

It's All in the Name: The Environmental Impacts of Tourism in  
Indiana Dunes National Park

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## Abstract

National parks are seeing more visitors than ever, raising concerns over the environmental conditions in the park. Past research on national park designation has focused on economic impacts; however, there is less literature on the environmental impacts. This thesis explores the environmental impact of national park designation, looking specifically at the Indiana Dunes National Park. Air pollution measures collected by the EPA in Porter County were analyzed to explore a relationship between air quality and an increase in visitors after national park designation. This paper also used a survey to gain an understanding of how stakeholders view the impact of tourists on the area. Questions were on erosion, flora, fauna, water pollution and air pollution. Analysis found that national park designation did increase visitor rates but was not related to any of the air pollution measures. Respondents expressed concerns over the environment due to tourists' actions, mainly for flora and fauna. The findings of this thesis urge the conservation plans of the national parks to be altered to better address parks' carrying capacity for visitors.

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# It's All in the Name: The Environmental Impacts of Tourism in Indiana Dunes National Park

## Introduction

Yellowstone National Park marked the beginning of the national park movement in the United States, eventually leading to the creation of the National Park Service in 1916 (“Quick History”). Yellowstone was established “as a public park or pleasuring-ground for the benefit and enjoyment of the people”, which is the tagline of the NPS as well (“Quick History”). In addition to the current 63 national parks, the National Park Service oversees many different federal land designations, including national heritage areas, national monuments, and national lakeshores. Each designation offers a different level of protection and resources, determining what visitors can and cannot do on the land and how much funding the park gets to maintain the area. These designations are also flexible, and areas can be redesignated – as happened with the Indiana Dunes National Park.

National Park designation comes with the strictest level of federal protection, the most funding, and the most restrictions on what visitors can do compared to land designations controlled by the Forest Service and the Bureau of Land Management (National Forests). They typically have an entrance fee of \$25 to \$35 per vehicle, but fees are different for individuals and motorcyclists (“Fees at Work”). Most of these fees stay within the park to fund projects regulated to visitor experience and conservation.

National park visitors’ spending is an important factor in the national and local economy, and the vast amount of literature on economic effects of national park

designation supports this practice (Weiler & Seidle, 2004). This data is often used in support of the creation of more national parks. As the National Park Service reports, visitors spent \$14.5 billion in 2020 and created 234,000 jobs nationwide (NPS). For the Indiana Dunes, visitors spent \$103 million in 2020, creating 1,230 jobs and an economic output of \$141 million (NPS). Tourism is also assumed to have created an estimated economic impact of \$62 million for Porter County (Pete, 2021).

The Indiana Dunes was designated a National Lakeshore in 1966, after a long lobbying movement that began in 1899 (“History of”). In 2019, the Indiana Dunes National Lakeshore was renamed to Indiana Dunes National Park (“Frequently Asked Questions”), which covers over 15,000 acres today. While a change in designation may mean more funds for the park to use to protect the environment, this is not the case for the Indiana Dunes National Park – which did not gain a substantial number of resources after the redesignation (House of Representatives, 2017). The natural area is important to the Midwest as it is one of the most biodiverse places in the country (Foundation Document Overview). Within 15,000 acres, the Park contains 1,100 different plant species (Foundation Document). The Park contains sand dunes, beaches, forests, and marshes. It is next to the Indiana Dunes State Park, 20 miles from Chicago, and near industrial plants.

Over 30 million people are within a 3-hour drive to the park, making the Dunes much more accessible than other NPS units (“Frequently Asked Questions”). Visitors can compete in the Three Dunes Challenge - where they summit the three largest dunes in the area – swim in Lake Michigan and visit a homestead. There are many trails for visitors to hike, including Trail no. 9, which has been identified of one of the most scenic hikes in the United States by USA Today (Pete, 2021). The Indiana Dunes is home to

some of the best birding in the country, with an extremely popular birding festival taking place each year. Last year, participants spotted over 211 different bird species (Indiana Dunes Birding Festival). It is clear that the Indiana Dunes offers a wide variety of activities for visitors, attracting people from many areas.



**Figure 1. Visitor Map of Indiana Dunes.** This map was made before 2019, hence it being called the Indiana Dunes National Lakeshore. The geography of the park is the exact same today. Notice how the Park stretches from Gary, Indiana, all the way to Michigan City, Indiana and the breaks within the park. Source: NPS.



**Figure 2. Closer Image of the Dunes.** This close up of the Indiana Dunes illustrates the Park's proximity to two steel mills and a power plant (seen in the white area labelled Port of Indiana). Source: NPS.

The Dunes is also a uniquely accessible park. First, it can be reached by public transit. Using the South Shore Line, visitors from Chicago and Gary and all along Northern Indiana can access the park for a low cost. The train has multiple stops throughout the park, so visitors can reach a variety of destinations. Second, the park does not have an entrance fee. While other parks have an entrance fee ranging from \$25 to \$80, the Indiana Dunes does not charge visitors, making the park accessible to a wide socioeconomic range of visitors. Not having an entrance fee does have its downfalls, as an entrance fee does increase revenue and not having one limits the budget, therefore the ability of the Dune to expand conservation. In 2017, the number of visitors was 2,158,471, which decreased to 1,756,079 in 2018 (Rowe, 2021). These rates were greatly surpassed after it was redesignated to be a national park in 2020 and 2021, which saw 2,293,106 and 3,090,846 visitors respectively.

The times of free entry to the Dunes may be coming to an end as park officials are hosting conversations on instating a fee. An increase in visitation rates has led to concerns on space, as parking is limited in most areas, especially beach parking. This past summer, the Dunes started charging a parking fee at West Beach due to the overwhelming number of people trying to park (“West Beach”). Furthermore, the park saw an increase in violent crime last summer. This caused a temporary increase in rangers, with one to two extra rangers being brought in most weekends (Rowe, 2021). For a long-term solution, officials are considering an entrance fee to minimize the size of crowds and crime. An entrance fee has the potential to change the visitation of the park and reduce the accessibility of the park.

A change in the type of visitor does not seem to be enough of a change to prevent environmental impacts either. Since people around the world have become concerned

about the impacts and sustainability of tourism, eco-tourism has risen in popularity. Eco-tourism is not clearly defined and can mean any activities that fit into the definition of being “responsible towards the natural environment” (Dangi & Gribb, 2018). Despite the goal of eco-tourism to be more environmentally friendly to the places being visited, the practice continues to have negative impacts similar to regular tourism (Isaacs, 2000). In fact, a dependence on ecotourism may act as a kind of insurance, that allows more risk-taking behavior to take place and ignoring pressing issues (Isaacs). This means that areas that depend on ecotourism view their actions as not harming the environment, allowing for other, potentially more damaging behavior, to take place.

