM Canyon Country District visitation data shows similar trends to other public lands in Canyon Country. Over the last decade (2009-2019), visitation to the Moab Field Office and the Monticello Field Office lands has increased significantly (Figure 4). In 2009, the Moab Field Office was seeing approximately 1.67 million visitors a year. In 2019, the Moab Field Office had an annual visitation rate of 3 million visitors a year, an increase of 1.4 million visitors over ten years. Similarly, the Monticello Field Office had approximately 180,000 visitors a year in 2009. In 2019, the Monticello Field Office had approximately 450,000 visitors a year, an increase of over 200,000 visitors in ten years. As can be seen in Figure 4., the Monticello Field Office has seen a fairly steady increase in their visitation over the last decade. However, the Moab Field Office saw a similar trend as other public lands in the area. Between 2009-2013, the Moab Field Office had a steady increase in visitation, but from 2013-2019 the rate of visitation increased dramatically. The Canyon Country District total is the sum of the Moab Field Office and the Monticello Field Office. Due to the large difference in visitation between the two field offices, the Canyon Country District total follows more closely with visitation trends of the Moab Field Office. The total visitation rate increased dramatically beginning in 2014. The Canyon Country District sees over 3.5 million visitors a year as of 2019.

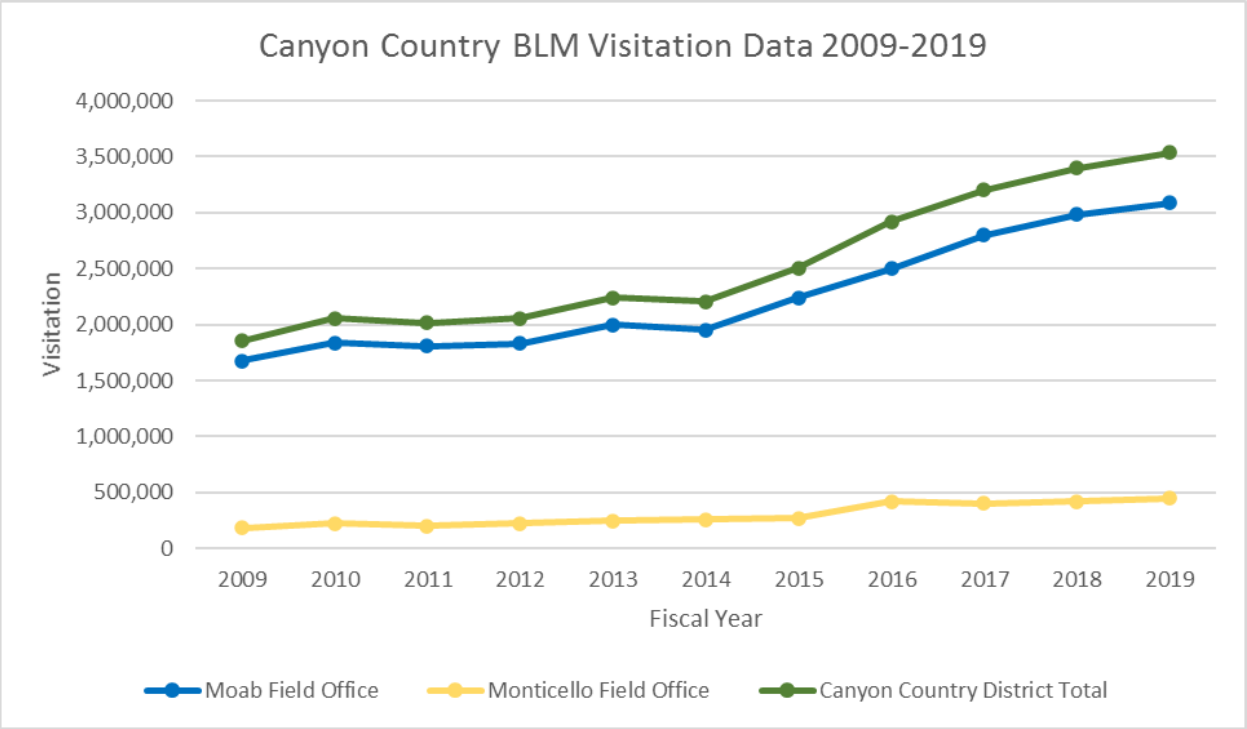

Figure 4. Visitation for the Bureau of Land Management Canyon Country District from 2009-2019. (*BLM Utah Estimated Visitation by Field Office.Pdf*, n.d.)

Throughout the interviews, it was clear that interviewees had observed similar trends to those shown in the visitation data from the various land management agencies. Interviewees discussed the increase in visitation in multiple facets. First, interviewees all spoke to the increase in visitation by highlighting how dramatic the increase in visitation has felt to them. The majority of interviewees live within the Canyon Country region and they experience visitation increases not only through their jobs but through aspects of their everyday lives such as grocery shopping and recreating in their personal time. One interviewee said, ““It has felt very exponential…There's just a lot more people here. You can just tell, you feel it around you…I stopped going to places that I love going to because they're just not accessible due to the amount of people.” (Scientist Interview 1). Words like exponential, and explosion were consistently used

to describe their observations on how visitation has changed, and many mentioned changes in their own behaviors to cope with more people being in places they frequent.

Secondly, interviewees spoke of how their community has changed because of the immense development that has happened in Moab over the last decade as more hotels, second homes and tourist accommodations are built to accommodate the increasing number of visitors in the region. One interviewee said "Well it has changed dramatically. My first visits to the Canyon Country in the early 1980s and places like Moab were on the fringe. They were not developed tourist locations. It's just exploded over the last decade or more." (Scientist Interview 4).

Thirdly, interviewees spoke to how visitation for specific activities has increased. They mention that recreation activities like OHVs, dispersed camping and mountain biking have all become more popular and may contribute to increased visitation in the region.

