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Assessment of potential environmental impacts of nature-based tours originating within Clark County, Nevada

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**ASSESSMENT OF POTENTIAL
ENVIRONMENTAL IMPACTS OF
NATURE-BASED TOURS
ORIGINATING WITHIN CLARK
COUNTY, NEVADA**

By

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A thesis submitted in partial fulfillment of the
requirements for the degree of

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ABSTRACT

ASSESSMENT OF POTENTIAL
ENVIRONMENTAL IMPACTS OF NATURE-
BASED TOURS ORIGINATING WITHIN CLARK
COUNTY, NEVADA

By Beth Domowicz

The purpose of this thesis was to assess the potential magnitude of negative environmental damage of nature-based tours originating in Clark County, Nevada. An ordinal ranking system was used for assessment of five variables. These variables were resource use, noise pollution, soil degradation, vegetation degradation, and wildlife disturbance. There were two proposed answers. The first was that as distance increased, negative tour impact would increase. This was not supported, since tours had high impacts for destinations that were close by and far away. The second was that most tours were not causing high damage to the environment. This hypothesis was supported; most tours had average ranks that were on the lower half of the value scale. The study was a first attempt to assess the nature-tour industry locally, and should be used as a baseline in future studies for measuring growth in the industry.

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INTRODUCTION

The purpose of this study was assessing the potential environmental impacts of nature-based tours originating within Clark County, Nevada. Tourism is a major component of the economy of Clark County. The Las Vegas Chamber of Commerce (2003a) announced that Las Vegas receives more than 35 million visitors per year. Many of these visitors are embarking on nature-based tours to locations in and around Clark County during their stay. No assessment of this industry or tour impacts on the environment has been done to date in this area. This study will begin the process of characterizing the nature-based tourism industry in Clark County, Nevada.

In the last few decades, there has been a change in traveler attitudes about the desirable aspects of a vacation destination. A study done by Weiner (1991) confirms that tourists have had an increased interest in nature travel. He found that in 1990 11.5 million U.S. citizens took trips with environmental themes. Many tourists are drawn to areas that offer some type of nature-based activities. This has caused natural areas to be included in marketing strategies for tourist destinations, including Clark County. The result is increased demand for nature-tours, which has led to an increase in the tours being offered.

Strong competition in the tourism industry leads to the marketing of all areas of potential interest to a tourist. Many information sources for tourists are promoting the natural areas in and around Clark County as attractions. The Las Vegas Chamber of Commerce (2003b) boasts that:

Away from the man-made excitement is a world of natural beauty unlike any other place on earth. Red Rock Canyon's unique rock formations are perfect for both the photographer and the rock climbing enthusiast. Mt. Charleston offers

hiking, skiing, and all the wonderful sensations of the High Sierras. Lake Mead is perfect if you're into water sports. The Grand Canyon, Valley of Fire, and Death Valley are all short hops from the Strip. (LVCC 2003)

The Nevada Commission on Tourism (2003) will send out a Nevada Visitors Guide packet or a Nevada Adventure Guide packet to anyone that requests them. Both packets emphasize natural areas as tourist attractions. The City of Las Vegas (2003) encourages visitors to enjoy the, "... enchanting panoramas in the Red Rock National Conservation area, Lake Mead National Recreation area and at Mount Charleston. All are only minutes from the Las Vegas Strip." As a result of this type of marketing and an increased interest in travel involving nature, there are a variety of nature-based tours being offered to visitors in the Clark County area.

Most tours being offered from Clark County are to areas which support desert ecosystems. According to the Desert Research Institute for the Center for Arid Land Environmental Management (2003), "...arid lands are among the most environmentally sensitive on Earth, and, with climatic changes and encroaching population centers, they are also being increasingly threatened." So, tours to desert areas have more potential to cause severe and longer lasting environmental damage than those to non-desert destinations. Even so, over-use of any area will result in major damage, as has occurred in the Grand Canyon National Park and elsewhere (Kenworthy, 1999; Rainey, 1999). Since desert areas are more sensitive, and some of the tours are to desert areas, it is important to assess the potential for damage caused by tours.

Assessing the potential for negative environmental impacts caused by nature-based tours originating in Clark County, Nevada is important for all of these reasons. Tourists worldwide are becoming more interested in nature travel. That has led to the

inclusion of outdoor spaces in the marketing of Clark County as a tourist destination. Since there is increased demand for tours to outdoor locations, there is an expected increase in nature-based tours and the operators that provide them. Increased tourism to these areas will likely cause negative environmental impacts. Negative impacts to these areas are even more likely due to the sensitivity of desert ecosystems. An assessment of the individual tours will determine what potential damage they may cause, and will serve as a tool for measuring growth in this industry in the future.