Unfortunately, tourism is not the only potential cause of environmental degradation. The Dunes is surrounded by steel plants, as this area was once a thriving industrial park. Despite plants closing in the area, many remain active and have negative environmental impacts. This past Fall alone, there were two chemical spills within two weeks, forcing the beaches to be closed until the spills could be contained (AP News, 2021). The nearby industry poses serious concerns for the environment in, and around, the Indiana Dunes National Park.

Increases in visitation and a lack of funding to support the increases, have led to concerns over the environmental impacts from these tourists. Thus, this thesis hopes to gain a better understanding of environmental concerns that may occur from national park designation, first by establishing that designation impacts the number of visitors, and second by analyzing the relationship between tourism and environmental health. This issue is made more urgent by the COVID-19 pandemic, which broke out approximately one year after the Indiana Dunes was redesignated. The pandemic caused nearby governments to shut down public beaches and other activities, pushing the



public to the national park – which remained opened. This was seen all over the country, as many national parks broke previous visitor records during the pandemic. With the number of parks growing and there being record-breaking visitors to many parks each year (The New York Times, 2021), it is important to ensure that these spaces are being preserved so that the future can enjoy these areas as we do today.

## Literature Review

National parks and other protected areas are entrusted to the government under the public trust doctrine, which has been viewed as crucial for conservation (Issacs, 2021). Concerns over the government living up to this agreement have arisen due to increased crowds at national parks, and the damage that these crowds may do (Baker, 2021). Furthermore, the National Park Service has a history of not collaborating with stakeholders nor requiring research to inform management policies (Slocum, 2016). While collaboration has played a big role in the creation of the Indiana Dunes National Park, there remains concern for other areas of the United States. Since the impacts of tourism in national parks has not been widely studied, the question of the direct causes of any negative environmental impacts in the parks remains unclear.

### *Local Impacts of National Parks*

Studies have already demonstrated that national park designation increases visitors to the area. Weiler and Seidle (2004) demonstrated that national monuments that were redesignated as national parks saw an increase in visitation of over 11,000 visitors a year. This study did not test if these are completely new visitors to the park, or if this was a net zero of visitors – meaning the influx of visitors were ones that would have been at a different park if not for the new one. However, this research does

demonstrate that the increase is substantial from the redesignation and not following a previous trend. Furthermore, distance from a major metropolitan area did not play a large role in the visitor increase. This study is helpful for demonstrating that the label of national park impacts visitor rates, but it is limited in that it only looks at national monument redesignation. It also looked at the economic impact of the increased number of visitors but did not explore any environmental impacts.

A second study in 2006 by Weiler further explores the impact of national park designation on visitor rates and the possibility of the name “signaling” to visitors. This study used a simple regression and found that a change in designation to park status increases the number of visitors from across the nation and does not impact local, state numbers. Furthermore, the increase in visitors to the redesignated park does not correlate to a decrease in other parks. In other words, the increase in visitors represents a net gain and are new visitors to the NPS system. The designation of national park itself may be important for signaling information to out of state visitors, who may not know the area as well, whereas locals do not need the signal to understand what the area is like and has to offer.

### *Economic Impacts*

There is a great amount of literature on the economic impacts of national park. A study in Germany found that increasing park amenities attracts more visitors, which then increases the amount of money spent in the local economy (Mayer et al., 2010). This implies that by putting more money into an area – such as building visitor centers and more parking -will lead to positive impacts on the local economy. This is what many national parks do in order to attract more visitors.

### *Environmental Impacts*

The idea of a social carrying capacity guides the research on whether visitors to national parks have a negative environmental impact. A 1996 study by Manning et al. describes this theory of carrying capacity applied to visitors at national parks. In this study, carrying capacity includes ecological factors and the quality of the visit for tourists. NPS launched the Visitor Experience and Resource Protection (VERP) which “defines carrying capacity as the type and level of visitor use that can be accommodated while sustaining the desired resource and social conditions that complement the purposes of the park units and their management objectives”. It includes nine steps that identify resources, standards, and alternatives, and depends on long-term management. VERP was tested at Arches National Park and results were helpful for identifying indicators and standards of quality of visitor experience. Management plans like VERP may be needed for maintaining an environmental standard for national parks, but this paper focused on the visitors’ enjoyment of the park and did not address whether these management plans help the environment.

Studies that have focused on the environmental impact of tourists have found mixed results. Research in Southeast Asian parks, using quantitative data, found that for some countries it increases the GDP and increases CO<sub>2</sub> levels, this is not surprising as these two variables have been linked previously (Ahmad et al., 2019). On the other hand, tourism causes some countries to be proactive and introduce environmental regulations that will keep the environment clean – which is what tourists pay to visit at these parks. The study provided many recommendations for reducing environmental degradation due to tourism, including regulations on waste, energy, farm to market food

to reduce water and package waste, working together with other areas, and being proactive about issues.

Qualitative data has also been used to explore environmental impacts. In the UK, researchers used the Delphi technique to survey a variety of stakeholders on their thoughts of a sugar mill project (Green et al., 1989). The Delphi technique is a method of collecting expert opinions on an issue without the experts being in a group setting and thereby reducing group bias. This allows for individual responses to be given- as opposed to a group's response – and provides more candid and personal responses. These researchers found concern for environmental impact from tourism development among the experts, who predicted that not paying attention to these concerns may lead to degradation of the resources that tourists use. This study does not investigate the environmental impacts itself, however, and is only using data from the Delphi surveys.

A second survey-based study created a five-essay question survey and sent it to park superintendents, receiving 44 responses (Wang & Miko, 1997). In addition to the five main questions, respondents were asked to rank the environmental impact of specific activities from insignificant to extremely significant. Researchers analyzed responses by determining the percentage and mean response for each item. A majority of the respondents mention air or water quality issues, and 84 percent mentioned flora/fauna issues. This survey, however, was only sent to park superintendents, and did not involve park rangers and other stakeholders who may have noticed different things than the superintendents.

The techniques used in these two studies will guide the quantitative methods portion of my thesis. I reached out to stakeholders in the Indiana Dunes National Park are to understand their perspective with this issue.