Most importantly, interviewees all highlighted how the demographics of visitors has changed. They have noticed more new visitors (i.e. visitors who are new to outdoor recreation activities or recreating in the desert) in the region than ever before. They specifically tied this to the COVID-19 pandemic and suggested that, likely due to restrictions on travel, many people are looking for opportunities to explore new places that are closer to home, which has brought new visitors to the region that may have never come otherwise. Visitation data has not been gathered to show the effects of COVID-19 on visitation rates in the Canyon Country region, however, interviewees had a strong correlation between visitation increases and the COVID-19 pandemic. Overall, interviewees confirmed that visitation in the region has been increasing by substantial levels.

A previous study found similar results within the state of Utah as a whole. It found that Utah has seen record numbers of visitors in the last decade and nearly every type of public land

in Utah including National Parks, State Parks, and National Forests has had increasing visitation rates (Smith & Miller, 2020). Literature suggests that increased visitation trends to public lands are expected to continue into the future. This increase in visitation in Canyon Country can likely be attributed to the 2012 Utah Office of Tourism's clever marketing campaign, which advertised Utah's diverse outdoor recreation opportunities. This campaign, called the Mighty Five campaign, exhibited the recreation opportunities of the five national parks in Utah and encouraged recreation-based tourism in the state. Since two of Utah's national parks (Arches National Park and Canyonlands National Park) are located within Canyon Country, this campaign likely was responsible for the initial significant increase in visitation in 2013. This campaign helped to establish Canyon Country as a hotspot for outdoor recreation, which likely led, in part, to the significant increase in visitation in the years following.

Understanding visitation trends is important in achieving sustainable outdoor recreation in the region because it is widely accepted that as visitation increases, the impacts from outdoor recreation increase as well (Hammitt et al., 2015). This relationship between visitation and degradation is not linear and exists as an asymptotic curve, where the initial use of land for recreation causes a significantly larger impact than subsequent use (Hammitt et al., 2015). While subsequent use does not create nearly as intense of impacts as initial use, impacts still increase as visitation increases, just at different rates. Canyon Country visitation has increased significantly over the past decade and so it can be presumed that there has been an increase in the impacts of outdoor recreation as well. Due to this increased impact, it is much more likely that the land will exceed its threshold of acceptable use set by the BLM than if recreation maintained consistent visitation trends of less visitors.

It should be noted that 3.5 million visitors who recreate on Canyon Country District land a year are not impacting every acre of land (*BLM Utah Estimated Visitation by Field Office.Pdf*, n.d.). In fact, the visitation to Canyon Country is relatively concentrated to popular areas and the 50 miles surrounding Moab. Based on recreation ecology theory, concentrated use is important to minimizing the impacts of outdoor recreation as it ensures less initial use (rather than subsequent use as described above) is occurring (Hammitt et al., 2015). However, despite concentrated use already happening in Canyon Country, the impacts of increasing visitation can be seen through the increasing spatial extent of outdoor recreation in the region. Recreation ecology recognizes that areas that experience high use generally have the worst and the most impacts from outdoor recreation This holds true for Canyon Country, as interviewees stated that impacts from outdoor recreation are especially seen at popular trailheads and high use recreation areas. However, as visitation has increased in Canyon Country, the amount of high use sites has grown extensively as well. Many interviewees spoke to how trails that they used to frequent often are no longer appealing due to their high visitation rates. While the impacts from high use outdoor recreation tend to be concentrated, the amount of high use areas is increasing, which increases in the total amount of landscape affected by the impacts of outdoor recreation. In a similar vein, recreation ecology theory recognizes that as visitation increases, the spatial extent of recreation expands (Hammitt et al., 2015). This has become prominent in Canyon Country, as people are venturing farther out from traditional popular areas to avoid crowds and find new recreation opportunities. Many interviewees spoke about a figurative ring being around Moab, describing how although there are millions of acres of public land to recreate on in the region, the majority of recreation occurs within the 50 miles around Moab. Interviewees stated how they felt this ring getting bigger as visitation increased. Many of these spots may not necessarily be the most popular

trailheads or hot spots for recreation, but they are attracting more visitation than ever before, which means that more initial impacts are occurring on the land. Overall, the level of use at popular areas and the spatial extent of use are increasing as a result of rising visitation rates. This creates more additional impacts throughout the region for land managers to handle as they seek to manage recreation sustainably.

Given that the BLM Canyon Country District manages nearly 3.6 million acres and high use outdoor recreation only occurs on fraction of that, scientist interviewees stated that while this increase in spatial extent is happening, they do not believe that it is these impacts from visitation are creating ecological impacts at scales that are detrimental to the overall health of the desert ecosystem in southeastern Utah. Increasing visitation is not necessarily cause for alarm, but it is an important consideration for BLM Canyon Country land managers as they seek to manage recreation sustainably. If visitation continues to increase at similar rates that they have been over the last 7 years and land managers struggle to handle increasing visitation, then it is possible visitation could push the landscape well past its threshold for acceptable harm and the impacts from outdoor recreation could start to become ecological impacts at scale.

4.2. Perceived Physical Impacts of Outdoor Recreation in BLM Canyon Country District

To address my second research question, "What are the perceived impacts of outdoor recreation on Bureau of Land Management land in Canyon Country as visitation has increased?", I asked my interviewees questions regarding the environmental impacts they observe while on BLM land in the last 10 years. Interviews with BLM officials, scientists, and local outfitter led to a wide range of observed physical impacts from outdoor recreation. Six perceived physical impacts were identified as the most significant due to their frequency throughout interviews. The six perceived physical impacts that were identified are soil crust disturbance, vegetation

disturbance, cultural and archaeological artifact disturbance, poor air quality, off road/trail travel, and human waste (Table 1). Each of these impacts is discussed in turn, below.

Table 1. The six perceived physical impacts of outdoor recreation in Canyon Country.