APPROACH

The central research question in this study was what is the potential magnitude of the negative environmental impacts of nature-based tours originating in Clark County, Nevada? I expected to find that the tours being currently offered are less damaging to destinations that are closer to the center of Las Vegas and more damaging to destinations that are further away because of the resources being used to travel to destination locations based on the inclusion of resource use as an impact variable (Giannecchini 1993, Zurick 1992). Overall, I expected the majority of the tours are not causing high environmental damage. This was based on the lack of concern about nature-based tourism by the local residents.

First, it is important to define the term nature-based tourism. It has been defined as tourism that makes use of natural areas with the intention of focusing on natural aspects of the area (Bjork 2000, Hemmi 1995, Valkama 1997). I used this definition to limit the study, because I included only tours that specifically mention the use of natural spaces for enjoyment. Tours to man-made attractions, such as Hoover Dam or the Las

Vegas “Strip” were not included, unless they also specified the enjoyment of a natural area.

To answer the research question, it was necessary to use several tools. An initial list of all or most of the companies giving nature-based tours in Clark County, Nevada will be compiled. Data concerning tours being offered will be collected from websites and brochures. The data was entered into Excel data tables and grouped according to location and tour type. Then the information was analyzed based on five variables that indicate possible potential negative environmental impacts, identified in the literature. Distance to each tour destination was obtained and used as a multiplier to calculate resource use, which was then assigned a rank value. The other variables were assigned rank values based on information from literature review. The resulting values were averaged for analysis.

By conducting research in this way, it was assumed that all tours listed on websites and brochures are being given with significant enough frequency and to a significant number of people that there was a potential for each of them to individually cause negative environmental impact.

Group tours were not included in the study for a similar reason. Companies that cater to large tour groups (i.e. 20 or more people traveling together) usually will tailor a tour to the needs of the individual group. So, the tour programs are not consistent. The tours are also not offered with any real frequency or consistency, since they are very dependant upon larger groups of people. So, information provided about tours on a website or in a brochure may not even be a good indicator of the tours being conducted.

For these reasons, tours being offered by companies that clearly cater to group type tours were not included in the study.

I only included tours that were being offered by tour operators. Tour operators are the actual companies that are responsible for providing the services for the tour (guide, equipment, etc.). Tour agencies will often offer packages that contain a single tour or combination of tours that will ultimately be given by the tour operator company. In an effort to not repeatedly count the same tour, if it was obvious that a company was merely selling packages or tours that were actually being given by another company, then those tours were not counted.

Only tours that are within a day trip from Clark County were included. This was because this study was seeking to assess tours that were being taken as part of a vacation trip to Las Vegas. The assumption was that if a tourist was on vacation and was visiting Las Vegas, then they will not want to take long trips to other locations. So the nature-based tours that these groups of people were taking are within a day trip of Las Vegas, or 24 hours round trip.

There are also companies that offer tours only in foreign languages, and these were unfortunately not included in the study. Tour operators that offer tours only in foreign languages usually cater to their clients, so often the brochures and websites are written in a foreign language. Because of this I was unable to interpret the information about tours being offered by those operators. If the website and brochure of a tour company were written in a foreign language then I did not include the tours in the study. But they should maybe be included in future studies.

The negative environmental impacts that were used as variables in this study were broken into two categories, general and site specific. General impacts were impacts that effect areas while traveling to destinations as well as the destination areas. The general impacts were resource use and noise pollution. Site specific impacts were impacts that were affecting, most specifically, the destination area. The site specific impacts were soil degradation, vegetation degradation, and wildlife disturbance. Although there are other variables that have been considered in earlier studies, these five were the most reoccurring and relevant in the literature for the purposes of this study (Giannecchini 1993, Vaughan 2000, Zurick 1992).

The use of resources was an important consideration when estimating environmental impacts. Several previous studies have taken this impact into consideration when assessing environmental impacts (Giannecchini 1993, Zurick 1992). For the purposes of this study, resource use was calculated by determining a estimated number of gallons of gasoline per person needed for a roundtrip tour to the destination location. This was calculated by using a formula that takes into account fuel efficiency for vehicle type, number of passengers that can fit into the vehicle, and miles roundtrip to destination.

