

ACCESSIBILITY AND VISITATION IN UNITED STATES NATIONAL PARKS

by

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DEDICATION

This thesis is dedicated to two women who have inspired me for the last thirty years. To Sophia Rodriguez, thank you for providing me with constant motivation. To Schineatha Rodriguez, thank you for proofreading every paper I have written and for being my sounding board. I could not have reached this milestone without either of you. Your support and encouragement mean everything to me.

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The purpose of this study is to investigate potential factors influencing U.S. National Park visitation. The study also examines the perception of accessibility within the U.S. National Park Service (NPS). Statistical tests are performed to present findings and a multivariate regression model is used to analyze autoethnographic data related to national park attributes. Mapping is used to visualize select regional and park level features. Study results indicate that the quality of facilities is of high importance to overall national park visitation. While perceptions of accessibility within the park service do not show a positive trend, they are not seen to have a significant effect on overall visitation. Findings from this report provide input on which unit features the U.S. NPS might focus on to improve visitation and what type of data the department can begin to collect in order to make improvements on accessibility for visitors living with disabilities.

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CHAPTER ONE: INTRODUCTION

In the spring of 2015, on my first visit to Waialua Beach, Hawaii, I experienced what I can only describe as awe. I did not have that word at the time, but I felt a new emotion walking along the coastline and seeing the Pacific Ocean for the first time. I know now that an experience of awe is what gifted me with an unexpected shift toward a more selfless and appreciative perspective.

Awe, and more specifically, nature-induced awe is an emotion encapsulating both dread and wonder which can be triggered by experiencing a greatness through the sublime (Bethelmy and Corraliza 2019). I had never seen a body of water so vast as the Pacific Ocean. I could not even conceptualize its reach. Standing on the beach where I would usually be self-conscious about my leg brace and whether I could comfortably navigate the sand, all I could think of was the waves, the horizon, and how much was happening in that ocean that we would never know about. The programmed voice in my head full of anxiety and reasons I did not deserve to be in that space just as much as everyone around me got smaller that day. Less than one year later, I walked into the University of Texas San Antonio to find my now advisor who could help me conceptualize that awe that I had experienced. Little did I know that the voice in my head listing reasons why that space was not meant for me, was the same voice holding back several others in my community.

I did not experience a comparable level of wonderment again until winter 2019. On a solo trip to Calgary, I visited Banff National Park. I had never gone on a small, guided tour before nor had I been to a national park outside of a Grand Canyon trip my parents took me on as a child. I could not decide if I would attend my scheduled tour until the morning of. I can acknowledge now that I was worried of the possibility of being too tired to finish a hike or unable to navigate a

rocky trail or any other scenario where my mobility constraints could lead to negative physical or social feedback. Then, I remembered that feeling I had on the North Shore in Hawaii, so I got in the tour van. Within a few hours, I was standing on a frozen Lake Louise completely enamored and trying to find the words to explain to my wonderfully adaptive tour guide how little I had imagined a day like that across my life and how grateful I was to have experienced it. I assumed that a national park could never be accessible enough for me, so I never attempted entry as an adult. The sadness that I felt for the potential I had that morning to cancel my tour made me think of the millions of people living with disabilities who may choose or decline such adventures.

When I returned to Texas, my interest in the U.S. National Park System (NPS) grew. Did I luck out or is there a formula to choosing where we consume these moments of wanderlust and wonder? This thesis aims to shed some light on potential driving factors in park visitation as well as perceptions on the accessibility of the NPS for people living with disabilities, a population which enters U.S. National Parks at a disproportionate rate compared to their non-disabled counterparts (Blotkamp et al. 2010). Reasons for this include lack of accessibility and perceived lack of belonging. Other more tangible reasons could be distance traveled from origin point and cost of participation once inside the park system. Given the social and socioeconomic disparagement experienced by these populations, people living with disabilities may have the most capacity for realizing the psychological benefits of access to such a vast natural space as a national park. So, a community with some of the lowest access points could stand to benefit from entry the most. We must, along with the organizations managing our natural spaces, continue to identify ways to acknowledge and decrease the quantifiable discrepancies in access to our natural spaces for people living with disabilities.

CHAPTER TWO: LITERATURE REVIEW

Awe in U.S. National Parks

Several studies have validated my feelings of awe from years back and have established a positive correlation between exposure to awe-inducing nature settings and human health. Awe is confirmed to promote prosocial behavior. One study was able to demonstrate that the experience of nature-related awe leads to increased feelings of the small self which results in a higher sense of community and prosocial attitudes and actions (Piff et al. 2015). Similarly, it has been determined that when individuals feel awe, it leads to self-diminishment and subsequently increased humility (Stellar et al. 2018). Another study discovered that awe affected daily life satisfaction even more than contentment and pride among other positive emotions (Anderson, Monroy and Keltner 2018).