Perceived Physical Impacts Caused By Outdoor Recreation	
Impact	**Definition**
Soil Crust Disturbance	Refers to the death or disturbance of biological soil crusts due to foot, vehicle or other recreation traffic
Vegetation Disturbance	Refers to reduced growth or death of vegetation due to foot, vehicle, or other recreation traffic
Cultural and Archeological Artifact Disturbance	Refers to the graffiti, theft, or destabilization of rock art and ruins
Poor Air Quality	Refers to the dust generated by vehicular travel, causing there to be significant dust in the air lowering the general air quality in the region
Off road/trail travel	Refers to trails and roads becoming larger than initially intended or the creation of new roads/trails due to vehicles and people traveling off of designated routes
Human Waste	Refers to poop, toilet paper and trash left as a result of humans defecating in backcountry settings.

Soil crust disturbance was identified as an impact by BLM officials and scientists. Throughout interviews, interviewees identified off road/trail travel and dispersed camping as primary causes of soil crust disturbance. Additionally, they noted that soil crust disturbance is a primary cause of erosion and dust in the region. Most interviewees noted that many recreationalists are unfamiliar with soil crusts as they are unique to the desert and therefore, significant unintentional impacts occur as a result of insufficient knowledge of the landscape. Lastly, most interviewees were concerned with the impacts of soil crust disturbance due to its long recovery time and its importance to vegetation in the region. The identification of soil crust disturbance by interviewees as an impact of outdoor recreation supports the results from other

studies in which they found that biological soil crusts are easily distrubed by human activities such as hiking and off-road vehicle use (Cole, 1990; Rowe et al., 2018; Webb & Wilshire, 1983). One study found that in areas of medium to high recreation use, soil crusts were reduced by up to 30 percent of their original area (Rowe et al., 2018). The two following quotes from scientists interviews summarize the discussions around soil crust disturbance in the region well.

> *"The one thing that I can point to is the disturbance of the cryptobiotic soil and the effect it has on increasing dust. This has been a topic of discussion in the Canyon Country for a long time." (Scientist Interview 3).*

> *"There's no more crust because so many people have walked all over these areas. And you can tell because the plants are pedestals. So you can see that erosion is happening." (Scientist Interview 1)*

Vegetation disturbance was identified as an impact by BLM officials and scientists. Throughout interviews, interviewees mentioned that increased use in concentrated areas was primarily responsible for vegetation disturbance. They stated that as more people recreated in the same areas, the vegetation has a harder time growing because it is consistently damaged by vehicle and foot traffic. Additionally, interviewees discussed the effects of soil crust disturbance and soil compaction due to high use in relation to vegetation. The disturbance and compaction of soils makes it difficult for vegetation to grow and to recover once impacts have been made. The identification of vegetation disturbance by interviewees as an impact of outdoor recreation supports the results from other studies in which they found that damage to existing vegetation and loss of vegetation ground cover are common in areas where recreational use is occurring (Hammitt et al., 2015; Kissling et al., 2009). Vegetation disturbance is one of the best studied impacts of outdoor recreation within the field of recreation ecology (Hammitt et al., 2015). The following quote summarizes the discussions surrounding vegetation disturbance well.

"Some of those areas have gotten really used. That's when you start to look at larger and larger impacts…the place gets really compacted and nothing's going to grow there" (Scientist Interview 2)

Cultural and archeological artifact disturbance was identified as an impact by every stakeholder group. Throughout interviews, interviewees mentioned that cultural and archeological artifact disturbance occurs as a result of insufficient knowledge about the ethics of visiting these sites. People are unaware of how their actions can unintentionally degrade cultural and archaeological artifacts. Additionally, several interviewees brought up recent incidents of vandalism in Canyon Country on rock art panels, which were clearly intentionally made. Interviews highlighted that unintentional and intentional cultural resource impacts are occurring in the region. Furthermore, interviewees discussed how cultural and archaeological artifacts in Canyon Country differ from many other similar sites around the country as they are not heavily stabilized or protected; they still exist in their original form today. This makes the sites in Canyon Country particularly vulnerable to recreation impacts. Lastly, multiple interviewees touched on how the cultural and archaeological artifacts in Canyon Country are nonrenewable resources. Recreation impacts, whether graffiti, vandalism, or simply destabilization, compound one another without any potential for the sites to recover. Impacts on these resources exist permanently. Recreation impacts on cultural resources have not been studied as intensively as other impacts. However, the identification of cultural and archeological artifact disturbance by interviewees as an impact of outdoor recreation supports results from the few studies on this topic, which found that graffiti, vandalism, and general disturbance near sites can cause significant damage to cultural resources (Hedquist et al., 2014; Monz, 2021). Studies also identified OHV use and proximity to roads to be major causes of cultural resource destruction, which was not discussed by interviewees in this study (Hedquist et al., 2014; Sampson, 2007).

The following quote summarizes the discussions surrounding cultural and archeological artifact disturbance well.

> *"We've always gone with this idea of leave only footprints, but that's what is killing a lot of the sites out here, the footprints. Just that little amount of your vibram soles getting up close to stuff and looking at it undermines the walls." (BLM Interview 2).*

> *"I happened to drive by someone.. and he's literally scratching his name on the wall on top of petroglyphs just because other people have done it." (BLM Interview 4).*

Poor air quality was identified as an impact solely by scientists, though it was discussed by every scientist interviewee. Interviewees all associated decreasing air quality with the increased vehicular travel in the region as more types of motorized recreation become popular among recreationalists. Interviewees also strongly associated the disturbance of soil crusts with the increase in poor air quality in the region. The identification of poor air quality in the region supports existing literature surrounding air quality in arid ecosystems. Previous studies have identified wind erosion and OHV use to contribute significantly to the amount of dust in the air and worsen air quality (Duniway et al., 2019; Ouren et al., 2007). Below is an exemplary quote on the discussion surrounding poor air quality.