Research by Dangi and Gribb (2018) expanded beyond the opinions of park managers and involved park concessionaires in a survey. This study of Rocky Mountain National Park involved a questionnaire regarding the two stakeholders' perceptions of sustainable ecotourism management and visitor experiences in the park. This survey looks specifically at ecotourism, and not tourism as a whole. Responses revealed that concessionaires and park management agree in some areas, such as that ecotourism is a positive thing, but disagreed in other areas – including carrying capacity of the park, visitor conflict issues, and the impacts of horseback riding within the park. The inclusion of concessionaires is an important step in involving parties that also have intimate knowledge of the park and may see impacts of visitors as well. However, this questionnaire was mainly concerned with opinions on management and ecotourism, and less focused on environmental concerns stakeholders had, leaving the topic of negative impacts from ecotourism and other activities in the park unanswered. Furthermore, this paper does not identify the cause of the impacts within the park.

Another study by Zajchowski et al. (2019) explored the relationship between air quality and visitor behavior in federally protected areas, including National Parks and forests. While tourism may contribute to worsened air quality; a poor air quality may impact visitors' experiences and behaviors. Researchers asked what the processes are that contribute to poor air quality and if visitors change their behavior because of air quality. By interviewing government professionals, researchers found that nearby industry is a serious concern for air quality in the protected area (Zajchoowski et al., 2019). Respondents also expressed concern for reduce visibility for tourists and health impacts on sensitive populations. The results from the survey demonstrate a clear need

for air quality management, building upon the Clean Air Act and addressing the knowledge gap of environmental impacts and effects on tourism.

Research on U.S. national parks have predominantly focused on the economic impacts of national park designation. This thesis will expand upon national park designation by exploring the environmental impacts. Specifically, this paper aims to explore if it is the designation of national park status that leads to more tourists, or if tourists were going to visit an area regardless of its designation. While there are factors outside of tourism that contribute to environmental degradation, including climate change, this thesis is only looking towards tourism. This research will also contribute to research on the social carrying capacity of the national parks, as it intends to illustrate whether an increase in visitors does have negative environmental impacts or not. The previous researched outlined in this section will help design the methodology of this paper, especially with collecting my qualitative data and guiding what questions are included on the survey. Past research has also created the framework for me in explaining why these impacts are important as we move forward and must adjust policies to manage increasing visitor rates.

## Methods

Both quantitative and qualitative data are used for my research on the environmental impacts of national park designation. To understand the impact of national park designation, the number of visitors to the park from 2015 to 2021 were recorded; 2019 was noted as the year of redesignation. The data is public on the Dune's website, except for the most recent figure of 2021, which was collected through a park employee. Linear regression was used to relate the number of visitors to designation

through years. A linear regression assumes that there is a linear relationship between input variables (year) and a single outcome variable (number of visitors). This method allows me to determine if visitor rates and time are related; however, I am not able to account for other factors – including COVID.

The visitor variable for the Indiana Dunes was then used to examine environmental impacts due to tourism. Quantitative data included air quality measurements from 2017 to 2021, which were the dependent variables. The air quality data includes measurements for ozone and particulate matter 2.5, meaning particles of 2.5 microns or smaller in width. Ozone is measured by parts per million, while PM 2.5 is measured with microns per cubic meter. This data was all collected using the EPA's database of yearly monitoring reports and was selected as it is the data collected by the nearest EPA monitor site to the Park. The monitor station used is the Ogden Dunes site in Porter County, Indiana, near West Beach. In accordance with the Clean Air Act, the EPA has set the level of acceptable PM 2.5 to a three-year average of 12  $\mu\text{g}/\text{m}^3$  or less ("Revised Air Quality"). The EPA has revised the standard of ozone over time, and in 2015 the standard was strengthened even more to an 8-hour average of 0.070 ppm ("Eight-Hour Average"). The standard is fully met when the annual fourth-highest daily maximum is 0.070 ppm or less. Since poor air quality may be a deterrent for people visiting the park, each measure was identified to ensure that the area is meeting EPA standards. However, fires in Western United States in 2020 and 2021 were known to impact air quality across the United States, which cannot be completely accounted for until data for future years is available to compare visitor behavior. (Fischels, 2021).

Three different linear regressions were used to relate visitors and tourists for each air quality measure. The specific measure was always the outcome variable; one

model only used year has a predictor variable, the second model used only visitors as a predictor variable, and the third model used both variables as predictors.

The qualitative data was collected using a survey sent out using Google Forms. Using a snowball sampling method, I identified certain stakeholders with the help of Dr. Bouman of the Keller Science Action Center of the Field Museum. These stakeholders often passed the survey on to others they thought would be interested and dispersed the survey among the mailing list of the nonprofits they are a part of. This method uses nonrandom sampling and may have limited diversity in opinions, especially selection bias. However, this survey is aiming to capture the perceptions and experiences of stakeholders familiar with the park, and this was the most efficient way to achieve this. In addition to sending the survey to park employees, the survey was sent to an employee of the South Shore Line, members of Friends of the Indiana Dunes, the Porter County chapter of Audubon Society, the Porter County chapter of the Izaak Walton League, Indiana Dunes Tourism, Save the Dunes and the Shirley Heinze Land Trust. The final sample size was 70 participants.

Bias was attempted to be reduced by using carefully worded questions that are in the Wang and Miko survey, as these questions have already been tested and demonstrated to be effective and neutral. Multiple follow-up emails were sent to non-responders up until the survey was closed on February 15<sup>th</sup>, 2022. In addition to typical demographic data collected – name, age group, place of employment and length of employment - the respondents' positions and organizations were collected in order to differentiate between stakeholders and account for different internal biases. Next, participants were asked questions on the impact of tourist activity on water quality, air quality, erosion, flora, and fauna. In addition to ranking the level of significance tourism



has on each of these environmental areas, these main areas also had a short answer question so that respondents could go into depth with their answers. Within each main section of concern, multiple questions were included asking the participant to rank the concern of impact of certain tourist activities – including boating, littering, leaving designated trails, noise pollution, and many other items. A few questions asked about non-tourist activities as well, these items were included to account for concern of the nearby steel mills and other industries and to differentiate these concerns from tourism concerns. Survey responses were analyzed by finding the mean rating for each question and the breakdown by percent of each rating for each question, as performed in the Wang and Miko (1997) paper.