Noise pollution has been a proven negative environmental impact. The United States Office of Science and Technology has determined that one of the five factors for figuring out the impact of noise was by calculating its negative effects on the ecosystem (Harvey et al. 1979). A study done by Mbaiwa (2003) attested to the negative effects of noise from boats and tour planes on wildlife populations, including nesting birds. Vaughan (2000) also included noise as having negative environmental impacts on

wildlife and biodiversity. For this study, noise pollution was ranked according to an estimate of the amount of noise produced by the different types of tours.

Soil degradation as a negative environmental impact has been well documented in the literature. Soil degradation, as an environmental impact, refers to erosion of trails (Vaughan 2000, Zurick 1992), soil compaction (Adams et al. 1982), and scarring (Goefl 2001). For this study, ranking values for soil degradation were estimated using the literature.

Another important environmental impact was degradation to vegetation. Vegetation degradation was established within the literature as a negative impact (Adams et al. 1982, Spellerberg 1998, Vaughan 2000, Zurick 1992). Braun and Fluckiger (1998) found that road pollutants have been shown to cause physiological stress on some plants and may make them more susceptible to pest attack. Damage to vegetation was estimated by the potential for the tour to directly or indirectly affect vegetation along its route.

The final impact being assessed was wildlife disturbance. Within the literature wildlife disturbance was listed as an important consideration for assessing impacts to an area (Giannecchini 1993, Vaughan 2000, Zurick 2003). Impacts to wildlife included takes, loss of habitat, introduction of exotic species, disruption of feeding habits, habitat fragmentation, and disturbances in breeding behaviors. For this study, wildlife disturbance was assigned ranks based on potential for any or all of these occurrences.

A ranking system was used for estimating potential negative environmental impacts. The use of a ranking system for scoring of data is supported within the literature (Smith et al. 1967, Thomas et al. 1993). For this study a ranking system consisting of

scores 1-5 (1 being the least damaging and 5 being the most damaging) was applied to each of the possible variables. A ranking system similar to this, because it assigned values to qualitative information, was used for assessing of visual impacts or traffic congestion levels for National Environmental Policy Act compliance. In this study, these scores were added for each tour with the highest possible score being 25 and the lowest possible score being 5. This ranking did allow for an estimated potential environmental impact for each tour and all combined.

METHODS

An initial list of companies was obtained through several methods. First, all companies listed under the “Tour” and “Tour Operators” sections of the January 2003 Sprint Yellow Pages, for the Las Vegas area code 702, was compiled into an initial list. The list contained the following information (if provided): company name, address, telephone number, and email address. Any listings that suggested that the business location was a bureau for tourists to find brochures were visited and brochures were collected. From these brochures, companies that appeared to be giving nature-based tours and that were located within Clark County were included in the initial list. Also, websites were investigated to see if information is available about permit holders for the natural areas that may be destination locations for tours from Clark County. If this information was available and those companies were located within Clark County, then they were also included in the initial list of companies. These sources were used to obtain the information used for compiling the initial list of businesses.

Next, I narrowed down the initial list. If a brochure was not obtained for the business, then information was collected from the businesses website. If there was no listing of a website for companies on the list, then the business was called to try to obtain the website address. During this process, businesses that were offering group tours or foreign language tours were excluded if it became apparent that this was the case without asking other questions. After this step was completed, the new list (which included web addresses) was then used as the working list of businesses.

A spreadsheet was created next, for inputting data that was retrieved. The table was created using the factors and possible values which are listed in Table 1. Next, the spreadsheet was completed through data collection. Each website was systematically visited and information relevant to the factors listed in Table 1 was entered into the spreadsheet. The same was done using the brochures that were collected. If any information was not provided, then the cell in the spreadsheet was left blank. This information can be found in Appendix A.

After the raw data spreadsheet was completed, another spreadsheet was created. The purpose of this spreadsheet was to assess the potential “General” environmental impacts of each tour individually. The variables for general impacts are resource use and noise pollution. Table 2 lists the factors that were used to determine a rank value for resource use for each tour.