> *"And so there's no doubt that in places where lots of people are going we're seeing…more dust, you can just see it in the valley" (Scientist Interview 1)*

Off road/trail travel was identified as an impact by every stakeholder. Throughout interviews, interviewees associated off road/trail travel with soil crust disturbance and vegetation disturbance because as designated routes widen and social trails are formed, soil and vegetation are disturbed and damaged in the process. Interviewees also had a strong association between off road/trail travel and the OHV recreationalists. One study found that off road travel by OHVs affects the surrounding vegetation, wildlife, soil and erosion processes significantly (Switalski,

2018). Previous literature found that off road/trail travel by non-motorized traffic is associated with increased erosion, damages vegetation, and increases likelihood of roads and trails channeling water unintentionally (Hammitt et al., 2015). The following quote summarizes the discussions surrounding off road/trail travel well.

> *"So I'd say the types of impacts that we typically see are people traveling off designated trails, people traveling outside of existing trailways…people start to creep to the edges of trails or they start to drive to the edge of roads. Then roads begin to widen" (Scientist Interview 4).*

Human waste was identified as an impact by BLM officials and scientists. Throughout interviews, interviewees discussed human waste in the region in multiple facets. Firstly, they mentioned human waste as an social impact of recreation in the region as it leaves behind noticeable poop and trash that litters the landscape and affects the experiences of others recreating. Secondly, most interviewees mentioned the sanitation problems associated with having an abundance of human waste in the region left in public areas. Most interviewees discussed community concerns for human health and safety in popular recreation areas. Lastly, interviewees discuss the lack of knowledge associated with human waste disposal and the desert ecosystem by visitors leading to the abundance of human waste in the region. Visitors are unaware of human waste laws and guidelines as well as the ecological considerations (i.e. poop does not decompose quickly in desert environments) to defecate successfully. The identification of human waste as an impact outdoor recreation supports the results from other studies in which they found that human waste in recreation settings to be an issue of sanitation (Bridle & Kirkpatrick, 2003; Cilimburg, 2000). There is little research on the biophysical impacts of human waste on public lands and specifically little to no research on human waste in Canyon Country, which is inherently different from human waste disposal elsewhere (Monz, 2021). The following

quote summarizes the discussions surrounding human waste well.

> *"They're concerned about both public safety and resource impacts from people leaving their human waste behind." (BLM Interview 1)*

> *"Sanitation is a big deal. People are notoriously either unprepared or unwilling to take good care of their stuff [human waste]. We have health department concerns in some of these areas that are heavily used for dispersed camping." (Scientist Interview 5).*

Understanding the impacts of outdoor recreation in Canyon Country is important in achieving sustainable outdoor recreation in the region because in order to mitigate recreational impacts on the landscape, land managers must know what the impacts are. The six perceived physical impacts identified by interviewees represent the most observed impacts of outdoor recreation as visitation has increased. These impacts are by no means the only impacts from outdoor recreation in Canyon Country, but they are the impacts that have been observed the most by BLM officials, scientists, and local outfitter.

My results indicate that some of the primary physical impacts identified by interviewees highlight the unique ecological and cultural considerations of Canyon Country. Specifically impacts like soil crust disturbance, cultural and archeological artifact disturbance, and human waste are impacts that are unique to the desert ecosystem and the region of southeastern Utah. This highlights how environmental conditions and ecoregions react differently to the stressors of outdoor reaction. The Colorado Plateau is often referred to as being resistant but not resilient, meaning that it can withstand use from recreational activities but once those activities occur it cannot recover quickly from the recreational disturbances (Monz, 2021). Additionally, Canyon Country has additional cultural characteristics that need to be considered that are not applicable to other public lands. These ecological and cultural considerations are important because, while broad recreation ecology management practices still apply to the managing recreation in the

region, they may miss the nuances associated with Canyon Country specific impacts such as these.

As impacts were identified, interviewees highlighted two causes that they believed were closely associated with the impacts of outdoor recreation in Canyon Country. First, interviewees consistently mentioned OHV use as a primary cause of impacts. OHV use was associated with soil crust disturbance, vegetation disturbance, poor air quality, and off road/trail travel. This is notable because it highlights that not every type of recreational activity causes the same amount of impact. Studies have found that OHV use causes the highest degree of disturbance out of all types of recreational activities (horseback riding, hiking, mountain biking, etc.) (Hammitt et al., 2015). Since Canyon Country is well known for its OHV recreation opportunities, it is not surprising that OHV use, given its popularity and potential for damage, has been highly associated with many of the perceived physical impacts identified here. Secondly, interviewees mentioned an insufficient knowledge of recreationalists on proper rules and regulations as a cause for increased impacts in the region. Insufficient knowledge was cited as a cause for impacts because recreationalists are causing unintentional harms as they are unaware of unique ecological and cultural considerations of Canyon Country. Insufficient knowledge was associated with soil crust disturbance, cultural and archaeological artifact disturbance and human waste. This is notable because visitor behavior has a large impact on nature and intensity of impacts (Monz, 2021). Visitors who have knowledge of rules and regulations and best practices cause significantly smaller impacts than visitors who do not (Monz, 2021). As visitation in the region has increased, more first time visitors are coming to the region, and therefore impacts due to insufficient knowledge are likely to increase.

4.3 BLM Canyon Country District Management Challenges

To address my third research question, “What challenges does the Bureau of Land Management face in achieving sustainable outdoor recreation in Canyon Country?”, I asked my interviewees questions regarding where the land management practices of the Canyon Country BLM District fell short in addressing the impacts of outdoor recreation and increased visitation in the region. Through these conversations BLM officials, scientists, and outfitter identified several management challenges that the BLM faces. Management challenge refers to challenges that BLM faces as a result of their management structure or their ability to manage outdoor recreation successfully. While every interviewee offered important insight to the challenges the BLM faces, the BLM interviewees were able to offer a more comprehensive understanding of the challenges they face everyday. For this reason, themes in this section are particularly influenced by the BLM interviews. Five management challenges were identified as the most significant due to their frequency throughout interviews. The management challenges that were identified are staffing shortages, inadequate funding, reactive policy, administrative processes, and education of visitors (Figure 5). Each of these challenges is discussed in turn, below.

Table 2: The five management challenges associated with managing outdoor recreation in Canyon Country.