While the methods in this thesis have been used before to create generalizable data, there are concerns about the ability to apply the opinions towards Indiana Dunes National Park to other parks, as the Dunes may face many problems that the other parks do not – including industrial waste. This decreases the ability to generalize the results of this paper; however, the survey used in this study has been used before to create generalizable results (Wang & Miko).

## Results

### *Quantitative Analysis*

The raw quantitative data is shown in Table 1., including the number of visitors to the visitor center, and the two air quality variables. The three-year averages for ozone and PM 2.5 are within the EPA standards as well (Table 1.). The number of visitors for each year since 2015 is shown (Table 2.). The number of visitors increased between every year except for 2017 to 2018, which saw an 18.6 percent decrease (Figure 3.).

Using linear regression modeling in R, the relationship between year and number of visitors was found to be significant ( $p=0.016$ ), reaffirming past findings (Weiler & Seidl, 2004; Weiler, 2006). Park officials attribute this increase to the change in designation (Pete, 2021).

**Table 1.**

Year	Number of Visitors to Visitor Center	Median AQI	Ozone (parts per million)	PM 2.5 (micrograms/cubic meter)
2017	108,767	41	0.043	8.869
2018	93,502	38	0.043	7.303
2019	170,057	41	0.048	7.273
2020	122,234*	41	0.047	7.920
2021	147,632**	40***	0.046	8.282

**Table 1. Visitors and Air Quality.** This table illustrates the number of visitors to the visitor center, the ozone, and the PM 2.5 for the years 2017 to 2021.

\*Due to COVID-19, the visitor center was closed between March 2020 – May 2020. It then operated from an outdoor tent between June through September.

\*\* Partial figure from January to October 2021

\*\*\* Finalized numbers not available until May 2022

The three-year average for the air quality variables meets the EPA standard, implying that air quality should not have impacted visitors itself, as an average unhealthy air quality may deter visitors for restrictions on activities and viewing (Table 1.). None of the air quality measures were statistically significant from 2015 to 2021.

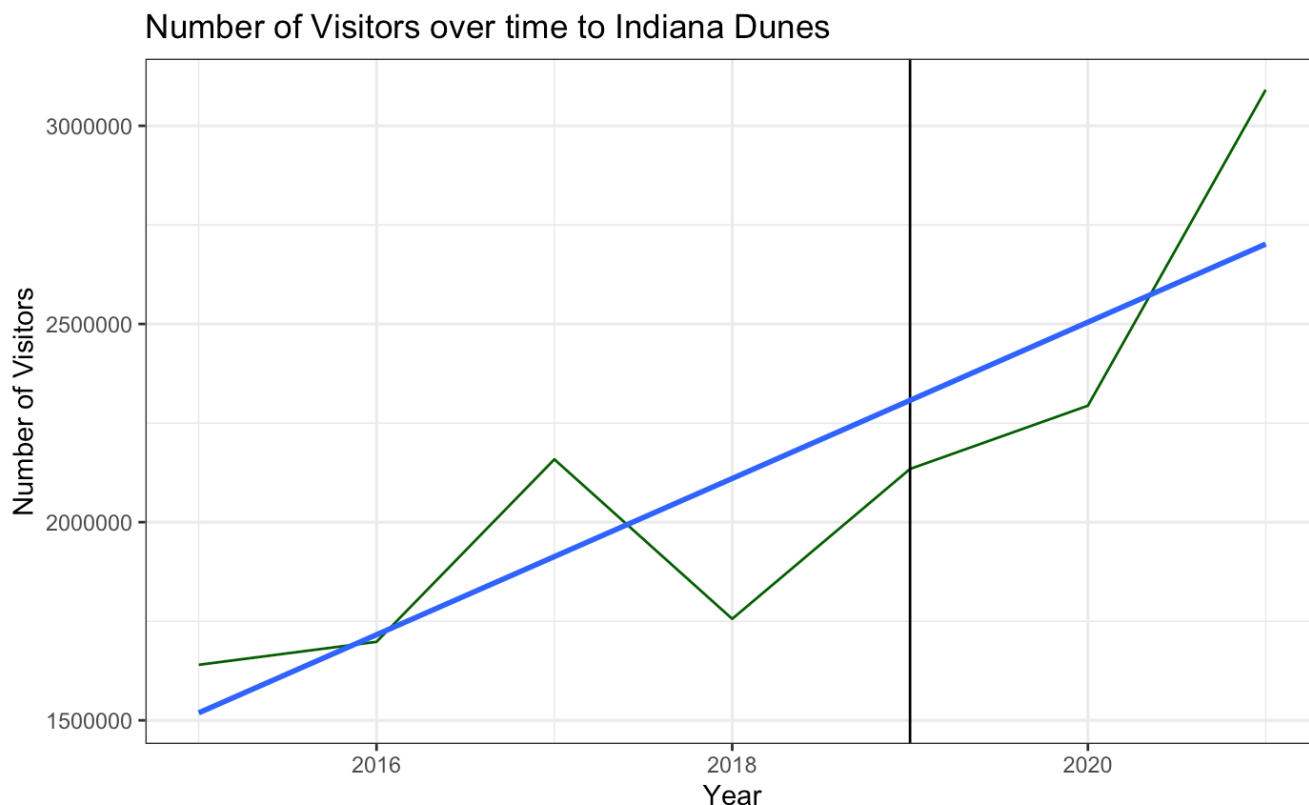
**Table 2.**

Year	Number of Visitors
2015	1,640,195
2016	1,698,223
2017	2,158,471
2018	1,756,079
2019	2,134,285
2020	2,293,881

2021

3,090,846

**Table 2. Number of Visitors Each Year.** This table illustrates the visitation numbers from 2015 to 2021.



**Figure 3. Number of visitors to Indiana Dunes from 2015 to 2021.** The visitor rate has increased since 2018, with the biggest jump from 2020 to 2021 (green line). The year 2019 is marked in the graph to remind the year designation was changed. The blue line is the line of best fit.