Table 1. Factors and Possible Values For Creating Working Data Table		
FACTOR	POSSIBLE VALUES	COMMENT (MEANING OF VALUE)
# (Number Assigned for Research Purposes)	1A-29B	Each company was assigned a number value, the letter value is the tour value for that company.
Operator Name	Name of Business	Reference information
Tour Type	Airplane, ATV, Bike, Boat, Bus, Cruise, Helicopter, Hike, Horse, Hummer, Jeep, Jet-Ski, Kayak, Motorbike, Rafting, SUV (16)	Will show what activity is taking place, so a potential damage estimate can be made
Destination Location	Bryce Canyon, Colorado River, Death Valley, Desert Areas (NV), Grand Canyon, Lake Mead, Marysvale, Monument Valley, Mt. Charleston, Oatman, Red Rock, Sandy Valley, Yosemite, Valley of Fire, Various, Zion (16)	This value was determined by using the main focus destination of the tour. If the tour had no main focus it was designated as "various" and will then rely on duration information to make some calculations for the tour impacts. "Desert in Nevada" will also rely on duration information for making calculations.
(NM) (0)/ M (1) Non-motorized (NM) Motorized (M)	0 or 1	Tours were designated as motorized if the majority of the tour was spent on or in a motorized form of travel
On (0)/ Off (1)	0 or 1	Tours were designated as off-road only if that specific word was used in the description of the tour.
Freq. #/Wk.	Any real number value	Could be important for determining actual impact of a tour
Length (Hrs.)	0-24	Could help estimate resource use for tours that go to various locations
Description	Descriptive information about tour activities	Could help to make a determination about the potential impacts of the tour

Table 2. Calculating Rank Value for Resource Use		
FACTOR	POSSIBLE VALUES	COMMENTS (Meaning of Value)
Tour #	1A-29B	This value was used to identify the individual tours, it is the same value that was assigned earlier in the study
Vehicle to destination location	Airplane, Bus, Helicopter, Hummer, Jeep, SUV, Van	Determines a value for fuel efficiency, based on an estimate for the type of vehicle- if a vehicle was not given it will be assumed that van was used for passenger pick-up.
Corresponding fuel efficiency (miles/gallon)	Real number (A)	An estimated value for that type of vehicle based on literature research. All fuel efficiencies were rounded up to a whole number mpg.
Destination location	Bryce Canyon, Colorado River, Death Valley, Desert Areas (NV), Grand Canyon, Lake Mead, Marysvale, Monument Valley, Mt. Charleston, Oatman, Red Rock, Sandy Valley, Yosemite, Valley of Fire, Various, Zion (16)	This values were taken for the earlier spreadsheet
Estimated distance round trip to destination location (miles)	Black Canyon: 80 Bryce Canyon: 480 Colorado River: 80 Death Valley: 320 Desert Areas: 110 Grand Canyon: 456 Lake Mead: 60 Marysvale: 556 Monument Valley: 776 Mt. Charleston: 76 Oatman: 270 Red Rock: 34 Sandy Valley: 80 Yosemite: 740 Valley of Fire: 110 Various: 280 Willow Beach: 80 Zion: 312 (B)	These values were obtained from several sources and are estimations based on a starting point of McCarran Airport
Carrying capacity of vehicle	Real number (C)	These values were obtained from several sources (Greyhound 5/1/03, Grand Canyon Tour Company 5/1/03, prior knowledge in subject area), for airplane tours there are two different plane styles so an average capacity was calculated.
Equation (B/A/C)	B value/ A value/ C value	Fill in values from table for A, B, and C
Total (gallons/ person)	Equation=D	This is the estimated value for gallons of gas consumed per person for a round trip to destination location
Corresponding Rank	Possible Values 1-5 Highest Value (D): 57 1: 0-11.4 2: 11.4-22.8 3: 22.8-34.2 4: 34.2-45.6 5: 45.6-57	Take the highest value for D (which will be referred to as D) and divide by 5, then the ranks will be assigned as: 5= From D - (D /5) to D 4= From D - 2(D /5) to D - (D /5) 3= From D - 3(D /5) to D - 2(D /5) 2= From D - 4(D /5) to D - 3(D /5) 1= From 0 to D - 4(D /5)

Fuel efficiencies were obtained from several sources. For sport utility vehicles (20mpg) an average of the lowest and highest fuel economy in each class was used (Environmental Protection Agency 2003). The fuel economy for airplanes (.34 mpg) and buses (6.2mpg) came from studies done by the Center for Transportation Research, Argonne National Laboratory (1990's). The value for airplane fuel efficiency was also applied to helicopter tours (.34 mpg). Fuel efficiency for jeeps was determined to be 19 mpg (Automotive 2003). A value for Hummer fuel efficiency (12 mpg) was retrieved from a website (Green Concepts 2003). Passenger vans used for tours had a fuel efficiency of 8 mpg (Frampton pers. comm. 2003). All values for fuel efficiency were rounded up to the next whole number, the purpose of doing this was to allow for possible variances in makes and model year of vehicles used by operators. The values for fuel efficiency were used to calculate resource use. The calculations for resource use for all tours are in Appendix B.

