Natural Resources and Environmental Sciences Capstone Project

MARION COUNTY PARK AND LAKE USER SURVEY

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Introduction

The purpose of this project was to create a survey to collect data for use by Marion County Park and Lake. This data, with analysis, would provide information for the development of a lake management plan, which the Lake does not currently have. The primary objectives of the survey are to collect data on visitor and resident demographics, trip itinerary, and opinions on what the park and lake offer. Currently, Marion County Park and Lake only collect information from visitors who rent spaces or obtain camping or boating permits. These visitors fill out a paper form, which is kept at the lake office. For those camping, the paper form is eventually transferred to the county records. Depending on the purpose of their visit, the forms can include name, date, city visitors are coming from, number of nights camping, and type of boat. While useful, this method only captures a portion of residents and visitors participating in certain lake activities, and it does not cover all information necessary to create a lake management plan.

Background

Marion County Park and Lake, not to be confused with Marion Lake reservoir, is located in the western Flint Hills at 38.3198°N, 96.9853°W, approximately two miles southeast of the city of Marion (Figure 1). Marion County Park and Lake is a 300-acre county-owned park, 153 acres of which is a freshwater lake, which reaches depths of 40 feet. The lake is the drainage point for a watershed of over 4,000 acres, the HUC 8 Upper Cottonwood watershed. The Civilian Conservations Corps Black Veteran Company #4755 began construction of the lake and facilities in 1936. The dam was finished by the end of 1937, and the park officially opened in May of 1940 ("Marion County Park and Lake," n.d.).

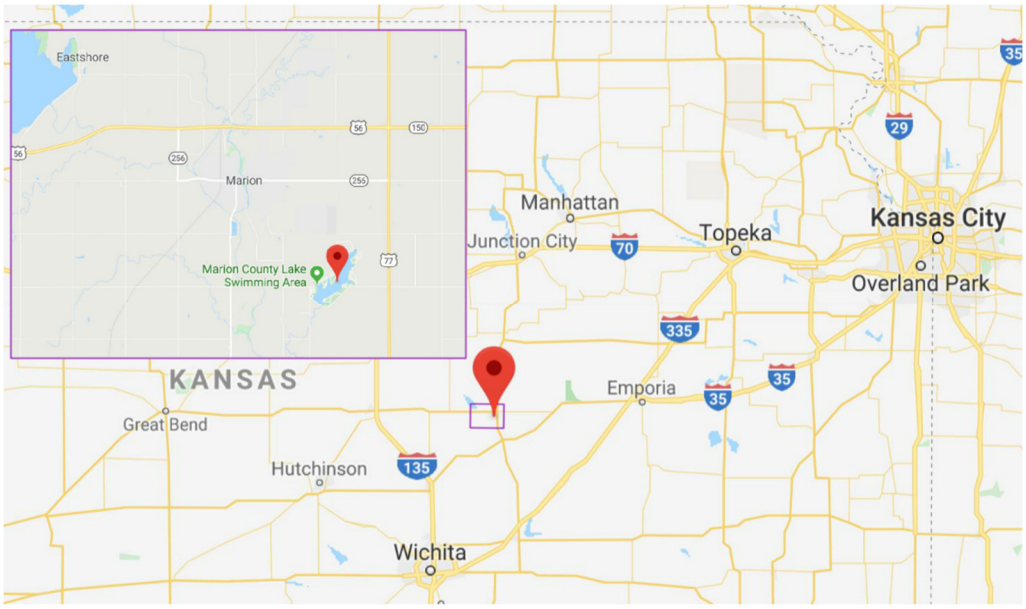

Figure 1: Map showing the location of Marion County Park and Lake. Marion Lake can be seen in the northwest corner.

The lake has a host of facilities and activities for residents and visitors alike. Entrance to the park is free, and around the lake is a four-mile paved road with many access points and five miles of trails. Marion County Park and Lake has 275 permanent residencies within its boundaries, as well as a large trailer park and camping facilities. The trailer park has permanent seasonal rentals, as well as a campground with picnic tables, fire rings, and optional electrical and water hookups. The park has two shelter houses with fireplaces/grills, an air-conditioned metal building with toilets and a kitchen that can be reserved for events, a dump station, and a shower and restroom facility for campers ("Marion County Park and Lake," n.d.).

The water recreation available at the lake are boating, fishing, and swimming. Boats used for fishing are not required to have a permit, as long as the boat does not have a wake-causing motor. Those used for other recreation, such as water skiing, must obtain appropriate permits. All boats are allowed but must be inspected by the lake superintendent before use on Marion County Lake in an effort to reduce the spread of invasive species. Boat storage is also available through private docks. Fishing, bow fishing, spear fishing, and bullfrogging are allowed 24 hours per day,

but anglers must obey all regulations and laws set by both Marion County Park and Lake and the Kansas Department of Wildlife and Parks. A heated dock is open to the public for winter fishing. Species in the lake include walleye, saugeye, crappie, bass, wipers, sunfish, bluegill, catfish, and drum. The lake was originally stocked with fish in 1940. Swimming is permitted from a 1,400 foot swimming beach during daylight hours, and scuba diving is allowed by certified divers in accordance with Marion County restrictions. The park also has summer nature programs, a concessions building with snacks and supplies, and a museum covering the history of the lake and area ("Marion County Park and Lake," n.d.).

Literature review

Algal blooms

Many lakes across the United States are affected by algal blooms and zebra mussels. Both algal blooms and zebra mussels can negatively affect the lake's ecosystems. The algal blooms can take up all the oxygen, resulting in the death of many other organisms, especially fish. The zebra mussels are an invasive species in many lakes across the United States, causing the lakes to have a reduction in biodiversity and resources.

Algal blooms are causing debates throughout science research over the effects they have over lake ecosystems. By definition, algal blooms are a rapid growth of microscopic algae or cyanobacteria in water, often resulting in a colored scum on the surface. Some algal blooms are not harmful to the lake ecosystem, while other algal blooms have harmful effects due to the toxins being produced, and the algal blooms taking up all the oxygen. Not only can the algal blooms have an effect on the ecosystem of the lake, such as the fish dying, the algal blooms can also affect humans at the lake.