The search and appreciation for natural wonderment is certainly not new in the twenty-first century. In the eighteenth century, during the sublime movement, there was high value and prestige aligned to the opportunity to experience an environment devoid of humans so grand that it was compared to seeing the face of God. Some environmentalists began to insist that locations aligned to the sublime movement were becoming domesticated spectacles. The popularity of the awe-inducing sites was causing them to lose the features of pristine untouched charm which once made them great (Bethelmy and Corraliza 2019, Cronon 1996).

With the early environmentalists in the nineteenth century came the Arcadian movement and a push for public appreciation of nature's intrinsic value. Ecologists subscribing to the theories of this movement believed in the resistance of human dominance over nature and the importance of preserving undeveloped land (van Koppen 2000). The Act of March 1, 1872 instated Yellowstone National Park as the first of its kind thus igniting the global movement

toward national parks (ParkNet: National Park Service 2000). In just two decades, John Muir founded the Sierra Club in 1892 which was intended for U.S. conservation, but it was not met without opposition. Muir's insistence for preservation of the U.S. wilderness was threatening to the agendas of the nation's timber companies and several of its politicians (Scribd 2013). This debate between the weight of the intrinsic versus instrumental values of our awe-inducing natural spaces is one that Muir did not see resolved in his lifetime nor do I anticipate will be resolved in mine.

Present day, it is evident that annual visitation to U.S. National Parks is on the rise (IRMA Portal 2019) and as was seen during the era of the sublime, there is controversy surrounding the increased popularity and associated ecological implications on our protected parks (Lawhon, Taff and Schwartz 2016). In fact, there have been recent efforts by certain popular parks, like Grand Teton National Park, to decrease visitors' use of social media picture geotagging to reduce foot traffic in "Instagram-worthy" locations (Holson 2018).

The steady climb in the interest of U.S. National Parks allows for a deeper dive to discover what factors are influencing park visitation in the twenty-first century. People may still be visiting these protected natural spaces in search of experiencing the vast and untouched sublime, or perhaps manmade enhancements like designated trails and lodging have more of a draw for visitation. Additionally, I would like to discover how well these natural spaces are enabling access for the diverse levels of physical and mental ability within the U.S. society. More than thirty-six million U.S. residents reported having one or more disability in 2009 (Erickson, Lee and von Schrader 2011). I wonder if our park system has properly accommodated this often marginalized 12% of the population or if these spaces are exclusively tailored to non-disabled persons.

Disability Geography

The approach of disability geography focuses on the relationship with disability and our environments (Kudlick 2003). It is an imperative perspective which can add greatly to conversations of awe and access to nature. There is a sound qualitative foundation on disability geography theories and hopefully, increased inquiries such as this one will continue to call for and produce more quantitative data. For now, the perspectives discussed are the foundation from which more dynamic approaches to the study can grow.

It is Reginald Golledge who called for a substantiated geography-of-disability field and for population subgroups dedicated to the community. He said, “although in most societies today there is evidence of efforts to compensate for disability (e.g. wheelchair ramps, special toilets, Braille markings on elevators), the peculiar spatial insights of the geographer should add significantly to these efforts and help isolate and resolve the peculiar sets of spatial problems not already addressed by other concerned researchers” (Golledge 1993). The geographical model of disability is an answer to Golledge’s call. Its main meaning is to expose the interrelations between people living with disabilities and geographical space. Spatial exclusions are accounted for here when discussing social arenas and built environments. In efforts to reduce the apparent marginalization, the model sees needs related to myriad of disability types as examples of the many needs that can be found throughout our modern society (Zajadacz 2015).

A unique characteristic of the disability subfield is that it is highly intersectional and has extremely strong personal ties sourced mostly by “insiders.” This means that many of the publications of disability geography research has been authored by people who either experienced disability personally, by relation, or through occupation. This publication is no different in its conception, and I aim to use the U.S. NPS as my spatial environment of study.

The validity of the field must not be solely based in the passion of the scholars (Worth 2008). For this reason, feminist geographer, Gillian Rose's concept on approaching the oppression of women has carried over into the disability subfield. She presents "betweenness" as a solution for researchers. The goal of researchers should not be to claim distanced objectivity, which was the preferred perspective of many of her male counterparts, nor should they claim absolute sameness. Disability research has since attempted to find space "in between" where, regardless of personal connection or lack thereof, analysis and resulting conclusions can be made with minimal bias (Worth 2008).

Mental Barriers to Access

A seminal compilation of past research regarding disability by author Catherine Kudlick provides substantial input on the troubling early perceptions of people living with disabilities. Aristotle was listed as one of the classical thinkers who had opinions regarding the perfect human body. Deviations from the normal physical form were likened with terms like "mutilated." This creates a social level of powerlessness and "otherness" on people living with disabilities by imposing a negative label to their social category which is dictated solely by appearance before a more informed impression can be made (Kudlick 2003).

This negative connotation with disability was reflected in a study on the public opinion of potential accessibility upgrades within the Isle of Mainau in South Germany. The study found that many of the survey respondents who confirmed having an existing disability opposed the idea of accepting services created to increase their inclusion. This would mitigate the risk of bringing more attention to their disabilities and potentially becoming socially stigmatized (Seeland and Nicole 2006). This prioritization of social acceptance is seen in Crawford & Godbey's categorization of constraints wherein one's interpersonal and intrapersonal constraints

must be overcome first before they can address their own need for adaptations to tangible, structural needs or constraints (Sus Sola Corazon 2019).