Management Challenges of Canyon Country District	
Challenge	**Definition**
Staffing Shortages	Refers to the BLM having an insufficient number of employees to complete all necessary tasks to manage recreation. This is due to vacant positions as well as not having enough employee positions overall.
Inadequate Funding	Refers to a lack of money or resources to complete projects or manage sites effectively
Reactive Policy	Refers to major impacts from outdoor recreation occurring before the BLM can create a management solution, causing the BLM to create solutions to address issues rather than prevent them from occurring
Administrative Process	Refers to the long and intense process BLM offices have to go through to alter their rules and regulations to address the impacts of outdoor recreation
Education of Visitors	Refers to the challenges associated with educating visitors, especially first time visitors, on the rules, regulations, and outdoor ethics of BLM land in the Canyon Country region

Staffing shortages was identified as a management challenge by all stakeholder groups. Throughout interviews, interviewees spoke about staffing shortages in multiple facets. First, BLM interviewees identified three challenges that create staffing shortages for their district: a long hiring process, cost of living vs. wages, and insufficient number of staff. Most BLM interviewees stated that it is difficult for them to hire new staff due to the long hiring process they have. One interviewee said, “It's a multi-year process to hire somebody when they leave and then other people have to take over that role.” (BLM Interview 5). They mention that because of the long hiring process, it is difficult for them to have enough people to do the job that is required of them. They stated that due to the long hiring process they have many open jobs and

the duties of the open positions have to be shared among other staff. Additionally, BLM interviewees spoke of how it is difficult to hire additional staff as the cost of living in Moab is so high and the BLM's wages are not sufficient for the cost of the area or competitive among other employers in Moab. One Interviewee said, "We have a problem with cost here. McDonald's on their billboard says starting at $19 an hour. Well we don't pay that much, we can't…beat the market demand." (BLM Interview 5). Lastly, interviewees mentioned that despite hiring challenges and compensation challenges, they simply do not have enough staff even if those positions are filled. They stated that because they manage over 3.6 million acres and 3 million visitors, their recreation staff of around 30 people is insufficient to handle and plan for this amount of demand. Other interviewees also echoed this expression. An outfitter interviewee stated, "There's basically, from what I see, zero enforcement of any practices. I've guided for years, and never been approached by BLM staff members to see if I was even permitted. So you can tell they have a shortage of staff, especially now." (Outfitter Interview 1).

Inadequate funding was identified as a management challenge by every stakeholder. Inadequate funding refers to the BLM not having enough resources to accomplish their necessary management tasks like increasing infrastructure. Most BLM interviewees mentioned that their district is funded primarily by user fees and that they get little funding from the federal government. While they mention that their district has more recreational staff, resources and funding than many other BLM districts around the country, they also have significantly more demand. Other interviewees echoed these concerns as well. One scientist interviewee said, "Well their funding and the amount of staffing that they have to keep up with demand is pretty meager." (Scientist Interview 5). Interviews highlighted that demand for outdoor recreation has

far surpassed the management capacity of the Canyon Country District due insufficient funding. The following quote summarizes the discussions surrounding funding well.

> *"Land managers are trying so hard, it's not that they need to do more, it is that they need funding. They want to do their best but the reality of it is that these agencies are dramatically underfunded. They don't have the resources that they need in order to even do the smallest enforcement, let alone to build more infrastructure." (Scientist Interview 1).*

Reactive policy was identified as a management challenge by BLM officials and scientists. Reactive policy refers to the BLM addressing the impacts of outdoor recreation once they have already caused significant damage to the landscape rather than addressing problems before they become an issue. Most BLM interviewees mentioned it is difficult for them to be able to predict how the impacts of outdoor recreation will affect their land, so often reactive policy is the only way they are able to effectively address issues. BLM interviewees were very aware of their reactionary actions. Likewise, scientist interviewees felt as though BLM does not have the capacity to respond in a timely manner to impacts that arise, which set them on the track to be reactionary. Interviews highlighted a cycle of reactionary policy where BLM is consistently working to address issues the impacts of outdoor recreation, but they are always one step behind recreationalists. This makes it difficult for them to recognize issues before they arise and be proactive.

Administrative process was identified as a management challenge by BLM officials. Administrative process refers to the challenges BLM officials face due to the structure of the agency as a whole and the administrative hoops officials are required to jump through to take action on the impacts of outdoor recreation. BLM officials highlighted multiple administrative processes that challenges them successfully managing their land including resource management plans struggling to predict changes in outdoor recreation and the fact that BLM does not have an

equivalent to the National Park Services superintendent's compendium. Firstly, BLM officials highlighted that their governing documents, the Resource Management Plan, are written every 15-25 years. But they stated that these documents cannot predict the drastic changes in recreation that occur in that time, so it is hard to manage within these plans. BLM officials stated that the last resource management plan for the Canyon Country District was written in 2008. They highlight that recreation needs now are very different from those in 2008, so it makes it difficult to utilize plans that never predicted current conditions. Additionally, BLM officials frequently touched on the fact that BLM lacks a superintendent compendium. In the National Park Service, they can frequently make changes to their management plan as their superintendent can utilize the superintendent compendium, an action that allows for the superintendent to make immediate changes in their management plan. However, in BLM, they do not have a similar method to change their management plan and require federal approval to make changes. Interviewees continued to explain how long and hard these administrative processes are to complete. The following quotes highlight the conversation around these administrative difficulties well.