With the long-term trends in agriculture practices, there has been an increase in nutrient flow, specifically phosphorus, that is entering the lake (Michalak et al., 2013). The increase of nutrient flow and a weak lake circulation is the perfect environment for the algal blooms to form. The research states that the impacts algal blooms have on people that are visiting or working at lakes include exposure to microcystins while participating in recreational activities at the lake (Hardy et al., 2016). Microcystins are toxins that are released from cyanobacteria or blue-green algae, the algae most commonly found in algal blooms. The articles have shown that these microcystins can affect people at the lake even if they are not going in the water (Backer et al., 2010). If people are on the water, possibly boating or fishing, or if they are near the water, on the shoreline, they can be affected by the inhalation of cynotoxins produced by the algae (Backer et al., 2010). However, the greatest impact the algal blooms can have on people is through participation in activities directly in the water, such as swimming. One study shows that if the water quality is low due to the increased amount of algal blooms, it can have a huge impact on the health of younger children, specifically infants (Jones, 2019).

While it is important to know about the possible health issues that coincide with algal blooms, it is also important to know about how the algal blooms impact recreational activities at the lake. Research has found that many people are unlikely to fish at lakes if there are high amounts of algal blooms on the lake. Anglers want to fish at a lake that is aesthetically pleasing and has a lower chance of unhealthy fish (Gill, Rowe, & Joshi, 2018). One question that needs to be answered beyond the research discussed is how to best educate people on the risks of algal blooms and the precautions to take. While finding ways to educate people, it is also important to think about the outreach methods and how people will be informed about possible health risks.

Zebra mussels are an invasive species originating in the Eastern hemisphere, that have made it over to the United States. They were introduced into the Great Lakes and have now spread throughout most of the United States.

The articles have shown the importance of restricting invasive species at lakes to maintain biodiversity, prevent economic loss, and reduce the impact to human health (Cole, Keller, & Garbach, 2016). The key to success for limiting the spread of this invasive species is by educating boaters on the importance of not spreading the zebra mussels the precautions to take to ensure the prevention of spreading. Along with limiting the spreading of zebra mussels, research shows that it can be challenging to remove invasive species. Removing the invasive species is crucial to the success of the native species in the lake, but if not managed correctly, many native species could be threatened (Vélez-Espino, McLaughlin, Jones, & Pratt, 2011). Research about the zebra mussels is mainly directed at the prevention of spreading invasive species, to maintain the diversity and resources, and how to remove this species. The research has agreed that the management of lakes depends on educating others on zebra mussels and what precautions should be taken. One question that still remains is if there are other invasive species that could affect lakes across the United States and how these invasive species change recreational activities.

Both algal blooms and zebra mussels can have negative impacts on a lake's ecosystem. However, with proper education and research, these negative impacts can be limited with the necessary precautions of a lake's management.

Traffic analysis

Parks face difficulty in implementing proactive traffic management strategies instead of focusing on reactive measures once problems arise. Traffic within parks is constantly evolving and growing faster than a vast number of park managers have been expecting and managers are now having to react to this new development (Chantre-Astaiza, 2019). National parks have been

growing in popularity, but the rate at which they are growing has been increasing exponentially. With the addition of gateways focusing the influx of visitors into key locations, management can identify and deal with it accordingly. Traffic management methods are also being put in place at these gateway locations to find what types of vehicles are being used throughout the park, how many vehicles per hour are in various locations, and how many people are in each vehicle. The range of detection methods have expanded greatly over the past decade with the use of infrared, magnetic, radar, pulse ultrasonic waves, and video (Gribbon, 1998). Developing these detection devices in a non-intrusive way into our parks can help identify problems, who is using these parks, what needs to be changed, and give ideas for future developments in the park.

With the problems that arise in the parks, we also have problems and benefits that arise in local communities. Pros and cons form from the addition of mass traffic related to the opening or operation of a nearby national or state park. Communities can have differing perspectives on how this influx of traffic affects them. Some cases of poor and struggling neighborhoods have been revitalized with this new influx of visitors. Many residents of these communities have been able to find work and have been able to get involved in more recreational opportunities (Golzardi, 2012). This can lead to a healthier lifestyle and a more comfortable standard of living due to an increase in income and wellbeing. With the several positives that can come from this there also comes negatives. Due to this influx of visitors and traffic, many residents complained about the additional noises, the increase in pollution from vehicles, and congestion on major roadways (Andereck & Vogt, 2000). As a park manager, the goal is to separate these issues from one another with the intent of the positives greatly outweighing the negatives, if not getting rid of the negatives all together. This is an ever increasingly challenging task to accomplish as the effects from traffic, and the amount of traffic, is constantly changing. As cars make the slow transition to an electric engine this may result in a decrease in pollution problems, but it may see an increase in issues elsewhere.

This is an example of an unknown that managers must adapt and react to (Regnerus, Beunen, & Jaarsma, 2007).

Surveys

When it comes to creating a survey, questions should be carefully selected and worded to clearly convey what is being asked. Most visitor surveys aim to collect basic demographic data as well as more specific information relevant to the situation. Demographic questions are generally agreed upon between authors, and often include age, gender, group status (family, friends, etc.), household income, and education (East, Osborne, Kemp, & Woodfine, 2017; Newmark, 2014; Wolf, Hagenloh, & Croft, 2012). Survey questions included for specific situations covered things like duration of stay, activities being partaken in, and preferred activities (Newmark, 2014; Wolf et al., 2012), or questions encompassing travel plans and economic status related to travel (Hallo et al., 2012; Song, Lupi, & Kaplowitz, 2010).

Visitors

With visitor travel surveys, an important distinction that must be made is who is a visitor and who is not. Newmark (2014) divides people into residents (if they exceed a given amount of time in the location), visitors (if they stay between one day and a designated upper-limit), and day-trippers (who stay for less than one day, but may also be considered a visitor), and additionally says that the purpose of someone's visit can classify them as a visitor. On the other hand, Wolf (2012) considered everyone a visitor as the study was conducted between and within two national parks, but divided visitors into two groups; passing and stopping. Stopping visitors stopped only temporarily and did not camp, while passing visitors stayed overnight. Cessford (2003) acknowledged that distinguishing visitors from residents is a challenge, especially in residential areas, but did not provide a solution. After establishing the audience, the next set of questions determine what the survey is looking for. In a lake use study, the questions should be directed at

how the audience is using or would like to use the lake (Brown, 2006).