### *Qualitative Analysis*

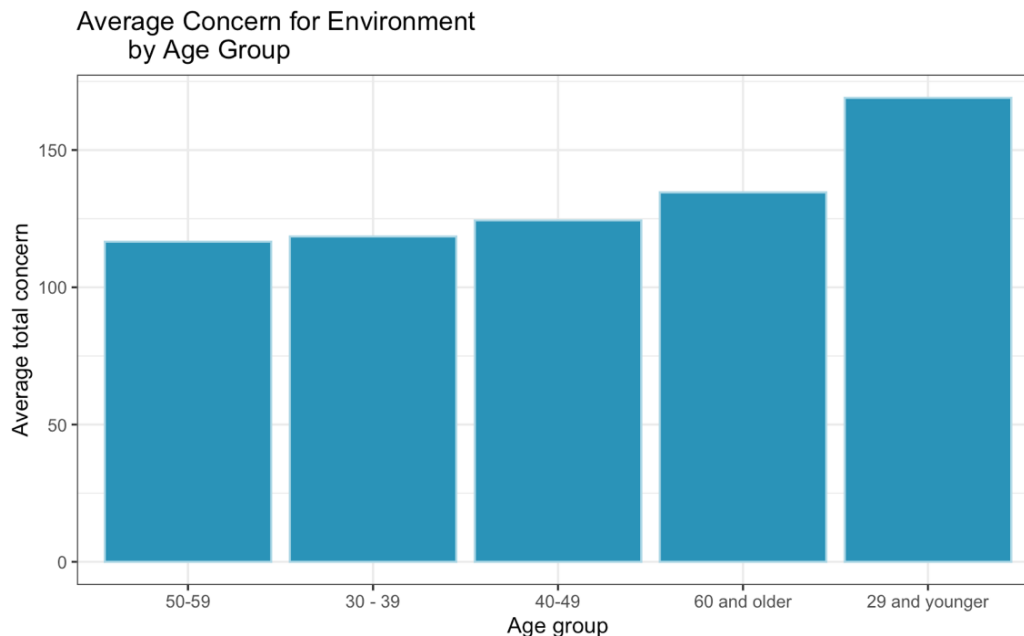
The majority of respondents were in the 60 and older age category (Table 3.). Participants who marked their employment as something other than Indiana Dunes National Park or South Shore Rail were assumed to be members of one of the nonprofits included in the survey, this group made up 94 percent of responses.

**Table 3. Age of participants**

Age	Frequency
29 and younger	1
30-39	2
40-49	5
50-59	8
60 and older	54

**Table 3. Age of participants.** The breakdown of the participants by age group. Most participants were at retirement age, which was expected given that most participants were a part of nonprofits and may have had more time to fill out the survey than the younger age groups who may be working full time.

The total concern, a variable based on the ratings given for each environmental area, varied by age (Figure 4.). The disagreement in responses may be due to the position and experience a respondent has with the park, as this survey drew from park employees and nonprofit organizations. Most members of the nonprofits were older than 60 (77 percent), and each nonprofit and person may have different perspectives and goals for the park that act as biases. Furthermore, it is important to remember the age group breakdown from Table 3, which demonstrated that only one participant was in the 29 and younger group, while 54 are in the 60 and older group.



**Figure 4. Average concern for environment by age group.** This was calculated by adding up the rating of significance for all factors per participant and averaging the number across age groups. If participants answered every question, the highest total concern could be 200 (rated 5 for each question) and the lowest could be 40 (rated every question as 1).

The average concern for each environmental area also differed. Based on survey responses, tourism posed the greatest risk to the health of fauna ( $m=3.638$ ) and flora ( $m=3.412$ )<sup>1</sup>.

The average rating of significance for water quality was 2.764, demonstrating that tourist activities do not pose a significant concern to water quality. Tourists' waste disposal and boating were considered to have somewhat significant impacts on the water quality in the park<sup>2</sup>. However, industrial waste disposal had a much higher

<sup>1</sup> Table 4, in Appendix A. This table shows the number of ratings for each option of each environmental area. The highest average concern due to tourism is shown for fauna. The second highest concern was for flora populations. Water concerns due to tourism have the lowest rating, leaning more towards being insignificant. This can be due to a variety of reasons, including that Lake Michigan is much larger than the portion contained within the park, and for their being industrious activities nearby that pose a greater threat than tourists.

<sup>2</sup> Table 5, Appendix A. This table shows the number of ratings for each option of each factor that may impact water quality. Unsurprisingly, industrial waste disposal was rated as extremely significant by most participants. The nearby steel mills lead to great concern for the water quality due to dumping and algae blooms.

average rating of concern for water quality. This result is expected due to the nearby steel plants that can be viewed from the park and may be unique to the Indiana Dunes.

Similar to water quality, tourist activities on air quality were not a major concern. For air quality, the concerns arise from cars idling ( $m=3.536$ ) or from there simply being more people<sup>3</sup>. Concern for industrial activities near the park was a consistent concern among survey participants:

“The large volume of individual cars used by visitors to the park does have a negative impact on air quality. While I do not know the percentage, it is a very small impact compared to the industrial and power plant pollution and the impact from non-visitor vehicles (in particular large trucks) on nearby highways.”

“Exhaust from motors (cars, boats, campers) may generate small areas of concentrated pollution near the ground level. Cars probably have the greatest impact because they are the main form of transportation to/from park and often wait in line at park entrance. However, compared to the pollution from the general Chicago area and local industry, these are minor.”

One respondent mentioned that the park is aware of the issue of idling cars and is trying to work with the South Shore Line and a shuttle system in order to reduce the number of cars trying to get into the park. Since the Indiana Dunes is a relatively new park, it is important to note that these problems may be recent ones that the park is already working on solutions for – such as this partnership with public transit.

The factors for erosion were expected to be rated more significantly than the previous environmental areas due to how delicate the dunes are and because many visitors’ reason for visiting the Dunes is for the beaches. This prediction was supported, as the average rating for erosion was 3.333, higher than the former two. Trampling

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<sup>3</sup> Table 6, Appendix A. This table shows the number of ratings for each option of each factor that may impact air quality. Tourist activities that relate to air quality have fairly low concern. Exhaust from cars pose a significant concern, but construction, campfire smoke, and exhaust from generators and boats were not big concerns for participants.

( $m=3.871$ ) and shortcutting ( $m=4.200$ ) were rated as being significant in their impacts<sup>4</sup>. The other factors were also somewhat significant, implying that tourists' activities are a big concern for erosion in the park and a potential focus area for future management policies.