Further echoing the mental hurdles faced by people living with disabilities is the social adjustment function. As a part of the functionalist theory, the social adjustment function is employed by a person to acclimate into a social group. It speaks to either the intentional or perhaps subconscious adjustment of oneself with the desire to earn approval and avoid consequence in a social group. (Daruwalla and Darcy 2005). It can be inferred that if access to a natural space was more empathetically and accessibly constructed, a person with limiting physical conditions would require less mental effort in the avoidance of social consequences. This could lead to an increased chance of a positive social experience.

Access for All

An example of a social landscape within a community normalizing accessibility, and thus decreasing the burden on those living with disability, is the town of Chilmark on Martha's Vineyard which historically was an anomaly. While the occurrence for being born with deafness was 1 in 5,728 in America, the rate was once 1 in 155 in Chilmark. Recounts of life in the town say that hearing people were essentially expected to be bilingual in speaking English as well as sign-language in the region (Groce 1985). With these factors in place, deafness was not seen as a handicap in the usual sense of the term since the obstacles related to the impairment were proactively intercepted with the community-wide adaptation. Alternatively, in the French Riviera, a community-ranking system portraying accessibility commitment levels has led to adaptations like a certified *Audiobeach* which guides people living with partial sight thus increasing independence. Other beach cities provided adaptations like seaside carpets to help create smoother beach floor surfaces for those who may benefit (Christofle and Massiera 2009).

These types of localities offer real life samples of a shift in perspective within an entire community and the product of a collective group deciding to question the norm.

Places that are structured to increase independence help to promote a more welcoming environment for people with disabilities who travel or commute often. The commute for rural dwellers with disabilities creates a middle-of-nowhere effect for the population. This is because of the long distance one must travel to access fully equipped hospitals, rehabilitation centers, and even family or friends located in urban areas (Pini and Chouinard 2017). This amplified feeling of exclusion can be experienced even in urban spaces. Research shows that trips to urban playgrounds can be filled with dread for families with children with disabilities. While it is noted that there is an absence of research regarding the variability of outdoor play for children with disabilities, access to natural space is still known to be beneficial. Outdoor play allows for aesthetic reflection and a creative outlet where place-making and a sense of rootedness can develop. “Barriers of fun” are structural obstacles which discourage children with disabilities to experience the outdoors in a way a non-disabled child might (Horton 2017).

An ableist barrier could be a gate door around a play area too small to fit a wheelchair through or unnecessary steps which could cause problems for a child with reduced sight. As was seen in previous studies, research has identified mental barriers to entry for the parents of children with disabilities. There was also association of failure that many parents were found to have associated with parks due to inability to simulate an idealist version of the outdoors for their children (Horton 2017). This type of negative association with a park can lead to an avoidance of entry. As more people are discouraged to visit, the lack of representation in these natural spaces will continue. This issue inevitably follows the disability community from urban parks to the U.S. National Park Service units.

The Current Research

The U.S. National Park Service was created in 1916 (U.S. Department of the Interior 2005). Visitation continues to show a positive trend with over one hundred million visitors across the NPS units annually and over seventy-million recreational visitors within the last ten years for the sixty-two National Parks alone (IRMA Portal 2019). It is such a highly populated system, and yet the NPS acknowledged in 2014 that NPS units were not fully accessible. NPS Accessibility Task Force also admitted that people with varying physical conditions were underserved in their “All-In” Accessibility Plan which was scheduled for five years of implementation ending in 2020 (U.S. Department of the Interior 2014). It is unclear how the effects of COVID-19 may have changed scheduling in this last year of accessibility upgrades. Disability research in the parks may increase as a result of the NPS’ accessibility campaign, but what is currently available is minimal.

The Comprehensive Survey of the American Public (CSAP) produced supplementary publications for both CSAP1 and CSAP2 delineating reasons for entry and non-entry by race and ethnic group. A similar matrix was not accessible based on disability type. The highest rated reasons for visitation across all visitors are to go sightseeing and to go vacationing with guests and relatives. Viewing sites of nature and seeing distant or unobstructed views are experiences within the parks which are known to bring the highest enjoyment for visitors (Taylor, Grandjean and Gramann 2011). The CSAP does report percentage of attendees having a disability and their satisfaction with accessibility within NPS by region. Additionally, there are national park visitor studies, some of which request feedback on overall satisfaction of accessible facilities (Blotkamp et al. 2010).

Now we will explore what we can derive from the best-suited data available and discuss what we could hope to discover about influencers and barriers to national park entry from increased data capture. During this exploratory study, we will investigate the following research questions: How is national park visitation related to associated acreages, regional designations, and autoethnographic attributes scores? What is the correlation between regional public perception of accessibility and national park visitation?