Distribution

The method used to distribute surveys can have an impact on the response rate and user demographics. Agrawal (2017) conducted a study on the quality of data received from self-reporting paper surveys, interviewer-assisted tablet-based surveys, and self-reporting online surveys targeting passengers on buses. His findings are that paper surveys had the highest response rate at 59%, followed by tablet at 39% and online at only 6%. In contrast, the online survey conducted by Moyle (2017) had a much higher response rate of 74% with 1,341 surveys sent. Of the literature viewed, surveys distributed electronically received fewer responses (Brown, 2006; Sirakaya, Sasidharan, & Sönmez, 1999). Electronic distribution can be less time-intensive for those administering the survey by eliminating the need for presence at the site of the study. This, however, can affect the response rate. For residential areas, surveys can be physically or electronically mailed to residential recipients. This works in a residential area where contact information is already known for the sample the survey is intended to reach (Song, Lupi, & Kaplowitz, 2010).

Overall, visitor data was collected at varying lengths of time. East (2017) collected data over a period of 51 days, Wolf (2012) monitored sites in 2006 and 2007 between the months of July and December, Douglas (2001) collected traffic data from November 1999 to June 2000, Simpson (2018) collected traffic data for a total of 61 days during June and July 2016, Orsi (2013) used image data taken between 2000 to 2011, and Arnberger (2005) used data collected from September 1, 1998 through August 31, 1999.

Mechanical trackers

The East (2017) study combined the use of GPS and in-person surveys to examine correlations between visitor demographics and behavior when at a zoo. The Wolf (2012) study

looked at four different visitor-monitoring techniques including direct human observations, assessment of proxy variables, GPS, and in-person interviews to gather data about tourist travel patterns along hiking trails. The two studies agree that using GPS to track visitor movement provides detailed and numerous data that, when paired with demographic information, can provide insight into how different groups interact with the same experience. For example, the zoo study found that higher income groups spent less time looking at the animals, while lower income groups spent more time at fewer exhibits. In this case, using complementary data collection methods allowed for a deeper and more accurate understanding of visitor behavior.

Douglas (2001) and Simpson (2018) used traffic monitoring devices to collect visitor data, and Cessford (2003) provided suggestions for this method. Douglas (2001) and Simpson (2018) both used traffic data to help conduct creel surveys that were more representative of the actual population and note that direct contact methods are most frequently used in these type of angler surveys. The goal of both studies was to find when this population is most active, to provide information about when the on-site survey should be deployed. Douglas (2001) used "Trafficorder" tubes that detect vehicles when the air is compressed, and can classify speed, type of vehicle, direction of travel, as well as the date and time. Simpson (2018) used the "Trafx" system, which registers vehicles based on a change in electromagnetic field. The Trafx method requires more calibration and provides less data than Trafficorder tubes. One difference between these studies that creates a challenge discussed by Cessford (2003) are the number of entries to the fishing area. The lake used in the Douglas (2001) study only has one entrance, while the lake in the Simpson (2018) study has more than one access point. Cessford (2013) commented that traffic counters should be placed on key access roads, and that these locations must be identified in order to collect data that is representative of the entire lake or park system.

Arnberger (2005) and Simpson (2018) utilized video and photo, respectively, to collect

visitor data. The Arnberger (2005) study compared the use of human observers with video recording in a national park to determine the benefits and drawbacks of each. Time-lapse video cameras were placed at five popular access points and took images every 1.6 seconds from sunrise to sunset, while human observers were placed at the same five locations and took observations from 8am to 7pm. Four days-worth of observations were used for comparison, and data collected included number of people in a group, direction of movement, user type, time, and number of leashed and unleashed dogs. Due to the ability to pause and rewind videos the time-lapse was more effective for collecting visitor data, especially during periods of high use and for fast activities. Simpson (2018) conducted a similar study, using vehicle counters verified by photos taken by trail cameras. Both of these studies used one method to verify or test the accuracy of another method, finding that mechanical methods provide reliable data.

Orsi (2013) conducted a study that used a combination of geotagged photos and GIS to estimate visitor flow in the Dolomites in Italy, the most complex method reviewed. Using GIS, a "gravity model" was created that estimated the number of people using the area based on parameters such as surrounding population and accessibility. Google Earth Panoramio was used to collect images geotagged in the Dolomites, which were individually reviewed to ensure the tagged location was accurate. The combination of the GIS and image data allowed investigators to quickly estimate visitor flows in a large area without conducting any field work. This method is dissimilar and more technology-heavy than the other methods explored.

Combining observations made by GPS, video, photo, and traffic counting devices with in-person or online surveys may be useful to associate demographic data with visitor movements and activities and can provide more detailed information.

Travel cost

Recreational areas have both use and non-use value. The use value of a reservoir could be hydroelectric power production, while non-use value is tranquility and view. It can be difficult to obtain a valuation of recreation areas based on non-use or non-market value, but one method of doing so is the travel cost method. Travel cost valuation can indicate comparative visitor preference. It can also provide a value for what a manager could reasonably expect to spend on maintenance and development of the lake based on the non-market value assigned. The travel cost method often uses concentric circles around the selected destination in order to assign levels of engagement (Wilton & Menz, 1983). The assumption under the travel cost method is that those within the farthest concentric circles, those who travel the farthest to reach the destination, value the destination more (Jackson & Herath, 1994). Those visitors within the smallest circle, closest to the destination, are assumed to value the destination comparatively less than those visitors traveling from the larger, farther circles.

Using travel-focused survey questions, mathematical equations can be applied to determine relative cost and valuation by the users. To better determine the valuation by users of the destination, consumer surplus can be calculated. The consumer surplus reveals the value above, or in addition to, the actual cost of travel (Sohngen, Lichtkoppler, & Bielen, 1999).