Roundtrip distance to destination locations was estimated using Mapquest (2003) and the Nevada Visitor's Guide (2001-2002). Distances were calculated based on distance from McCarran Airport, located in Las Vegas. Distances for Willow Beach, and Black Canyon were given the same value as the one for Colorado River, since they are both located on the Colorado River. A distance for tours to "various" locations was calculated using an average time for all tours to this area (4 hours). This time was multiplied by a mph rate of 35, for a value of 280. Desert tours were given a distance equivalent to that of Valley of Fire, since no other information was available (i.e. duration, destination, etc.).

The carrying capacity was calculated based on the assumption that all vehicles were full for each tour. The carrying capacity of a vehicle is the number of adults that it will seat comfortably. The carrying capacity of passenger tour airplanes was obtained by calling two different companies. Based on these calls it was determined that there were two different airplane types that were used for tours (Grand Canyon Tours 2003, Scenic Airlines 2003). An average of the carrying capacity of the two airplane types is what was used for this study $((19+9)/2=14)$. Greyhound Bus Company provided information for bus carrying capacity (48). Hummer capacity was established to be 8 people and van capacity at 15 (Frampton pers. comm. 2003). A carrying capacity of 8 for SUVs and helicopters was assigned. Finally, a jeep capacity was set at 4 passengers.

To determine rank values (1-5) for possible noise pollution caused by tours, literature sources were consulted (Harvey et al. 1979, Mbaiwa 2003, Spellerberg, 1998). Motorized tours were ranked as the most damaging and were given a rank of 5, because they are consistently outputting noise on levels that can cause disturbance to people and organisms around them. Tour types given a rank of 4 were: airplane (Harvey et al. 1979) helicopters were lumped into this category, and boat (Mbaiwa 2003) tours. The ranks of 1-3 were assigned to non-motorized tours, and ranks were assigned based on the how fast moving the tour was (which is based on the assumption that slower tours cause higher impacts because they impact the same area for a longer amount of time). A rank of 3 was assigned to hiking tours. The rank of 2 was given to horse tours. The rank of 1 was given to bike, kayak and non-motorized raft tours.

Rank values (1-5) for potential soil degradation were assigned based on a review of the literature. A rank of 5 was given to all tours that were motorized off-road, because

these tours cause the most damage to soil (Adams et al. 1982). Horse tours were given the rank of 4, because the horse's hooves put divots into the soil crust and many horse tours go off the trail (Goefl 2001). Helicopter tours were also given a rating of 4 because during take off and landing the strong winds could cause a lot of soil disturbance. Hiking tours were given the rank of 3, because with the literature it has been shown that hiker's also put divots into the ground as they are hiking which is unnatural for the soil (Goefl 2001). A rank of 2 was assigned to biking tours, because bike tires impact a narrow strip of soil and do not divot the ground (Goefl 2001). Airplane, boat, and kayak tours were given a rank of 1 because they have a very low potential for impacting soil. All tours that were considered on-road and were motorized were given a rank of 1.

Potential impacts to vegetation resulting from tours were assigned ranks based on information from previous studies. Off-road tours had the most potential to cause damage to plants, so they were given a rank of 5 (Adams et al. 1982). Spellerberg (1998) goes in depth about on-road traffic causing damage to plant life, so this type of tour was assigned a rank of 4. Boat tours were also given a rank of 4 because they can cause a lot of potential harm to underwater vegetation. A study done by Hillery et al. (2001) lends information for assigning ranks of: 3 for horse tours, 2 for bike tours, and 1 for hike tours. Airplane and helicopter tours were given a rank of 2 because they have limited potential to cause harm to vegetation. Kayak and non-motorized raft tours were ranked 1.