The average rating for flora was 3.412. There were many more factors to be rated for the flora section than any other section. In addition to concerns for industrial waste disposal ( $m=4.043$ ), the introduction of nonnative species ( $m=4.104$ ), destruction of habitat ( $m=4.250$ ), and erosion of dunes ( $m=4.203$ ) were seen as significantly impacting the flora quality<sup>5</sup> (Table 8.). Invasive species are a concern because of the numerous ways they can be carried into the park, as one participant explains:

“People going off dedicated paths cause damage to stabilizing plants such as marram grass. People also look for rare plants to collect them, which places such populations at further risk. I don't sense that the collection issue is that severe. People also bring in seeds of invasive species on vehicles, which compete with natives. That said, there are already many invasive plants in the area, the populations of which certainly affect adjacent natural areas' flora. Boats can also bring in aquatic invasives.”

However, not all participants were in agreement on the relationship between erosion and tourism. As another participant puts it:

“I do not believe tourism contributes to significant shoreline erosion, but I do believe shoreline erosion impacts tourism. That said, dune destabilization is definitely impacted by tourists - ie people going off trail.”

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<sup>4</sup> Table 7, Appendix A. This table shows the number of ratings for each option of each factor that may impact erosion. Shortcutting and walking off trail are a significant concern for the dunes and trails in Indiana Dunes National Park. This is a delicate ecosystem, so this is not a surprise.

<sup>5</sup> Table 8, Appendix A. The activities that have the largest impact on flora populations are industrial waste disposal, introduction of nonnative and invasive species, and – most of all – destruction of habitat. Nonnative species can be brought in inadvertently, through tourists' clothing and shoes, cars, and boats.

There is support for a link between tourism and shoreline erosion, but the relationship of this direction appears mixed based on this comment.

Finally, respondents rated the concern on fauna higher than the other areas (m = 3.638). Littering (m=3.841), development of roads and trails (m=3.725), and noise pollution (m=3.750) were all rated as significantly impacting fauna<sup>6</sup>. It is unsurprising that littering was rated so high, as many respondents left comments about tourists leaving items behind:

“Tourism unfortunately leads to increased pollution. Indiana Dunes National Park administers several beaches on Lake Michigan. Littering and waste from dogs is the biggest concern. Their carry out your waste and lack of trash cans program and reduced supervision due to budgetary shortages contribute to this problem.”

The development of roads and trails are *for* tourists, while littering and noise pollution are *due* to tourists, which require different management policies. Behavioral intervention could be used to impact the latter two, but development for tourism requires separate tactics to mitigate the effects.

## Discussion

This research explored the relationship between national park designation, tourism, and environmental impacts. It found that park designation is related to an increase in tourism and that stakeholders believe tourism impacts the environment in negative ways, particularly flora and fauna populations.

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<sup>6</sup> Table 9, This table shows the number of ratings for each option of each factor that may impact fauna. Participants expressed concern for noise pollution, development of roads and trails, and littering on fauna health.



The number of tourists and national park designation was found to be related through year, with many more tourists visiting after park designation. Unfortunately, determining the difference in visitor rate from the national park designation is challenging due to the COVID-19 pandemic. Nearby cities closed their public beaches for the sake of the pandemic, pushing people to go elsewhere who may not have ever visited the park if their local beaches were open. This may have impacted the data used in this paper and limit the certainty that effects found were from visitors.

The relationship between air quality, number of visitors, and year was not found to be significant for any of the measures. This could be due to the fact that the air quality measures are for a much wider region than just the national park and are therefore impacted by more factors than visitors to the park.

Survey responses demonstrate a clear concern for environmental areas due to tourism. Tourism factors were seen to impact flora and fauna more significantly than other areas. Furthermore, questions that addressed industrial actions and their impact on the environment were consistently rated as significant, posing serious concerns for the park that may be outside the park's ability to manage. This survey illustrates a few areas that parks may want to concentrate efforts on to mitigate impacts, including car exhaust, trampling, and going off trail, and littering.

There are a few limitations to this research. First, there are few quantitative measures for tracking environmental health over time. This is due to budget constraints and limits the ability to determine how tourism is impacting the area. Better funding for monitoring would lead to a better understanding of how tourism is physically impacting the environment, compared to perceptions of stakeholders. A second solution is an expansion of the Citizen Science program. This program allows volunteers, regardless of

their background in science, to engage in helpful data collection and park research. Expansion of this volunteer program would allow more data to be collected and would create stronger community ties.

The next limitation concerns the population of the survey. Most of the participants were older and a part of nonprofit organizations linked to the park. Future research would benefit by obtaining perceptions from a variety of park employees, from park rangers to maintenance workers, as well as people that live in the surrounding area. This would allow for a wider perception to be understood of the concerns that the Indiana Dunes faces. The COVID-19 pandemic also limits this paper, as many places were shut down and public beaches outside of the Dunes were closed, pushing more visitors to the park that may have not visited if not for the pandemic. Visitor rates due to designation compared to the COVID-19 pandemic are not able to be distinguished in this research, especially as the latest visitor rate was still during the pandemic. Across the National Park Service, visitor rates increased in 2021, which was attributed to the parks being able to be more available to visitors than in 2020 (“Annual Visitation Highlights”). Analyzing different parks before and after their designation that avoid the pandemic would be beneficial in ensuring that designation does increase tourism. It would also be helpful to conduct a short survey on tourists to ask why they are visiting the national park, if they had visited the park before national park designation and if they had heard about the Dunes before redesignation.

Finally, these results may not be generalizable as the Indiana Dunes is positioned in a unique area, close to steel plants and a major city, while other parks are more rural. Due to this, the Indiana Dunes faces environmental concerns related to the nearby steel mills, which most other parks do not relate to. Furthermore, this research was only on national park designation and did not consider other National Park Service units. Other

areas may have separate concerns. However, tourism is increasing at national parks across the US, and the concerns due to tourists may persist everywhere.

## Policy Implications

This research means to contribute to the conversation on conservation and environmental health in national parks, exploring if tourism and the environment have a sustainable relationship. In light of tourism posing serious concerns for environmental health, the federal government must consider policy recommendations that better achieve the intended purpose of national parks, for future generations to continue enjoying the beauty and wildness of nature. While the focus of national park designation has mainly been on tourism having positive effects on the local and national economies, the health of the environment plays a role in the continuation of this positive relationship. As former superintendent of Yellowstone, Dan Wenk describes “Our own species is having the greatest impact on the park and the quality of the experience is becoming a casualty.” (Simmonds et al., 2018). With a worsening environment, the National Park Service is going to have to consider better conservation methods to handle more park visitors and to protect the environment.