Methodology

To help understand the daily activities people participate in at Marion County Lake, we are collecting background data on the usage of the lake and will have visitors and residents of the lake complete a survey. The background data shows how long people are staying at the lake, how often they use lake facilities, a description of their boat, and where they are traveling from. The information collected helps provide a foundation for directing the questions needed on the survey, what information we still want to know and what questions are not being asked that are helpful for

the creation of an effective lake management plan. The survey includes questions about lake visits, the usage of the lake, and the demographics of visitors. Both the background data and the survey provide data for Marion County Lake to maintain a lake their visitors and residents want to return to each year.

Survey

To develop this survey, we determined what activities visitors and residents were participating in at the lake. We needed to find what was popular among users and what lacked in activity. By doing so, we can find which resources the lake should provide funding for, and what could be considered a misuse of resources if the activity is expensive to maintain and lacks use. Through our survey, we looked at sighting seeing, swimming, fishing, boating, camping, space rental, disc golf, and RC plane usage. We wanted both resident and visitor input on what they rank most important to their time at the lake.

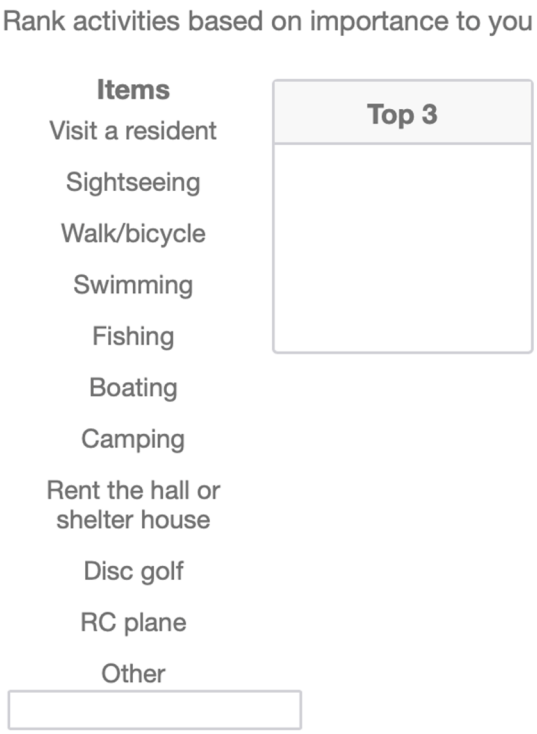

Figure 2: One survey question asks participants to rank their top three activities through a click-and-drag format.

To find more detail as to who was participating in each of the activities, we also set up a demographic section of our survey. In this section we ask participants about their gender, age, party size, relationship to others in the party, vehicle type, and how many times they have been to the lake. Demographics are important because they can drastically change how an activity is catered to. Determining if people are coming to the lake once, and only once, can be a drastic difference compared with if the lake is seeing large numbers of repeat visitors for a particular reason. One demographic question asks participants to select on a map where they are visiting from. This question shows the distance visitors are traveling to the lake, as well as where the majority of visitors are coming from.

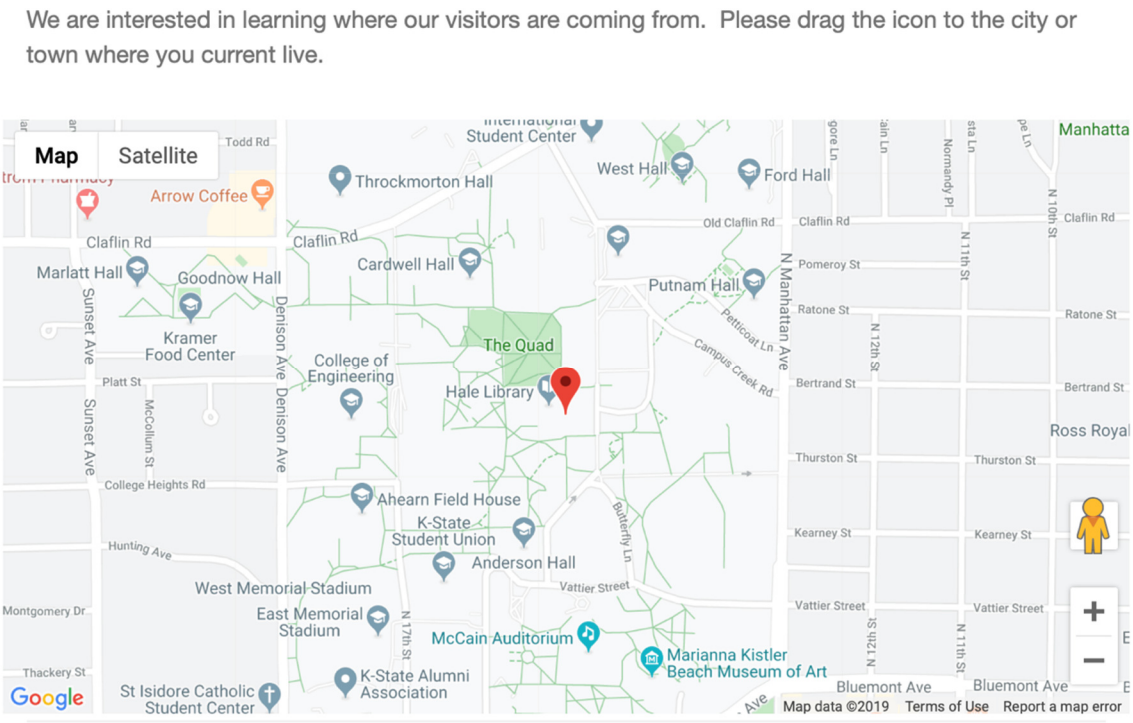

Figure 3: JavaScript embedded in this survey question allows visitors to select their exact home location on a map.

Finding the pros that the lake has to offer and also the cons that may be driving people away can only benefit the future of the lake. We believe these two aspects of visitor use and

demographics are key components to finding what is important for management to develop at the lake. This survey is currently being developed in the fall of 2019 with the intention of it being put in place in the summer of 2020 at the lake as a kiosk inside the lake office building. This survey will be deployed through the Qualtrics platform at a kiosk in the information center, as well as sent to residents through mail as either a physical copy, or directions on how to take the survey online.