Rankings assigned for potential wildlife disturbance impacts were based on the potential of the tour to threaten or disturb the habits of wildlife in the area. Off-road tours can greatly disturb or even kill animals and were therefore given a rank of 5 (Spellerberg

1998). On-road tours were assigned a rank of 4 (Spellerberg 1998). Boating tours were also assigned a rank of 4 because of the disturbance that they cause to nearby animals (Mbaiwa 2003). Horse tours were given a rank of 3 because they sometimes go off road and can therefore impact the habitats of many animals. Airplane and helicopter tours were given a rank of 2 because they could potentially harm animals in take-off or during flights. Bike tours were given a rank of 2 because they are fast moving and could injure or stress animals in the vicinity. Kayak and non-motorized raft tours were ranked 1 because the potential for disturbing wildlife while doing these activities is very low. Finally, Hike tours were given a rank of 1 because they cause some disturbance, but if hikers stay on the trails it will be minimal.

A summary of the ranking values for noise pollution, soil degradation, vegetation degradation, and wildlife disturbance can be seen in Table 3.

Rank Variable	1	2	3	4	5
Noise pollution	Bike Raft(NM) Kayak	Horse	Hike	Airplane (Harvey et al.1979) Helicopter Boat (Mbaiwa2003)	Motorized
Soil Degradation	Airplane Boat On- Road (Motorized) Kayak Raft(NM)	Bike (Goef2000)	Hike (Goef2000)	Helicopter Horse (Goef2000)	Off-Road (Adams et al. 1982)
Vegetation Degradation	Hike (Hillery et al.2000) Kayak Raft	Airplane Bike (Hillery et al.2000) Helicopter	Horse (Hillery et al.2000)	Boat On-Road (Motorized) (Spellerberg1998)	Off-Road (Adams et al.1982)
Wildlife Disturbance	Hike Kayak Raft	Airplane Bike Helicopter	Horse	Boat (Mbaiwa2003) On-Road (Motorized) (Spellerberg 1998)	Off-Road (Spellerberg1998)

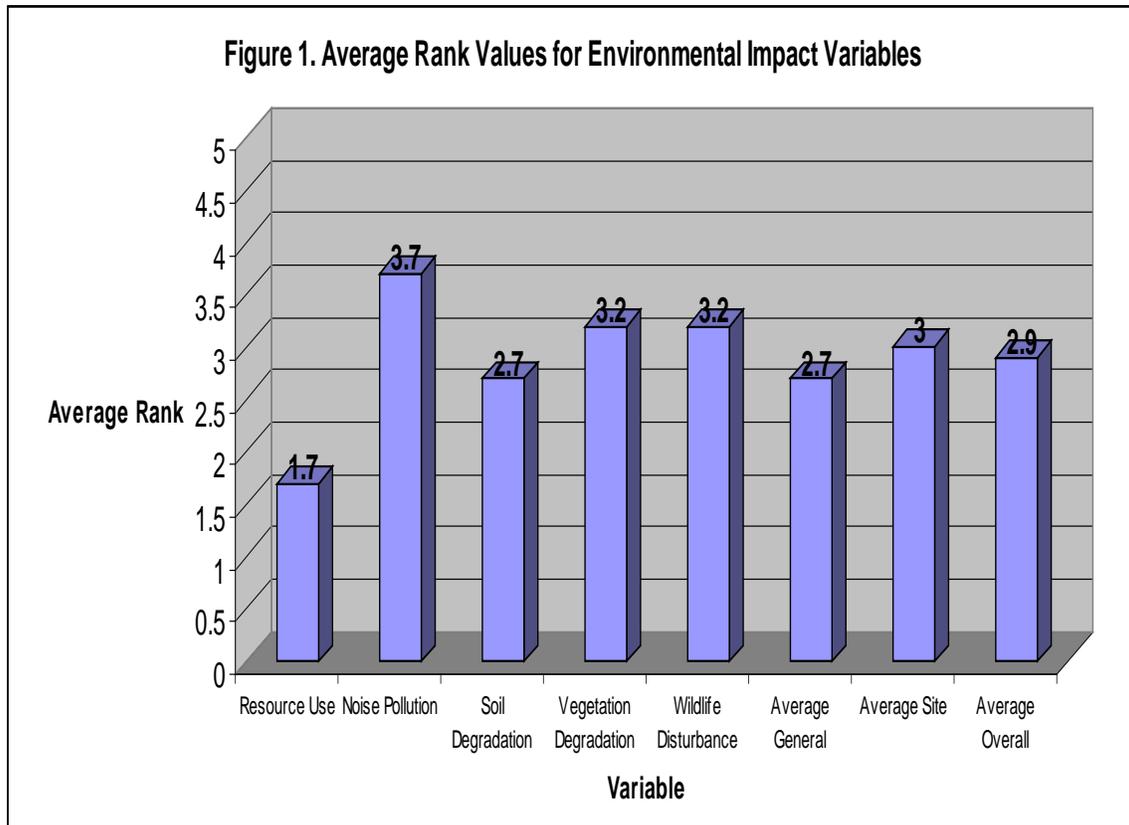
A rank for each tour in each of the five variable categories was determined according to Tables 2 and 3. These rank values were inserted for each tour into a spreadsheet that looks like Table 4.