> *"Because the BLM rules are not traditionally intended for 3 million visitors a year, changing the rules is quite cumbersome. I always say they make it hard for us to do the right thing." (BLM Interview 3).*

> *"And I think one of the biggest problems in the BLM is that making those controls is possible but it's so darn cumbersome. So in the National Park Service if the superintendent decides there should be a rule they can add it to the list of rules. But if the BLM wants to add a rule we have to go to the Federal Register, it has to go up to the headquarters or Washington office." (BLM Interview 3).*

Education of visitors was identified as a management challenge by every stakeholder group. Education of visitors refers to the challenges of reaching visitors to educate them on how to recreate responsibly and the rules and regulations of the region. Like other challenges,

interviewees discussed education of visitors in multiple facets including having limited contact with the visitors and the unique educational needs of the desert ecosystem. BLM interviewees stated that the nature of BLM is not conducive to frequent contact with visitors. They stated that due to the extent of the land they manage, limited staff capacity and the multiple entry points on BLM land, it is difficult for them to have contact with visitors. They stated that they felt as though limited contact with visitors resulted in visitors unintentionally causing additional impacts because they were unaware of proper recreation ethics and regulations. Additionally, all interviewees touched on how education is so important in Canyon Country because it is a unique desert landscape that most visitors do not know the nuances of recreating properly in this ecosystem. Interviewees stated that impacts like human waste are often the result of poor visitor education because visitors from other states are used to the idea that it is appropriate to defecate in wilderness settings. They discussed how the uniqueness in the desert ecosystem requires even more education and visitor contact, which they struggle to achieve. The following quotes provide a good summary of the discussion surrounding education of visitors well.

> *"One of the things that is a challenge is reaching people. People come from all over, they speak different languages, they're not necessarily coming to like a fee booth or talking to us." (BLM Interview 1).*

> *"One example is people walking off trail and trampling cryptobiotic soil. Not because they don't care, but because they're completely unaware." (Outfitter Interview 1).*

My results indicate that the majority of challenges (staffing shortages, inadequate funding, reactive policy, and administrative processes) faced by the BLM Canyon Country District relate to the policies and regulations established for the BLM at a federal level. While outdoor recreation is mentioned as a use of the BLM's multiple use framework, it can be seen that the BLM management structure was not intended to manage the amount of visitors Canyon

Country see's today. BLM Interviewees consistently mentioned their frustration with the processes that exist within the BLM that limit the speed and efficiency at which they address recreation issues. One interviewee said, "When you have park service type crowds, you need park service type answers." (BLM Interview 3). This highlights that the BLM bureaucratic structure and procedures may not be well fitted to handle significant increases in outdoor recreation.

Additionally, inadequate funding was identified as a management challenge the BLM Canyon Country District faces. This is notable because inadequate funding to public land agencies has been found to decrease the amount of ecological protections and mitigations agencies can implement (Koontz & Bodine, 2008). Impacts from outdoor recreation in high use areas are usually addressed through building more infrastructure such as campground, bathrooms and parking lots. However, these solutions are expensive and inadequate funding forces land managers to choose between less effective management solutions, prioritizing certain areas over others, or leaving impacts unaddressed. Likewise, inadequate funding also leads to short term problem based management planning rather than long term holistic resource management (Koontz & Bodine, 2008). Inadequate funding is not unique to the BLM Canyon Country district. Thomas & Reed (2019) in their study of management challenges for western land managers found over 75 percent of land managers interviewed from different types of federal and state land management agencies identified inadequate funding as a challenge (Thomas & Reed, 2019).

Furthermore, education of visitors was identified as a management challenge that the BLM Canyon Country District faces. This is notable because if recreationalists are unaware of rules and regulations, then the effectiveness of those rules and regulations is decreased (Thomas

& Reed, 2019). This is particularly prevalent in Canyon Country as the desert ecosystem requires many rules and regulations that are not common among other public lands. Interviewees linked challenges of visitor education on outdoor recreation to be associated with unintentional impacts especially soil crust disturbance, cultural and archeological artifact disturbance and human waste. The BLM Canyon Country district particularly struggles with visitor education as they have limited face to face contact with visitors. It is not uncommon for recreationalists to never interact with a BLM employee or ranger during their time recreating (Outfitter Interview 1). The BLM does utilize signage throughout their land to tell visitors rules and regulations, however, signage is only effective when recreationalists stop to read it. Additionally, while signage has relatively high levels of success in modifying recreationalists behaviors, in person contact is known to be the most effective method of communication (Hockett et al., 2017). Lastly, with the increase in visitation in Canyon Country, interviewees noted the increase in first time visitors as well. First time visitors are likely to require additional education than visitors who come to the region frequently. This adds to the challenge of educating visitors as many visitors have no background in outdoor recreation or desert recreation ethics.

4.4 Further Discussion

Visitation data, impacts from outdoor recreation, and management challenges are all important components of analyzing the current state of recreation and management in Canyon Country. However, these components do not exist individually from one another and are interrelated in nature. Here I will elaborate on how these three components relate to one another.

The relationship between visitation and impacts is important to understand to see how the physical environment has changed as visitation in the region has increased. Over the past decade, Canyon Country has seen a significant increase in visitation, and as visitation in the region has

risen so has the amount of impacts from outdoor recreation (*BLM Utah Estimated Visitation by Field Office.Pdf*, n.d.; Hammitt et al., 2015). Increased visitation has led to an increase in high use areas and extended the spatial extent of recreation in the region. This resulted in more area throughout Canyon Country being impacted by outdoor recreation. Interviewees identified soil crust disturbance, vegetation disturbance, cultural and archaeological artifact disturbance, poor air quality, off road/trail travel, and human waste as the perceived physical impacts that they have observed as visitation has increased. Ultimately, increased visitation has contributed to these six perceived physical impacts of outdoor recreation being prominent in the region.

Similarly, increasing visitation also is related to management challenges. As visitation increases, there are more people that the BLM Canyon Country District needs to accommodate through infrastructure like campgrounds and toilets, and also through recreation opportunities like trails and education. This puts additional pressure on the BLM Canyon Country District to supply these amenities. However, currently the demand for these amenities is far greater than the supply. Although the BLM Canyon Country District is eager to develop more recreation opportunities and satisfy the demand of increasing visitation, they are unable to do so to desired levels because of management challenges. These management challenges include staffing shortages, inadequate funding, reactive policy, administrative processes, and education of visitors. Increasing visitation enhances the management challenges the BLM Canyon Country District already faces. Visitation has been rising at a rate faster than the BLM can accomplish these tasks. Ultimately, increasing visitation has pushed the BLM Canyon Country District past its managerial capacity. They are doing their best to manage increased visitation successfully, but it can not keep up with visitation rates and they often fall short because of the management challenges they face.