Another section of the survey asks participants about policy issues facing the lake. The lake managers must decide how to handle certain key issues, and by surveying residents and visitors, a majority opinion can be determined. This majority opinion can be used to guide lake management policy. The issues we put in the survey are regarding policy on allowing geese to stay at the lake, the removal of dead or fallen trees, the hours boats can cause wakes, and how algal blooms affect visitors.

Documented Usage

User information has been collected for certain activities at the lake for years. The analysis of this data guided necessary survey questions and reflected the current usage of the activities that were recorded. Recorded activities were camping and boating. For boating, records were made of each boat entering the water at the lake. Boat type and registration were recorded, revealing the number and type of boats brought by visitors to the lake over a period of years. Those camping or renting a space also have records. These records reflect the space used, the length of time and the amount of money spent at the lake. The money is collected through camping fees and hall rentals.

The records have historically been collected on paper, and no analysis had previously been done on the records. The lake superintendent, Isaac Hett, entered the paper records into a Google spreadsheet. We developed a code that graphs this data from the spreadsheet. As part of the code, the graph results are updated automatically as more information is entered in the spreadsheet. This allows the results to update continuously with the additional information.

Results

Through data sets gathered by Hett, we viewed records of who has visited the lake to rent a space or obtain a permit in September 2019 and October 2019. We found that 69.4% of paying visitors use electricity when they visit, 8.3% of people use boat storage, 8.3% rent the hall that is available on site, 4.1% use cable, and 2.5% rent one of two on-site shelter houses.

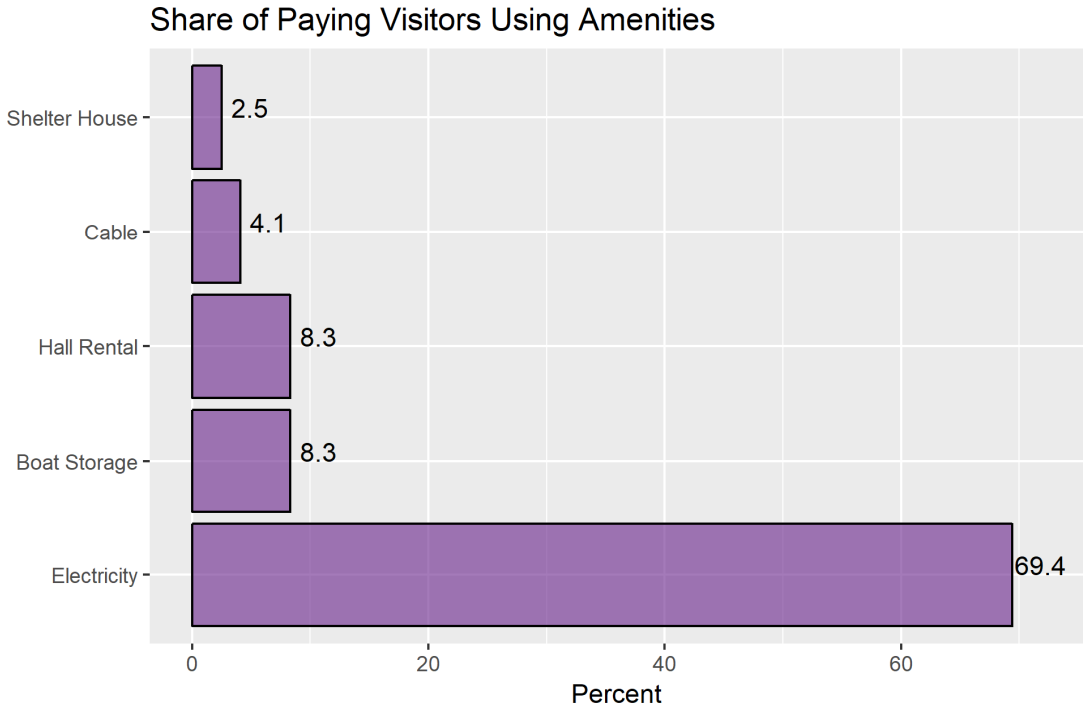

Figure 4: Chart shows percentage of visitors that pay for the available amenities.

Typically, visitors will spend an average of one to three nights at the lake with the most common amount of time being two days. The visitation spikes on weekends in September and October. We expect to see the trends change throughout the seasons with the addition of more data.

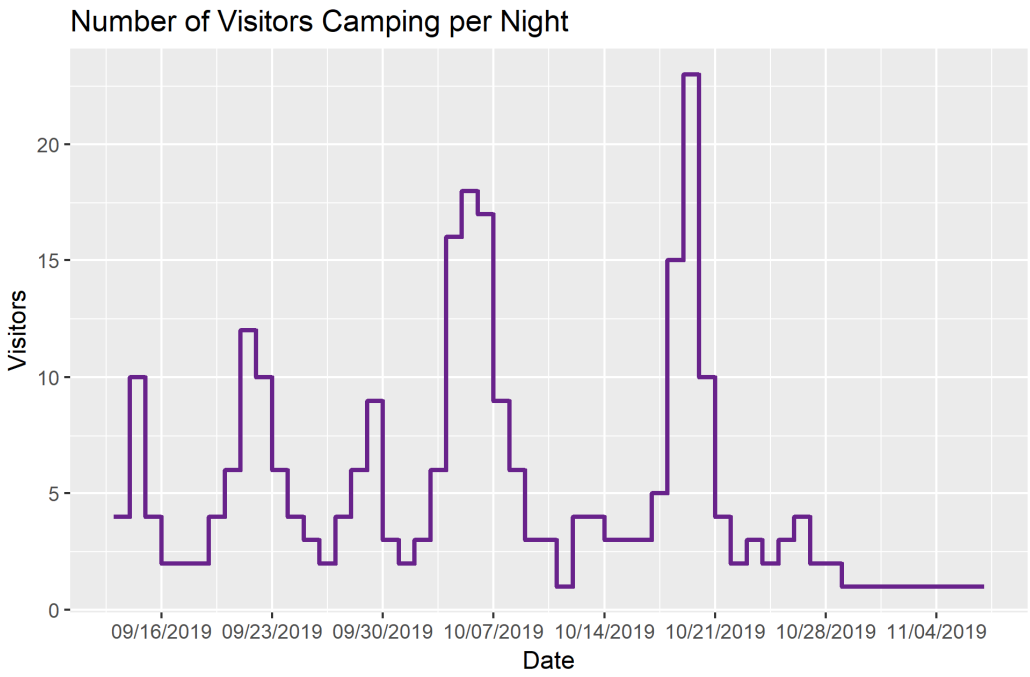

Figure 5: Spikes in this chart show peak camping times in September and October.