The best tourism management plan is not so clear cut. Should all national parks invest in a shuttle system and not allow most personal vehicles in as Zion National Park has done to limit car exhaust and overcrowding? Should the number of visitors be restricted to a calculated carrying capacity? Is it possible for parks to limit tourist waste? While this thesis cannot fully answer these questions, the findings highlight potential areas to focus on, including encouraging tourists to stay on trails, to not litter, and to be more vigilant about not bringing in nonnative and invasive species.

Solutions for tourism range in scale from increasing the number of trash cans and signs around the park to encourage better behavior, to a large-scale solution of strict limits on the number of cars allowed in the park. A start to improving tourism behavior is increasing the number of signs around the park, reminding tourists to stay on trails, how to safely watch wildlife, and warnings of what invasive species look like. Research has supported the use of signs to change tourists' behavior, but the language that the signs use to convey the message matters (Girasek, 2019; Allbrook & Quinn, 2020; Abrams, 2020). Using this research to inform future signs could help mitigate environmental concerns held due to tourism at a relatively low cost and easy implementation. Participants in the survey also noted potential solutions:

“I hope that the national parks receive increased funding so that they can be properly maintained and staffed for future enjoyment. I love the national parks in the US!”

“I would hope education would provide somewhat of a solution, but more important are a ranger presence and a ban on industry in the region. The recently constructed harbor in Porter has added to issues for the Dunes and park, ie, erosion and water quality.”

“The Indiana Dunes state and national parks are an extraordinarily diverse environment. At other national parks, like Yosemite, Zion, Bryce, Arches, etc., the number of visitors has been controlled because of the significant influx that was more than the parks could handle. If it's necessary to do this in the dunes area to preserve the plant and animal life and reduce pollution, it's time to consider doing that.”

Not all of these solutions are sensible in terms of the park's ability to enact them, such as banning nearby industrial activity. Most of these solutions would require an increase in funding – which could partially come from an entrance fee but would mainly need to come from Congress. Funding would allow for more education (posting signs around the park), paying for more park employees to monitor tourist activity, buying more trashcans for waste disposal, and other maintenance activities. It is possible for

this funding to occur, as national parks are a popular idea among the public, and Congress and President Biden have reflected this support in bills, such as the Great American Outdoors Act (2020). This act dedicates up to \$1.9 billion each year for the maintenance of national parks (Great American Outdoors Act, 2020). However, this is still not enough money for the parks to complete every management plan they wish for and gaining more funding would be challenging.

## **Conclusion**

This thesis has demonstrated that national park designation is related to an increase in tourism, and that stakeholders are concerned about the impact of tourist activities on environmental areas – with the main concern being for flora and fauna. This work has clarified the concerns of stakeholders and ensured their voices are heard. In addition to tourism, industrial activity is a significant concern for the Indiana Dunes National Park. This should be factored in when exploring management plans for the park, placing more emphasis on the need for a cooperative plan that goes beyond the park.

The COVID-19 pandemic has disrupted visitor predictions for the national parks and impedes on the ability to make conclusions for this paper. Research on how COVID-19 has impacted people visiting parks has found that people visited greenspace less (Heo et al., 2021). While some parks across the country had record-breaking visitors, many others saw sharp declines. This has made it unclear if the pandemic positively, or negatively, impacted the number of visitors to the Dunes. Future research would benefit evaluating rates for multiple parks before 2020 and many years beyond. Furthermore, following a same methodology on new parks would contribute to the understanding of

the relationship between national park designation, tourism, and environmental concerns.

It is crucial to consider the opinions of all stakeholders in the future as areas are considered for national park status. As the positives and negatives of park designation are weighed, the focus should be on what is best for the future health of the environment in the area. While this often means the strongest federal protection of the land is best, stakeholders have pointed out concerns from national park designation. Stakeholders can notice things that may be overlooked by officials and offer an impartial opinion. This research has demonstrated that stakeholders have many concerns for the environment based on tourists' activities, and these concerns should be a top priority in deciding future designation. Management plans should also be set to mitigate the effects of visitors before these activities lead to damage.

These concerns were not heard in the most recent national park designation of New River Gorge in West Virginia, where locals expressed concerns for insufficient amenities and the park not having enough money to solve these issues (Harold, 2021). In addition to traffic issues in the first year, the designation was linked to a jump in housing costs near the park (Starr, 2021). Clearly, the designation of national park is not only roses, but as serious social and environmental costs that need to be considered. The decision to designate an area to be a national park should be weighed heavily against if funds will be made available to offset negative impacts from tourism. Due to this, I do not believe that national park designation is the best option for every place. This does not mean that I think national parks should be dismissed completely – the designation does offer many benefits to an area, from economic revival to legal protection.

Discussion on future parks should better address stakeholder's concerns and be prepared for the influx of tourists that have damaging effects.

The involvement of stakeholders is crucial to answering questions on how to preserve the parks and continue to make them enjoyable to visit. This research should be expanded upon for all parks across the nation, especially as more national parks are created.

## Appendix A.

**Table 4. Concern for each environmental area.**

Area	Extremely Insignificant		Insignificant		Somewhat Significant		Significant		Extremely Significant		Mean
<b>Water</b>	10	0.147	20	0.294	20	0.294	12	0.176	6	0.088	2.764
<b>Air</b>	7	0.103	16	0.235	21	0.309	17	0.25	7	0.103	3.015
<b>Erosion</b>	6	0.087	10	0.145	19	0.275	23	0.333	11	0.159	3.333
<b>Flora</b>	2	0.029	17	0.25	17	0.25	15	0.221	17	0.25	3.412
<b>Fauna</b>	3	0.043	11	0.159	16	0.232	17	0.246	22	0.319	3.638

**Note.** This table shows the number of ratings for each option of each environmental area. The highest average concern due to tourism is shown for fauna. The second highest concern was for flora populations. Water concerns due to tourism have the lowest rating, leaning more towards being insignificant. This can be due to a variety of reasons, including that Lake Michigan is much larger than the portion contained within the park, and for their being industrious activities nearby that pose a greater threat than tourists.

**Table 5. Water Quality Factors**

Factor	Extremely Insignificant		Insignificant		Somewhat Significant		Significant		Extremely Significant		Mean
<b>Waste disposal</b>	2	0.029	17	0.250	17	0.250	17	0.250	15	0.221	3.382
<b>Industrial waste disposal</b>	0	0.000	2	0.030	2	0.030	12	0.179	51	0.761	4.662
<b>Boating</b>	3	0.044	10	0.147	26	0.382	19	0.279	10	0.147	3.338
<b>Fishing</b>	20	0.294	17	0.250	15	0.221	11	0.162	5	0.074	2.471
<b>Swimming</b>	9	0.132	19	0.279	11	0.162	19	0.279	10	0.147	3.029

**Note.** This table shows the number of ratings for each option of each factor that may impact water quality. The number of the left is the number of participants that rated it that number, and the number on the right is the percent. Unsurprisingly, industrial waste



disposal was rated as extremely significant by most participants. The nearby steel mills lead to great concern for the water quality due to dumping and algae blooms.