Lastly, impacts of outdoor recreation are also related to management challenges. Similar to the relationship between increasing visitation and management challenges, as the amount of impacts of outdoor recreation increase, the BLM Canyon Country District needs to put more effort and resources into addressing the impacts to ensure their land does not exceed their acceptable level of use. However, often due to management challenges like funding or staffing shortages, they are unable to address the impacts of outdoor recreation or do so in a timely manner. Conversely, if the BLM Canyon Country District cannot address impacts in a timely fashion, impacts may be exacerbated due to inaction or visitation.

These relationships play an important role when considering Canyon Country and sustainable outdoor recreation. The aim of sustainable outdoor recreation is to minimize the amount of degradation that occurs on landscapes and ecosystems as a result of outdoor activities to acceptable levels for continued future use. This is achieved through management practices put in place by land management agencies. However, sustainable outdoor recreation is often easier said than done. In Canyon Country, sustainable outdoor recreation has been difficult to achieve due to increasing visitation in the region. Increasing visitation has exacerbated the impacts of outdoor recreation and the management challenges the BLM faces. Increasing visitation is not necessarily cause for alarm in terms of sustainable outdoor recreation, but increasing visitation requires adequate management capacity, which the BLM Canyon Country district currently does not have. Again, the BLM Canyon Country District lacks the funding, staff, and administrative structure to manage 3.5 million people a year. Sustainable outdoor recreation relies heavily on land managers to manage the impacts of outdoor recreation and increased visitation, however, when land managers cannot provide adequate management to ensure impacts and visitation are of acceptable levels of use, then unsustainable outdoor recreation is likely to occur. Ultimately,

the management challenges faced by the BLM Canyon Country District make it difficult for the impacts of outdoor recreation and increases in visitation to be managed sustainably.

5.0 Implications and Potential Recommendations

The results from this study are significant because it is the first study to attempt to understand how increased visitation relates to the impacts of outdoor recreation and management in Canyon Country. Results found in this study can help to inform BLM management decisions surrounding recreation in Canyon Country. Particularly the identification of management challenges will help the BLM Canyon Country District because it solidifies aspects of their management that do not aid in achieving sustainable outdoor recreation and highlights where they may need to implement alternative methods to address issues associated with visitation and impacts. Additionally, this study, because of its novelty, raises more questions than it answers and it will help to inform future research by giving a basic understanding of these relationships as a starting point to investigate further. This research only brushes the surface of the relationships between these components and outdoor recreation management in Canyon Country.

Potential Recommendations

If the BLM Canyon Country District is going to achieve sustainable outdoor recreation, then new management strategies will need to be implemented to increase the management capacity of the district to be able to handle the increase in visitation and impacts, and to overcome management challenges. Since the management challenges identified in this paper nearly all center around bureaucratic processes such as staffing, funding, and policy creation, changes would need to be made at the federal level to address many of these challenges. Unfortunately, it is unlikely that changes will be made to improve BLM bureaucracy in the near future. While it may not be feasible to address the management challenges identified in this

thesis directly, the BLM has other opportunities to increase their management capacity in non-traditional ways. One method this can be achieved is through partnerships with nonprofit organizations and other volunteers. Partnerships allow the BLM to have access to more resources (specifically people) available to them without requiring additional funds or staff. Volunteers can help to maintain trails, signage and be educational resources for visitors on trails. Local recreationalists are often excited to give back to the public lands they love and partnerships can be formed easily. By taking small responsibilities off of the BLM, finite resources within the BLM can be put to the more urgent and important issues. The BLM Canyon Country District already has partnerships with some organizations such as The Access Fund and Grand County, but there is significant need for more involvement of other organizations. In a similar vein, another method the BLM Canyon Country District could build capacity would be to create more opportunities for outfitters to use BLM land for their businesses. By encouraging more outfitters use of BLM recreational resources, the BLM would be encouraging less knowledgeable first time visitors to recreate with a knowledgeable guide. Guides typically have an extensive knowledge of the area including its rules and regulations. Additionally, the BLM could partner with outfitters to encourage them to informally police areas they frequent (ex: tell someone to stop carving their name on top of the rock art). This could help build BLM management capacity as it would encourage more education of first time visitors and allow for more on the ground enforcement to take place.

6.0 Limitations and Suggestions for Future Research

The findings of this study should be considered with regard to some limitations. The first limitation in this study is that the research question evolved over time. Initially, the research question revolved around analyzing the effectiveness of BLM land management policies and

regulations in regards to outdoor recreation. However, interviews with stakeholders provided in-depth discussions and understanding of the management challenges the BLM Canyon Country District faces. Data from the interviews lent itself better to answering a research question focused around management challenges rather than the effectiveness of land management. Due to this shift in focus, interview questions that were used in this study were designed to answer a different research question. If this study were to be conducted again, interview questions should be reevaluated and rewritten to better direct conversations to discussing management challenges. The second limitation was the sample size of stakeholder groups, particularly local outfitters. There was a very small response rate from local outfitters and due to the time constraint of this project, there was not a possibility of pursuing more potential local outfitter interviewees. This limited the amount of data that I had from local outfitters. There are likely differences in observations and opinions between outfitters that I was unable to communicate through my study as I only had one local outfitter interviewee. If this study was to be conducted again, more local outfitters should be interviewed to more accurately represent their observations and opinions.

Future research should be conducted to explore the concepts presented in this paper more in depth. In particular, future research should be conducted to evaluate the effectiveness of the BLM Canyon Country District management in achieving sustainable outdoor recreation. This would build on the results from this study by understanding where current policies fall short in addressing the increasing visitation and impacts to the region, and what needs to change in order to achieve sustainable outdoor recreation. Additionally, future research should be conducted to explore the relationship between visitation, impacts of outdoor recreation and management challenges in Canyon Country in regards to wildlife. Wildlife disturbance and displacement has been well studied within the field of recreation ecology, but interviewees did not mention

wildlife in this study, so it was not explored here. There are likely connections between recreation and wildlife in Canyon Country that would fit well into this narrative if it were to be studied in the future.