The records also showed the amount of money visitors pay while visiting the lake. The most common amount spent was $25, with a standard deviation of $15. According to Hett, the amount the lake charges for camping is lower than most.

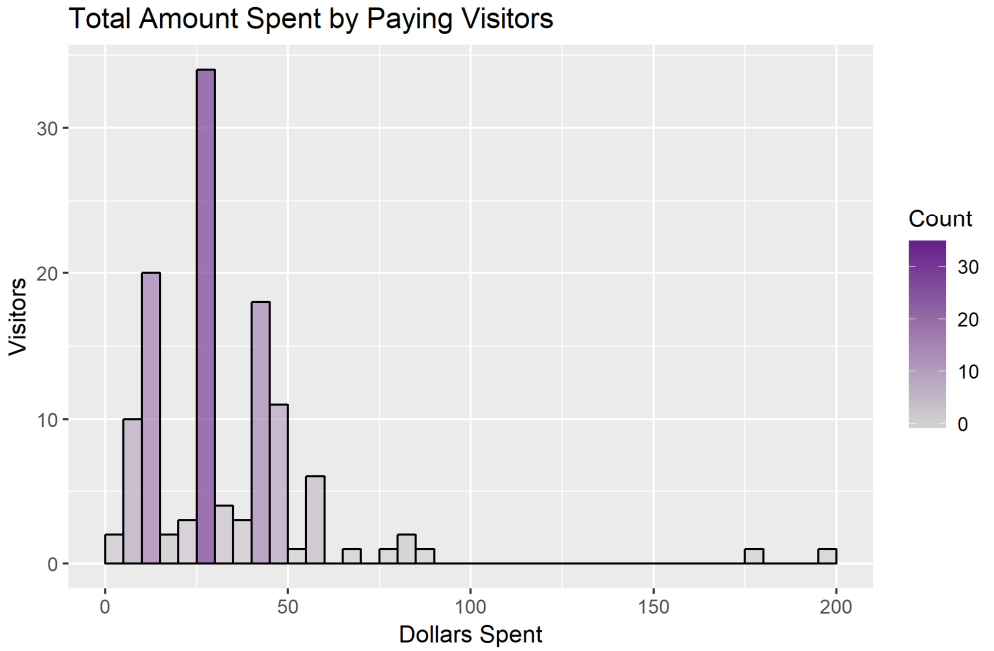

Figure 6: Chart showing the amount of money spent by visitors per visit.

We found that a majority (97.5%) of paying visitors are from Kansas. Of the visitors from within the state of Kansas, only 24% are from the nearby city of Marion. Using R, a data manipulation, coding and graphical display software, the location of each visitor's home was mapped, showing each location with higher density at the locations from which more visitors are coming. With the data collected so far, our data found that a majority of users are traveling from the city of Marion followed by the city of Wichita. The remaining visitors range from several locations around Kansas that centralize around Marion County Lake. This data indicates how far people are willing to travel to visit the lake and where most visitors are traveling from.

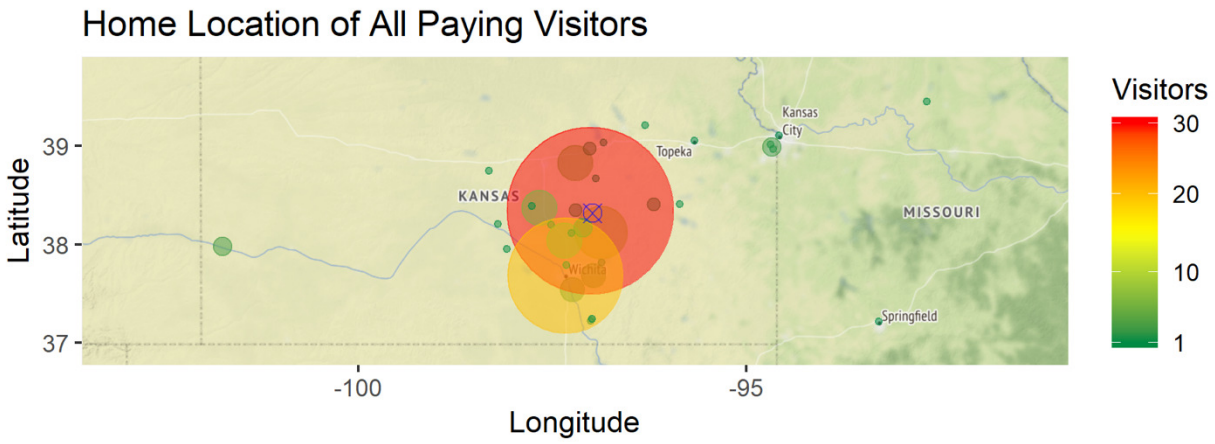

Figure 7: Map showing density of visitors traveling from home cities.

Conclusion

An effective lake management program stems from the wants and needs of the visitors and residents of a lake. By collecting and analyzing data from past, current, and future visitors, the lake will have a comprehensive package of visitor demographics and users. Surveying visitors in recreational settings is challenging for a variety of reasons, including their short duration of stay, multiple points of entry, and difficulty in contacting them. Even so, those engaging with the park

and lake provide vital information that is necessary for creating a successful management plan. This survey project will help Marion County Park and Lake management better understand who is using their facilities and how they are being used, including where visitors are traveling from, peak times, days, and months of activity, which activities are most popular, what visitors value in a lake, and how camping areas are being utilized.