CHAPTER THREE: DATA AND METHODS

The U.S. National Park Service (NPS) is a bureau within the U.S. Department of Interior which encompasses the sixty-two National Parks along with hundreds of units including monuments, military, parks, seashores, and even the White House. The U.S. National Park List from NPS provides full park names as well as state-level locations (U.S. DOI NPS 2020). The Integrated Resource Management Applications (IRMA) Portal allows the general public to run queries on visitation statistics by region and park (IRMA Portal 2019). The National Park Service Land Resources Division maintains NPS acreage data and provides regional designations by park (U.S. NPS Land Resources Division 2017). The NPS regions include Alaska, Intermountain, Midwest, National Capital, Northeast, Pacific West, and Southeast (Esri 2019). There are no national park units within the National Capital region which explains its exclusion of park-specific analysis. To visualize park localities and visitation, the two regions with the highest occurrence of national park units are illustrated below (Figure 1). Descriptive statistics, analysis on the potential correlation between 2017 visitation and acreage, and analysis for significant difference between 2017 visitation based on region will be performed.

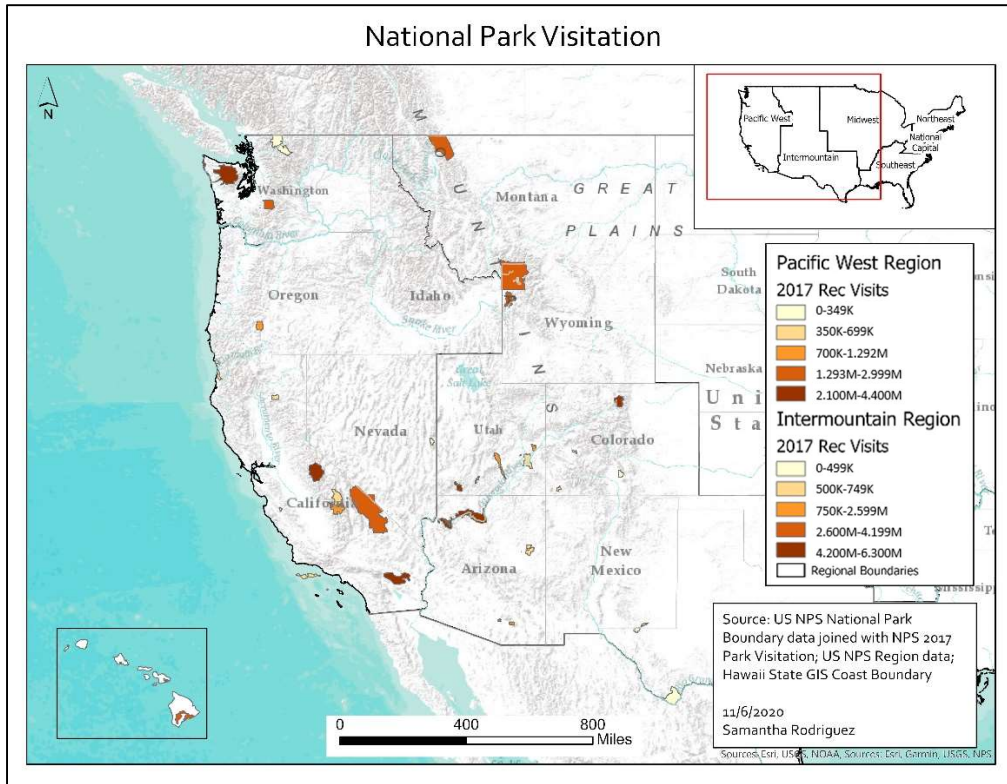


Figure 1: Pacific West and Intermountain Region Visitation Map

In support of their partnership with the National Parks Foundation, the EVOLVE Brand partnered with a professional photography duo to visit each U.S. National Park on an expedition in 2017. The seven-month journey resulted in hands-on experience and led to a collection of quantitative and qualitative ethnographic data for each national park. While there are currently sixty-two U.S. National Parks, Gateway Arch, Indiana Sand Dunes, and White Sands National Parks were not designated in enough time to be included in the attribute scoring exercise, so only fifty-nine of the units were examined in related analyses (Hahnel and Hahnel 2018). In lieu of future autoethnographic data that I would like to collect in postgraduate research, the scoring data created for each attribute they have assumed would insight a positive visitor experience is presented below (Table 1). Examination on the potential correlation between 2017 recreational visitation, acreage, and attribute scores is performed as well as an analysis of the difference between overall attribute scores based on region.