7.0 Conclusion

Like many other public lands around the country, Canyon Country has become extremely popular as a premier recreation location. As more recreationalists flock to the region, it raises questions as to how increased visitation affects the physical impacts and management challenges of outdoor recreation on BLM land in the Canyon Country region. Through the analysis of visitation data, and stakeholder interviews, this thesis sought to understand the relationship between these three components and situate Canyon Country within the concept of sustainable outdoor recreation. My research revealed that visitation in Canyon Country has increased significantly over the past decade (2009-2019). As visitation has increased, the impacts of outdoor recreation in the region have increased as well. Through interviews with stakeholders, six perceived physical impacts were observed as the most prevalent impacts as visitation increased. The six perceived physical impacts were identified as soil crust disturbance, vegetation disturbance, cultural and archaeological artifact disturbance, poor air quality, off road/trail travel and human waste. Additionally, my research revealed five management challenges that the BLM Canyon Country faces in managing the increase in visitation and impacts sustainably. The management challenges that were identified are staffing shortages, inadequate funding, reactive policy, administrative processes, and education of visitors. Ultimately, I found that increasinging visitation and the related impacts from outdoor recreation exceed the management capacity of the BLM Canyon Country District leading to unsustainable outdoor recreation. Management challenges have made it difficult for the BLM Canyon Country

District to keep pace with increasing visitation and impacts of outdoor recreation. If the BLM Canyon Country District is going to achieve sustainable outdoor recreation, then new management strategies will need to be implemented to increase the management capacity inorder to handle the amount of visitation and impacts the district gets. The results of this study can help to inform the BLM Canyon Country District on the relationships between visitation, impacts, and management challenges in order to achieve more sustainable management of outdoor recreation. Likewise, this study will hopefully inspire future recreation ecology research to be conducted in Canyon Country to better understand the nuances of sustainable recreation in this unique desert ecosystem.

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Appendix A: Sample Interview Questions

General Questions:

1. How long have you been working/recreating in the Canyon Country region?
2. How has the amount of visitors participating in outdoor recreation in the region changed over the last five years?
3. Have you observed any negative environmental impacts that have been caused by outdoor recreation? If so, what have you observed?
4. Are there particular areas (such as trailheads) that have had noticeably more traffic or where you have observed more human-induced degradation to the land?
5. Do those who you see participate in outdoor recreation do so responsibly? Follow Leave No Trace, stay on trails, pick up their trash, etc?
6. What does sustainable recreation look like to you?

BLM Official Questions

1. What rules and regulations currently exist to regulate recreation in the region?
2. How well have these regulations worked to balance outdoor recreation impacts with conservation of the landscape?
3. Are these rules and regulations enforced? If so, how?
4. Does the BLM have data on visitation rates to land in the Canyon Country region?
5. What challenges does the BLM face in addressing the impacts of outdoor recreation?
6. Explain how outdoor recreation fits into the multiple-use regulatory management the BLM does. Is it a high priority or low priority?
7. How often have policies or regulations around outdoor recreation changed over the last 5 years? Over the last 10 years?
8. Is sustainable outdoor recreation a priority of the BLM? If so, how is the BLM working to achieve sustainable recreation?

Scientist Questions

1. What specific harms does outdoor recreation pose to the region's landscape?
2. Which negative environmental impacts do you think are most important to address?
3. What special ecological or landscape considerations need to be taken into account when designing policies for the Canyon Country region?

Outfitter Questions

1. What have your experiences on the BLM land in the region been like?
2. Have you noticed that certain outdoor activities have a more intensive impact than others? If so, which outdoor activities are responsible for the more impacts on the land?

3. Are you aware of what the outdoor recreation regulations are when you recreate on Bureau of Land management land? If so, how did you find out? If not, what would be the best way for you to access this information?
4. What kind of regulations, if any, would you support to better manage outdoor recreation? Limit usage, need for permits, etc.
5. Is it important to you that land management agencies create regulations and policies to achieve sustainable outdoor recreation? Why or why not?

Appendix B: Sample Codebook SpreadSheet

Impact	Definition	Context
Human Waste	Human waste refers to poop, toilet paper and trash left as a result of humans using the bathroom in backcountry settings	Since the Canyon Country region exists within a desert ecosytem, organic waste does not decompose as it does in other ecosystems. When recreationalists leave human waste in recreation areas, it stays there for decades or until somone cleans it up. It creates public health concerns, takes away from other visitors experiences, and negetivley impacts the ecosystem.
Cultural Artifacts & Archeology	Cultural Artifacts & Archeology refers to impacts to archeological sites and artifacts. This includes graffiti, theft, destabilization of buildings, etc.	The Canyon Country region has been home to people for thousands of years. Today, there are reminitants of past cultures and civilizations. Since these artifacts and archeological resources are thousands of years old, they are considered a non renewable resource. Any damage to these resources cannot be fixed, and therefore mitigating resource impacts is very important. Additionally, these resources still hold a significant amount of spiritual and religous meaning for many tribes in the area.
Soil Crust Destruction	Soil crust destruction refers to damage to cryptobotic soils by people recreating on them	Soil crusts are an important part of the deseart ecosystem. They help to trap moisture in the arid desert soil, move nitrogen from the atmosphere to the soil, and help provide a more habitable environment for plants to grow. Likewise, soil crusts also take decades to form and impacts to soil crust effect the ecosystem for a long period of time.
Vegetation Destruction	Vegetation Destruction refers to reduced growth or death of vegetation due to foot, vehicle, or other recreation traffic	As visitation increases, more dispersed camping areas are established and current dispersed sites are widened. Dispersed camping sites are meant to be used by 2-3 vehicles at maxium, but areas are seeing upwards of 30 vehicles in certain sites. This overall increase in use and increase in intesity of use widens the area impacted by camping leading to impacts on vegetation, soil crust, and erosion.

Figure 7. An example of the codebook used to code interviews.