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Appendix A: Marion County Lake User Survey

Survey Flow

Block: Introduction (2 Questions)
Standard: Lake Visit (11 Questions)
Standard: Lake use (7 Questions)
Standard: Demographics (11 Questions)
Standard: Policy questions (7 Questions)

Page Break

Start of Block: Introduction

Q1 This survey will collect information on how you are using Marion County Lake and how you would like the lake to be used. The results from this survey will be used to create a lake management plan to better serve our visitors. No personally identifying information will be collected. Your information will be kept confidential.

Q2 Would you like to participate in this survey?

- ○ Yes, I would like to continue with the Marion Lake User Survey (1)
- ○ No, I would not like to participate. [Selecting this option will end the survey] (2)

Skip To: End of Survey If Would you like to participate in this survey? = No, I would not like to participate. [Selecting this option will end the survey]

End of Block: Introduction

Start of Block: Lake Visit

Q10 In this section, we ask that you answer some questions about your current lake visit.

Are you a resident or trailer owner at Marion County Lake?

- ○ Yes (1)
- ○ No (2)

Skip To: End of Block If Are you a resident or trailer owner at Marion County Lake? = Yes

Display This Question:

If Are you a resident or trailer owner at Marion County Lake? = Yes

Q36 Is the lake your main residence?

- Yes (1)
- No (2)

Q11 What day did you arrive at the lake? Enter the date in (mm/dd/yyyy)

_____

Q12 Select the time you arrived at the lake

- Morning, before noon (1)
- Afternoon, noon to 5:00 p.m. (2)
- Evening, after 5:00 p.m. (3)

Q13 What day are you planning to leave the lake? Enter date in (mm/dd/yyyy)

_____

Q37 Select the time you plan to leave the lake

- Morning, before noon (1)
- Afternoon, noon to 5:00 p.m. (2)
- Evening, after 5:00 p.m. (3)

Q16 If you are staying overnight, are you camping or staying with a resident of the lake?

- Camping (1)
- Resident's Home (2)
- Not staying overnight (3)

Skip To: End of Block If If you are staying overnight, are you camping or staying with a resident of the lake? = Not staying overnight

Skip To: End of Block If If you are staying overnight, are you camping or staying with a resident of the lake? = Resident's Home

Q17 On this visit, my party is staying in... (select all that apply)

- [ ] RV/Camper (WITH electric hookups) (1)
- [ ] RV/Camper (WITHOUT electric hookups) (2)
- [ ] Tent (3)
- [ ] Other, please specify (4) _____

Q23 Is this your first visit to Marion County Lake?

- ○ Yes (1)
- ○ No (2)

Display This Question:

If Is this your first visit to Marion County Lake? = No

Q21 On average, how many times per year do you visit the lake? (enter numerically)

_____

End of Block: Lake Visit

Start of Block: Lake use

Q20 What activities will you participate in during your current visit?

- ☐ Visit a resident (1)
- ☐ Sightseeing (2)
- ☐ Walk/bicycle (3)
- ☐ Swimming (4)
- ☐ Fishing (5)
- ☐ Boating (6)
- ☐ Camping (7)
- ☐ Rent the hall or shelter house (8)
- ☐ Disc golf (9)
- ☐ RC plane (10)
- ☐ Other (11) _____

Display This Question:

If Is this your first visit to Marion County Lake? = No

Q21 What activities have you participated in during previous lake visits?

- ☐ Visit a resident (1)
- ☐ Sightseeing (2)
- ☐ Walk/bicycle (3)
- ☐ Swimming (4)
- ☐ Fishing (5)
- ☐ Boating (6)
- ☐ Camping (7)
- ☐ Rent the hall or shelter house (8)
- ☐ Disc golf (9)
- ☐ RC plane (10)
- ☐ Other (11) _____

Q24 Rank activities based on importance to you

	Top 3
_____ Visit a resident (1)	
_____ Sightseeing (2)	
_____ Walk/bicycle (3)	
_____ Swimming (4)	
_____ Fishing (5)	

_____ Boating (6)

_____ Camping (7)

_____ Rent the hall or shelter house (8)

_____ Disc golf (9)

_____ RC plane (10)

_____ Other (11)

Q25 What do you value when selecting a lake to visit?

- [ ] Convenience of location (1)
- [ ] Variety of activities (2)
- [ ] Care of facilities (3)
- [ ] Family atmosphere (4)
- [ ] Safety (5)
- [ ] Aesthetics (7)
- [ ] Cost of amenities (12)
- [ ] Other (13)

Q27 How does this lake compare with others you have visited?

- ○ This lake is worse than others I have visited (1)
- ○ This lake is the same as others I have visited (2)
- ○ This lake is better than others I have visited (3)
- ○ I have not visited any other lakes (4)

Q28 How did you hear about Marion County Lake?

_____

Display This Question:

If Are you a resident or trailer owner at Marion County Lake? = No

Q29 Was visiting the lake the main purpose of your travel?

- ○ Yes (1)
- ○ No (2)
- ○ No, but it was planned into the trip (3)

End of Block: Lake use

Start of Block: Demographics

Q5 In this section, we will ask some demographic questions to better understand how visitors are using Marion County Lake.

Display This Question:

If Are you a resident or trailer owner at Marion County Lake? = No

JS

HomeLoc We are interested in learning where our visitors are coming from. Please drag the icon to the city or town where you current live.

_____

Gender What is your gender?

- ○ Male (1)
- ○ Female (2)
- ○ Prefer not to answer (3)

Q32 What year were you born?

_____

Display This Question:

If Are you a resident or trailer owner at Marion County Lake? = No

PartySize How many people, including you, are visiting the lake in the same party (i.e. came in the same vehicle)?
[Please enter numbers only]

_____

Display This Question:

If Are you a resident or trailer owner at Marion County Lake? = No

AgeGroups Please identify how many people in your party fall into each age category?

	Number of People in Each Age Category (1)
Children (0-5) (1)	
Children (6-17) (2)	
Adults (18-64) (3)	
Seniors (65+) (4)	

Display This Question:

If Are you a resident or trailer owner at Marion County Lake? = No

Relationships What are the relationships between members of the party?

- ○ All Family (1)
- ○ All Friends (2)
- ○ Both Family and Friends (3)

Display This Question:

If Are you a resident or trailer owner at Marion County Lake? = No

MeetParty Are you meeting additional people who traveled here separately (i.e. in a different vehicle)?