Table 1: National Park Attributes

Attribute	Score Range	Description
Facilities	0-10	proximity to lodging, variety of lodging types and affordability, food availability, bathrooms, visitor centers, showers, etc.
Trails	0-10	the actual park trails, as well as other opportunities for adventure such as snorkeling, rafting, diving, boating etc.
Scenery	0-10	overall beauty of the park, including landscapes, wildlife, and buildings.
Photogenic	0-10	how easy the park was to photograph and how well it translated into images
Crowds/ Transport	0-10	how busy the park was and overall how easy it was to get there and transport yourself around (e.g. ability to self-drive versus having to take park buses etc.)
Attribute scoring structure source: Renee Roaming (Hahnel and Hahnel 2018)		

Minimal data regarding accessibility within the NPS reduces the impact of statistical models. The CSAP1 and CSAP2 data was also collected using differing methodologies further decreasing the potential for analysis. CSAP2 data is primarily reflected in pertinent discussion. This survey includes the responses from 4,103 completed interviews and weighted percentages are applied here (Taylor, Grandjean and Gramann 2011). With these restraints, the data on accessibility by region is displayed using comparative bar charting and two comparative maps are presented for 2001 and 2009 displaying the change in regional survey results on accessibility perceptions along with overall national park visitation. These resources were created using ArcGIS Pro to allow for visual analysis (Esri 2020, Taylor, Grandjean and Anatchkova 2011). The accessibility responses from three visitor studies, by the National Park Service Visitor Services Project, focused on Yosemite National Park are presented using charting to display an example of how additional quantitative data capture across all units could lead to more meaningful discussions on accessibility (Littlejohn, Meldrum and Hollenhorst 2006, Le, Papadogiannaki and Hollenhorst 2008, Blotkamp et al. 2010).

CHAPTER FOUR: RESULTS

Descriptive Statistics

There are no U.S. National Parks with equal visitation counts. The 50th percentile of 2017 recreational visitation is 642,809 while the mean recreational visitation was 1,424,637. The least visited U.S. National Park in 2017, Gates of the Arctic National Park, had 11,177 recreational visits. Great Smoky Mountains National Park was most heavily visited with 11,338,893. So, there was a range of 11,327,716 among recreational park visitation in 2017. The interquartile range reflects the range between the 25-75% percentile in the dataset. This helps to remove influential outliers like the Great Smoky Mountains and Grand Canyon National Park. The middle 50% of the recreational 2017 visitation values lie within differences of 1,246,319.

The coefficient of variation is a value that represents the ratio of the standard deviation to the mean. Based on the coefficient of variation of 1.359187, the 2017 visitation for the U.S. National Parks is high variance with a standard deviation higher than the mean. With a positive skew value of 2.742231, there is a positive skew in visitation. This positive skew could also have been assumed due to the mean being larger than the median. With a kurtosis value of 9.812683 being greater than 3, the distribution is leptokurtic meaning that it would have a peaked appearance. A Shapiro-Wilks Test resulted in a 2017 Visitation P-Value of 5.046e-10. A P-value less than 5% implies that the data is not normally distributed. A histogram for the 2017 recreational visitation visually confirms that the visitation data is not normally distributed (Figure 2).

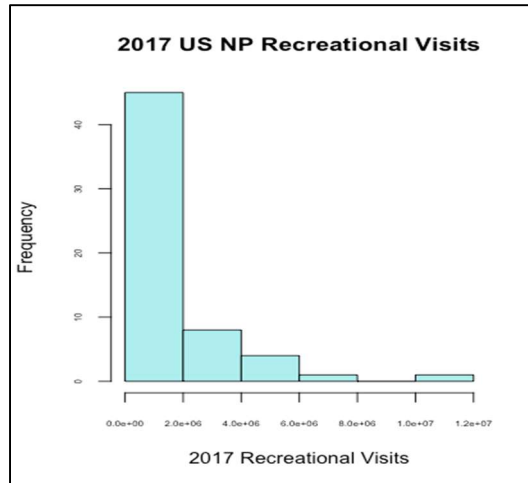


Figure 2: 2017 U.S. National Park Visitation Histogram

The dataset that did prove to have a normal distribution was the overall attributes score for each U.S. National Park (Hahnel and Hahnel 2018). When analyzing the collective score for the parks’ facilities, trails, scenery, photogenic, and crowds/transport, the Shapiro-Wilks Test resulted in a 0.1506 P-Value. A histogram visualizes the finding below (Figure 3).

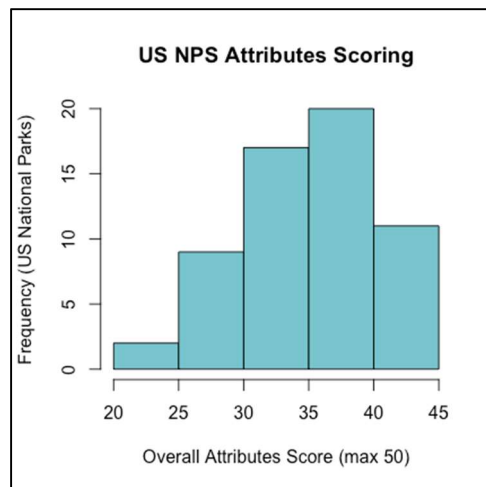


Figure 3: Overall National Park Attributes Histogram

Bivariate Correlations

The Spearman Rho Correlation Coefficient was used instead of Pearson’s coefficient because all the data is not normally distributed. A P-Value of 0.8233 implies that there is not a likely bivariate correlation between U.S. National Park acreage and 2017 visitation. When

analyzing regional COMP2 survey results regarding accessibility, a P-value of 0.3024 greater than 5% is returned suggesting no correlation when testing for relationships between 2009 visitation by region and percentage of respondents who strongly agreed or agreed that the U.S. NPS is not accessible for people who have disabilities. Similarly, there was a P-value of 0.9063 and no evidence of bivariate correlation between the percentage of respondents with someone in the household living with a disability in each region and the regional visitation in 2009.