Variable	General			Site Specific				Total General + Site Specific
	Resource Use	Noise Pollution	Total General	Soil Degradation	Vegetation Degradation	Wildlife Disturbance	Total Site Specific	
Rank Tour #								

Columns were added onto the end of the Table 4 for average general and average specific. These averages will be calculated by adding the ranks for the two general categories and divide by two, and adding the ranks for the three site specific and dividing by three. Averages were also calculated for each variable's ranking resource use, noise pollution, soil degradation, vegetation degradation, and wildlife disturbance. An average of all of the averages for average general and average specific were calculated and these numbers show up at the bottom of the columns.

RESULTS

The results of this study are all shown in Appendix C. A total of 111 tours were assessed for this study. The average overall rank of all tours was 2.9 out of 5. The average rank for general impacts was 2.7 out of 5. And the average rank for site specific impacts was 3.0 out of 5. Average values for all environmental impact variables used to estimate potential for negative environmental impacts are in Figure 1.



Resource use was lowest at an average rank of 1.7 out of 5. Noise pollution was the highest at 3.7 out of 5. The average for general (resource use and noise pollution) was 2.7. The average rank for site specific (soil degradation, vegetation degradation, and wildlife disturbance) was slightly higher at 3 out of 5. Since the value for resource use was so much lower, the values were graphed (Figure 2). Figure two shows that the values for resource use were either very high or very low. This is the reason that the average rank was only 1.7.