**Table 6. Air Factors**

<b>Factor</b>	<b>Extremely Insignificant</b>		<b>Insignificant</b>		<b>Somewhat Significant</b>		<b>Significant</b>		<b>Extremely Significant</b>		<b>Mean</b>
<b>Exhaust from cars</b>	6	0.087	11	0.159	14	0.203	16	0.232	22	0.319	3.536
<b>Smoke from campfires</b>	16	0.232	20	0.290	13	0.188	12	0.174	8	0.116	2.652
<b>Exhaust from generators</b>	11	0.159	22	0.319	12	0.174	13	0.188	11	0.159	2.870
<b>Exhaust from boats</b>	9	0.130	20	0.290	19	0.275	13	0.188	8	0.116	2.870
<b>Construction of tourism-related structures</b>	10	0.145	20	0.290	22	0.319	11	0.159	6	0.087	2.754

**Note.** This table shows the number of ratings for each option of each factor that may impact air quality. The number of the left is the number of participants that rated it that number, and the number on the right is the percent. Tourist activities that relate to air quality have fairly low concern. Exhaust from cars pose a significant concern, but construction, campfire smoke, and exhaust from generators and boats were not big concerns for participants.

**Table 7. Erosion Quality**

<b>Factor</b>	<b>Extremely Insignificant</b>		<b>Insignificant</b>		<b>Somewhat Significant</b>		<b>Significant</b>		<b>Extremely Significant</b>		<b>Mean</b>
<b>Trampling</b>	3	0.043	6	0.086	15	0.214	19	0.271	27	0.386	3.871
<b>Shortcutting and walking off trail</b>	1	0.014	3	0.043	15	0.214	13	0.186	38	0.543	4.200

<b>Pulling out, ripping, and collecting plants, rocks, and sticks</b>	8	0.116	9	0.130	19	0.275	7	0.101	26	0.377	3.493
<b>Construction of tourist facilities</b>	10	0.143	17	0.243	18	0.257	13	0.186	12	0.171	3.000
<b>Cars driving off road</b>	9	0.130	17	0.246	11	0.159	9	0.130	23	0.333	3.290
<b>Bikes riding off designated areas</b>	13	0.188	20	0.290	5	0.072	11	0.159	20	0.290	3.072
<b>Waste disposal</b>	16	0.232	10	0.145	8	0.116	7	0.101	28	0.406	3.304

**Note.** This table shows the number of ratings for each option of each factor that may impact erosion. The number of the left is the number of participants that rated it that number, and the number on the right is the percent. Shortcutting and walking off trail are a significant concern for the dunes and trails in Indiana Dunes National Park. This is a delicate ecosystem, so this is not a surprise.

**Table 8. Flora Quality**

<b>Factor</b>	<b>Extremely Insignificant</b>		<b>Insignificant</b>		<b>Somewhat Significant</b>		<b>Significant</b>		<b>Extremely Significant</b>		<b>Mean</b>
<b>Waste disposal</b>	6	0.088	14	0.206	16	0.235	16	0.235	16	0.235	3.324
<b>Industrial waste disposal</b>	2	0.029	5	0.072	15	0.217	13	0.188	34	0.493	4.043

<b>Introduction of nonnative and invasive species</b>	1	0.015	4	0.060	13	0.194	18	0.269	31	0.463	4.104
<b>Destruction of habitat</b>	0	0.000	6	0.088	10	0.147	13	0.191	39	0.574	4.250
<b>Fishing</b>	17	0.250	24	0.353	12	0.176	6	0.088	9	0.132	2.500
<b>Boating</b>	15	0.217	19	0.275	17	0.246	11	0.159	7	0.101	2.652
<b>Littering</b>	3	0.043	17	0.246	14	0.203	17	0.246	18	0.261	3.435
<b>Removal of shells or life-forms from the water</b>	19	0.275	11	0.159	12	0.174	15	0.217	12	0.174	2.855
<b>Changes in hydrologic regime</b>	5	0.074	8	0.118	12	0.176	21	0.309	22	0.324	3.691
<b>Erosion of dunes</b>	0	0.000	6	0.087	11	0.159	15	0.217	37	0.536	4.203
<b>Excessive sediment</b>	5	0.072	8	0.116	13	0.188	19	0.275	24	0.348	3.710

**Note.** This table shows the number of ratings for each option of each factor that may impact flora. The number of the left is the number of participants that rated it that number, and the number on the right is the percent. The activities that have the largest impact on flora populations are industrial waste disposal, introduction of nonnative and invasive species, and – most of all – destruction of habitat. Nonnative species can be brought in inadvertently, through tourists' clothing and shoes, cars, and boats.

**Table 9. Fauna Factors.**

<b>Factor</b>	<b>Extremely Insignificant</b>		<b>Insignificant</b>		<b>Somewhat Significant</b>		<b>Significant</b>		<b>Extremely Significant</b>		<b>Mean</b>
<b>Feeding fauna</b>	5	0.074	12	0.176	16	0.235	11	0.162	24	0.353	3.544
<b>Littering</b>	2	0.029	10	0.145	14	0.203	14	0.203	29	0.420	3.841
<b>Dogs in the park</b>	4	0.058	8	0.116	18	0.261	25	0.362	14	0.203	3.536
<b>Photography</b>	28	0.412	15	0.221	15	0.221	7	0.103	3	0.044	2.145
<b>Poaching</b>	14	0.203	13	0.188	11	0.159	13	0.188	18	0.261	3.116
<b>Development of roads and trails</b>	3	0.043	9	0.130	16	0.232	17	0.246	24	0.348	3.725
<b>Noise pollution</b>	2	0.029	8	0.118	16	0.235	21	0.309	21	0.309	3.750

**Note.** This table shows the number of ratings for each option of each factor that may impact fauna. The number of the left is the number of participants that rated it that number, and the number on the right is the percent. Participants expressed concern for noise pollution, development of roads and trails, and littering on fauna health.



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