There is a promising relationship between the overall attribute scoring of the national parks and visitation. The P-value of 0.00689 being less than 5% suggests a significant correlation. The coefficient of 0.3481568 being positive means that as the overall attribute score goes up, so does visitation. Additionally, according to the rule of thirds, the coefficient reflects a moderate strength relationship.

Difference Testing

The percentage of respondents who strongly agreed or agreed that the U.S. National Park System is not accessible for people who have disabilities is not significantly different between the CSAP1 and CSAP2 occurrences. This means there is no significant difference in perception of accessibility in the U.S. NPS among the regions from the 2001 to the 2008-2009 survey exercises. This is reflected in a P-value of 0.6163 result from a pooled variance estimate two-sample difference test. If the CSAP occurrences were to be conducted annually and results delivered by unit, the U.S. NPS could begin to investigate how their units are comparing in accessible offerings over time and where to direct their immediate attention. Another way to review the existing data for insights is with spatial visualization. The percentage of respondents who have the perception of the NPS as inaccessible are presented with the national park visitations in their correlating survey year in two maps below (Figure 4, Figure 5).



Figure 4: U.S. NPS 2001 Visitation and Inaccessibility Map



Figure 5: U.S. NPS 2009 Visitation and Inaccessibility Map

The symbology for regional accessibility perceptions on each map suggests that while visitation by national park services remained relatively constant, perceptions of inaccessibility within the U.S. NPS did increase (Figure 4, Figure 5). This is not surprising and is echoed in the three

Yosemite National Park Visitor Studies from 2005, 2008, and 2009 (Le, Papadogiannaki and Hollenhorst 2008, Blotkamp et al. 2010, Littlejohn, Meldrum and Hollenhorst 2006). When survey respondents confirming that they had used “Access for Disabled Persons”, each year, respondents percentage for rating accessibility as “extremely important” or “very important” was always higher than the percentage of respondents who rated a “very good” or “good” for the quality of the existing accessible features. The bar chart below was made in ArcPro and displays the disconnect in expectations for visitors with disabilities and the reality of the features they are given (Figure 6). In 2009, Yosemite received its lowest percentage of approval for quality. Visitor perception may have improved in the last decade considering the NPS Accessibility Task Force strategy execution ending this year (U.S. Department of the Interior 2014).

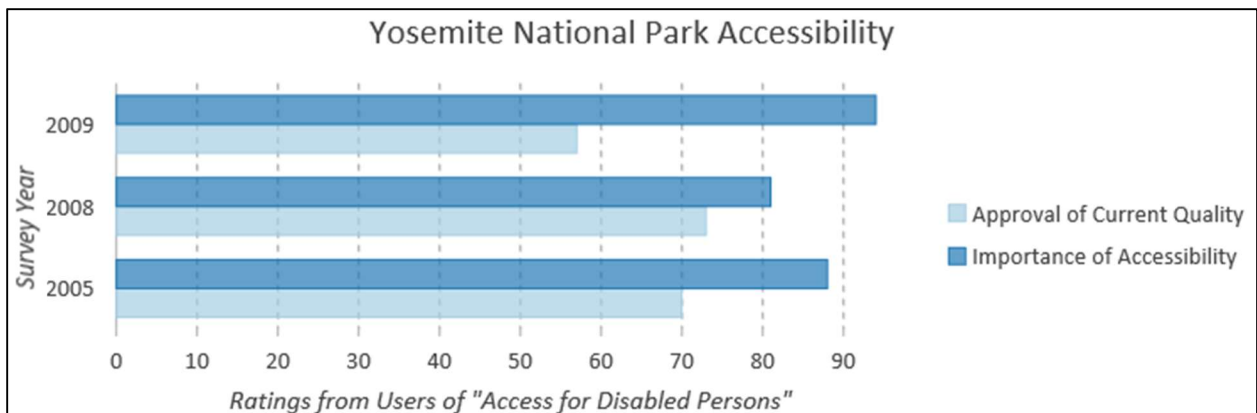


Figure 6: Yosemite National Park Accessibility Chart

A reported P-value of 0.251 being larger than 5%, suggests that there is not a significant enough difference in visitation by region to warrant any additional investigation. Conversely, the overall attribute scoring of the national parks continues to show significant results. A reported P-value of 0.00382 suggests that there is a significant difference in overall score based on region. Using the TukeyHSD analysis, the specific region groups that have significantly different overall attribute scores between each other are Midwest versus Alaska and Southeast versus Alaska (Table 2).