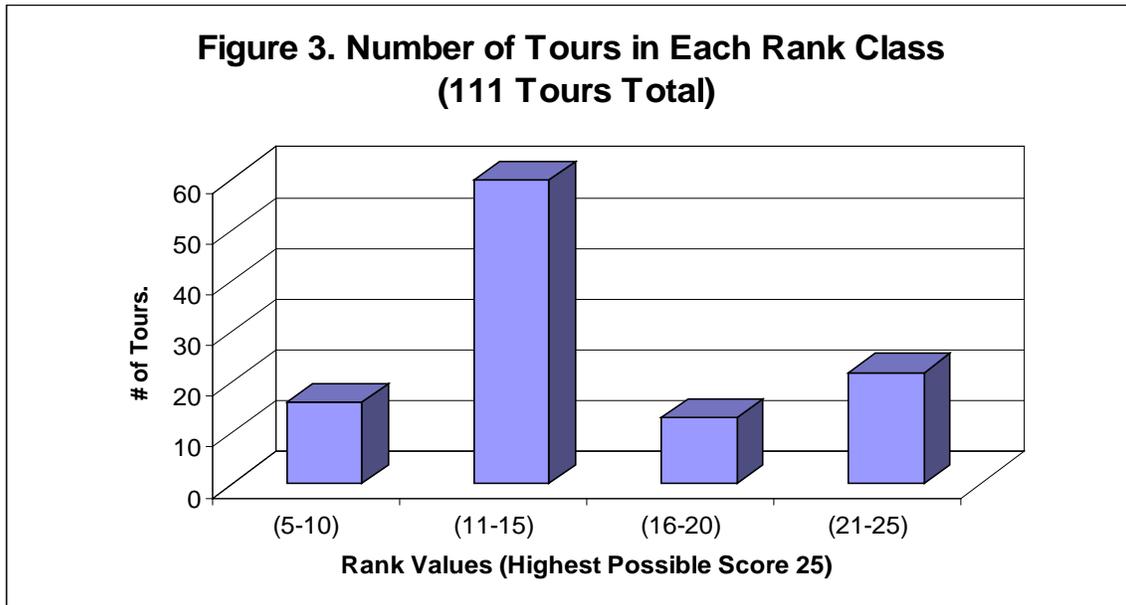
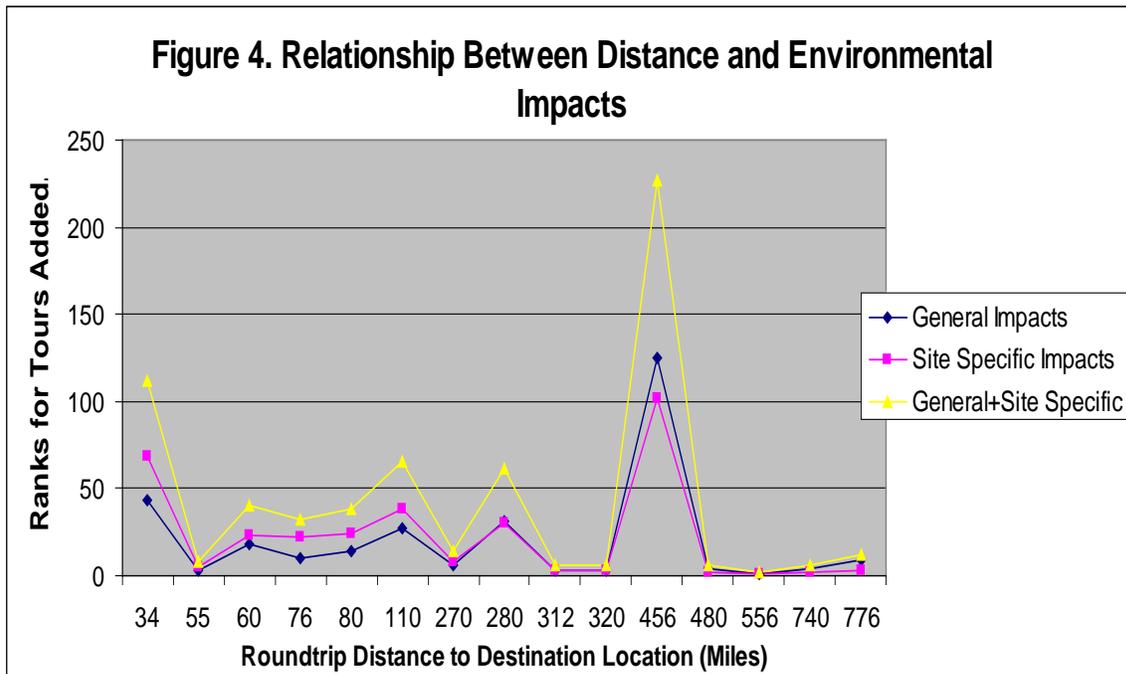


Figure 4 relates the overall ranks of all tours combined in all five categories to the destination distance.



DISCUSSION

The data did not support the first hypothesis. Which stated that as roundtrip distance increased, potential negative environmental impacts would also increase. Figure 4 shows that there were significant impacts at one of the higher roundtrip distances, but there were also significant impacts at the closest destination. So, this study shows that large impacts are occurring to the Grand Canyon which is more distant, but that significant impacts are also taking place at Red Rock Canyon which is the closest destination location; therefore there is no consistent relationship between distance and environmental impact. Some possible reasons for this are that resource use (the variable which incorporated roundtrip distance) was only one out of five total variables that were used. Another possible reason for this was that the values for resource use were either very high or very low (Figure 2). Since the ranks for this variable were evenly distributed, it may have caused an inaccurate representation of the “normal” scale for resource use.

The data supported the second hypothesis, that most tours would not have high overall negative impact levels. Figure 1 shows that none of the average ranks for the five variables were either 4 or 5 (the highest ranks). Figure 3 shows that the majority of tours scored on the mid to lower end of the scale, between 5 and 15 out of 25. Most of the tours were not highly damaging to the environment.

For this study, an ordinal ranking system was used to attempt to prioritize tours not to suggest real values. The researchers recognize that the environment is not impacted at a rate of 20% (5 ranks). It is also not to be assumed that a rank value for one variable is in any way equal to the potential impacts of a rank value for another variable.

This study was just a first attempt at assessing nature tour impacts for tours originating in Clark County.

For future studies, surveys are highly recommended as a tool for gathering information. Tour participants could be asked about their attitudes towards the tour's affects on the environment. Tour operators could be asked about their attitudes concerning ecotourism, environmental sustainability, and their environmental practices during tours. Park personnel could be asked about the damages that they are noticing, and their opinions about sustainability and the environmental practices of tour operators. This study should also be able to serve as a baseline for measuring growth in the nature tourism industry locally.

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