Table 2: TukeyHSD Results

\$`NPS\$Region`	diff	lwr	upr	p adj
Intermountain-Alaska	-3.1458333	-9.217341	2.9256741	0.6456872
Midwest-Alaska	-8.8125	-16.207577	-1.4174227	0.0108715
Northeast-Alaska	-1.8125	-13.108667	9.4836672	0.9968519
Pacific West-Alaska	-2.6948529	-8.82106	3.4313538	0.783416
Southeast-Alaska	-8.2410714	-15.636149	-0.8459941	0.0206469
Midwest-Intermountain	-5.6666667	-12.031336	0.6980025	0.107283
Northeast-Intermountain	1.3333333	-9.316795	11.9834619	0.9990405
Pacific West-Intermountain	0.4509804	-4.381437	5.2833975	0.9997709
Southeast-Intermountain	-5.0952381	-11.459907	1.2694311	0.1867087
Northeast-Midwest	7	-4.456404	18.4564045	0.4705044
Pacific West-Midwest	6.1176471	-0.299223	12.5345171	0.069931
Southeast-Midwest	0.5714286	-7.066174	8.2090316	0.9999229
Pacific West-Northeast	-0.8823529	-11.563759	9.7990536	0.9998743
Southeast-Northeast	-6.4285714	-17.884976	5.0278331	0.5642457
Southeast-Pacific West	-5.5462185	-11.963089	0.8706515	0.1268458

A boxplot assists in visualization of the significant differences (Figure 7). You can see that the Midwest plot essentially has no overlap with the Alaska plot, and this is the same case with the Southeast and the Alaska plots. Observe on the boxplot that Alaska has much more prevalence of attribute scoring present within the region than Midwest and Southeast. The Northeast plot is also extremely shallow because it has a smaller count of associated

observations, and they happen to have the same overall attribute score. Also, the Pacific West outlier is likely compromising its significance.

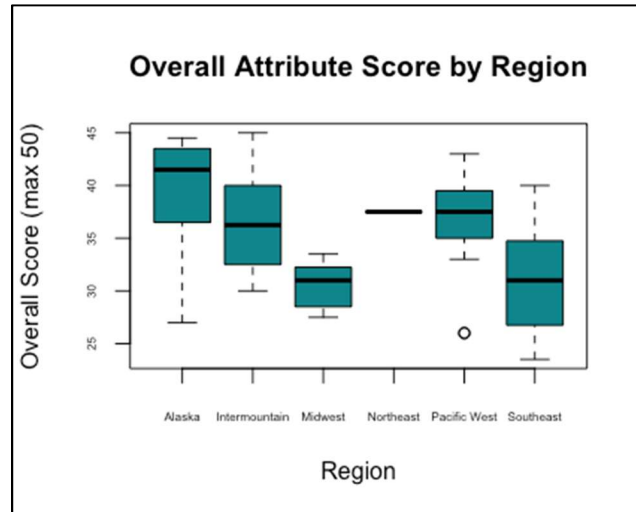


Figure 7: Overall Attributes Score by Region Boxplot

Multivariate Regression

Multivariate regression analyzes how many independent variables affect a dependent variable with a focus on the strength and magnitude of the relationship. The attributes are tested here to gain more insight on which of them can be attributed to visitation variability. Scenery scores are not included in the model due to the collinearity with the photogenic scores. Based on the Multiple R-squared, 42% of the variability of the 2017 Recreational Visitation to the U.S. National Parks is explained by the attributes (Table 3). When reviewing how the facilities, trails, photogenic, and crowds/transport attribute scores and their relationship to the 2017 recreational visitation, there are two attributes which reflect P-values less than 5% thus confirming a significant relationship: Facilities and Crowds/Transport.

Every 1-point increase in the facilities score leads to a 399,612 increase in visitation. These results are not surprising. Proximity to lodging, food availability, and relatively easy access to amenities and conveniences would likely increase visitation and those attributes would

also continue to be constructed due to the high visitation, so it could become a positive feedback loop between these two variables. Conversely, every 1-point increase in the crowds/transport score leads to a 589,071 decrease in the visitation count. The Crowds/Transport score was described to include ability to self-drive and navigate oneself independently. Considering that fifty-eight percent of park visitors said that seeing distant and unobstructed views “added a lot to their enjoyment”, the presence of too many roads could ultimately be a deterrent for visitors in search of that sublime experience (Taylor, Grandjean and Anatchkova 2011, Bethelmy and Corraliza 2019).

Table 3: Multivariate Regression Results

Independent Variable	Regression Coefficient	Std. Error	t value	P-Value	Sig Level
(Intercept)	3614665	2086084	1.733	0.088848	.
NPS\$Facilities.Score	399612	102274	3.907	0.000262	***
NPS\$Trails.Score	-127740	227760	-0.561	0.577217	
NPS\$Photogenic.Score	38167	178915	0.213	0.831876	
NPS\$Crowds.Transport.Score	-589071	167886	-3.509	0.000916	***
Multiple R-squared:	0.4173				
Adjusted R-squared:	0.3741				
F-statistic:	9.668			5.696E-06	

The ordinary least squares (OLS) assumptions for robust regression results include interval/ratio variables, linear association, and residuals that are normally distributed, homoscedastic and independent (Figure 8). Diagnostic testing found that there are non-normally distributed residuals caused by the present outliers. The Great Smoky Mountain National Park and Grand Canyon National Park both have vastly higher visitation than the other units. Removal of these national parks from the model results in other outliers becoming apparent including Zion National Park and Rocky Mountain National Park. Remaining findings were aligned to

compliance with the OLS assumptions. The residuals are homoscedastic and are not auto correlated. Finally, multicollinearity was not identified among the independent variables.

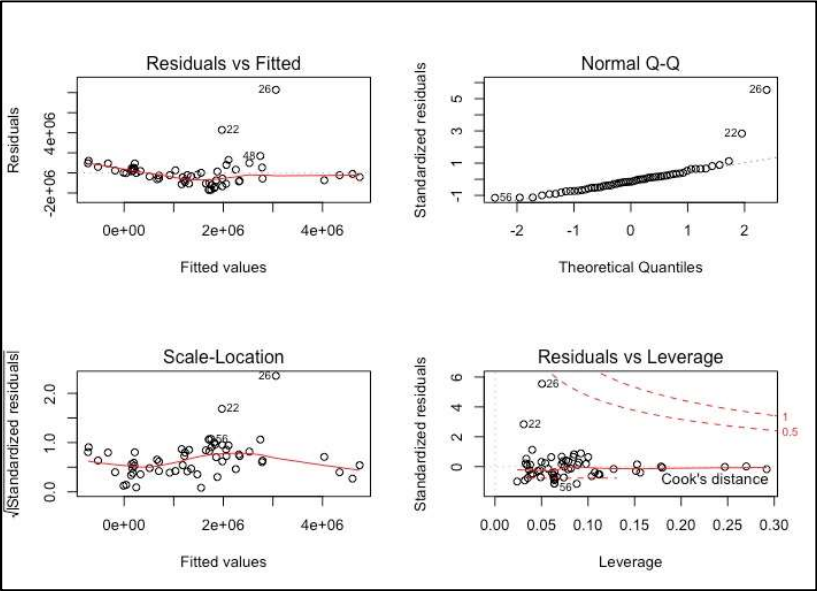


Figure 8: Multivariate Regression Model Diagnostics Charts

CONCLUSION

There is no bivariate relationship between 2017 visitation at U.S. National Parks and their associated acreages nor is there a significant difference in visitation based on the regional designations. However, Midwest versus Alaska and Southeast versus Alaska do have significantly different overall attribute scores based on the region. 2009 regional perceptions on accessibility did not produce significant correlations with 2009 visitation nor did perceptions on inaccessibility greatly differ among regions between 2001 and 2009. I advise that additional public feedback for the 2010s be acquired along with post hoc data upon the conclusion of ongoing NPS Accessibility Task Force efforts.

When reviewing how the facilities, trails, scenery, photogenic, and crowds/transport attribute scores and their relationship to the 2017 visitation, there are two attributes which show the most potential for a significant relationship: Facilities and Crowds/Transport. The model used to gain this insight did violate OLS assumptions with the presence of non-normally distributed residuals, suggesting additional research is required to confirm the stated magnitude of relationships.

Research Shortcomings

Those relationships that were found to be significant between attribute scores and visitation gainfully simulate the application of autoethnographic research and singular experience-based scoring as a research strategy for inquiries on the topic. The analysis was a purposeful exercise overall. However, for the purposes of this research, the limitations in the scope and subjective nature of the data collection process require that confidence in analytical results stated above be observed with caution.

The limited size in data regarding accessibility within the U.S. National Park System has decreased the substantive nature of the statistical analysis provided. With increased data points and responses to surveys like the CSAP1 and CSAP2 by national park association, a stronger model of analysis could be performed. Consistently reoccurring surveys at the park level and increased funding for institutions equipped to contribute this and all disability geography topics, would greatly reduce research shortcomings for myself and others in the field.

Future Research Questions

Not all the existing variables for this study proved to be impactful, but this research has ignited planning for research I intend to support in the future. A scoring system for the national parks structured from the perspective of an underserved population like a person of color and/or person living with a limited physical condition, could highlight attributes important specifically to these communities. This type of data could be coupled with increased visitor studies to create a robust collection of datasets and more substantive analysis in the future. Such reporting could inform the U.S. National Park Service, Department of Interior as a whole, and related state and city tourism departments throughout the United States.

I would also promote increased attention regarding the effects of social media on national park visitation and place attachment. Inquiries I would propose are as follows: How does social media geotagging affect the perceived value of U.S. National Parks and the areas within each park which visitors choose to seek out? What is the correlation between social media geotagging and visitation and how does it differ between the populations living with and without disability? How have social media strategies affected visitor demographics at a park level and what best practices might all units benefit to enact in order to promote a more diverse population of visitors across the U.S. National Park System as a whole?

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