- Yes (1)
- No (2)

Display This Question:

If Are you a resident or trailer owner at Marion County Lake? = No

Q33 What type of vehicle did you travel to the lake in?

- Make (1) _____
- Model (2) _____
- Year (3) _____

Display This Question:

If Are you a resident or trailer owner at Marion County Lake? = Yes

Q35 How long have you been a resident at Marion County Lake?

_____

Q37 Outside of normal residential use, how many days each year do you participate in lake activities?

_____

End of Block: Demographics

Start of Block: Policy questions

Q46 We would like to get your input on these policy issues of concern. Please share your opinions on the following.

Q41 Do you think migratory geese should be allowed to overwinter at Marion County Lake?

- Yes (1)
- No (2)

Q42 Should dead or fallen trees be removed from the lake and surrounding area?

- Yes (1)
- No (2)

Q43 Should the hours wake-causing boats are allowed to operate be extended?

- Yes (1)
- No (2)

Q45 Have algal blooms affected your decision to participate in lake activities?

- Yes (1)
- No (2)

Q44 Please use this space to express concerns about the lake.

_____

Q38 Thank you for participating in this survey. Your responses are greatly appreciated.

End of Block: Policy questions

Appendix B: Code used to graph data

```
#This program analyzes the data collected from Marion County Lake Camping
#Written by Maridee Weber and Gregory Newmark on 12/12/2019

#Libraries
library(googlesheets)
library(tidyr)
library(dplyr)
library(ggplot2)
library(readr)
library(ggmap)
library(scales)

#Set Working Directory
camp <- read.csv('https://docs.google.com/spreadsheets/d/e/2PACX-1vRUsvQfEl9wnSTz-
BAZ2kJKmyDqm5pSa4oxj7b27dPtgW8krnDsIuD01W2SLGz2SY_bQEnZv2wVo2P2/pub?gid=0&single=
true&output=csv')
boat <- read.csv('https://docs.google.com/spreadsheets/d/e/2PACX-1vRqKl-
_JR8bIwbihtVL6qnK0DbUmDD9JOUz1_VYzvYg-R3hPWMjGPhu0-oDeREIKGMbdZX-
kAoZIRtC/pub?output=csv')

#create date column
camp$date <- as.character(camp$Date..MM.DD.YYYY.) #making date column a character
camp$date <- as.Date(camp$date, tryFormats=c("%m-%d-%Y")) #making date column a date, adding
format
boat$date <- as.character(boat$Date..MM.DD.YYYY.) #making date column a character
boat$date <- as.Date(boat$date, tryFormats=c("%m-%d-%Y")) #making date column a date, adding format

#all count column
camp$counts <- 1 #assigning a value of 1 to counts
camp_total <- aggregate(counts ~ date, data=camp, sum) #creating a dataframe with counts per date

#for loop to create counts of visitors per night camping
nights <- camp$date[!is.na(camp$date)] #removes NA values
nextnight <- camp[camp$Nights > 1, c("Nights", "date")] #removes observations where Nights = 1
nextnight <- nextnight[!is.na(nextnight$Nights),] #removes NA values
nightbase <- nights #reassigns dataframe with all Night values, including Nights = 1 but not NA

for(i in 1:nrow(nextnight)){
  for(j in 1:(nextnight$Nights[i] - 1)){
    extranights <- nextnight$date[i] + j
    nightbase <- c(nightbase,extranights)
  }
}

nightcounts <- as.data.frame(table(nightbase))

#create date column
nightcounts$date <- as.character(nightcounts$nightbase) #making date column a character
nightcounts$date <- as.Date(nightcounts$date, tryFormats=c("%Y-%m-%d")) #making date column a date,
```

adding format

```
########################
## Graphic generation ##
########################

########################
##     Camping       ##
########################

#step graph of counts per night camping
base <- ggplot(data=nightcounts, aes(date, Freq)) #using ggplot with x = date, y = counts
base + geom_step(col="darkorchid4", aes(group = 1), size = 1) + #calling geom_step to make a step line
connecting data points
  labs(title = "Number of Visitors Camping per Night", #adding labels
       x = "Date",
       y = "Visitors") +
  scale_x_date(labels = date_format("%m/%d/%Y"), breaks = date_breaks("week")) + #function to create
date labels on x axis, date format, and how often
  ggsave("Camping by Date.png") #save the image

#histogram of nights camping #put actual number under each bar
ggplot(data=camp, aes(camp$Nights)) + #using gpplot with x = nights
  geom_histogram(breaks=seq(1, 14, by=1), #calling geom_histogram, axis from 0-15
                 col="black", #column outlines are black
                 aes(fill=..count..), #the fill will be determined by count
                 alpha = 0.6) + #opacity
  scale_fill_gradient("Count", low="gray82", high="darkorchid4") + #scale fill by "Count" column
  labs(title = "Number of Nights Visitors Camp", #adding labels
       x = "Nights",
       y = "Count") +
  ggsave("Camping.png") #saving the image

#histogram of money spent visiting
ggplot(data=camp, aes(camp$Total.Cost)) + #using ggplot with x = Total Cost
  geom_histogram(breaks=seq(0, max(camp$Total.Cost), by=5), #calling geom_histogram, axis from 0-100
                 col="black", #column outlines are black
                 aes(fill=..count..), #the fill will be determined by count
                 alpha = 0.6) + #opacity
  scale_fill_gradient("Count", low="gray82", high="darkorchid4") + #scale fill by "Count" column
  labs(title = "Total Amount Spent by Paying Visitors", #adding labels
       x = "Dollars Spent",
       y = "Visitors") +
  ggsave("total_cost.png") #saving the image


#bar graph of percentage of people who have boat storage, rentals, electricty vs plain, cable vs no
house <- round(sum(camp$counts[!is.na(camp$Shelter.House)])/sum(camp$counts)*100,1) #calculating
percent
hall <- round(sum(camp$counts[!is.na(camp$Hall.Rent)])/sum(camp$counts)*100,1) #calculating percent
boat <- round(sum(camp$counts[!is.na(camp$Boat.Storage....Months.)])/sum(camp$counts)*100,1)
#calculting percent
```

```
cable <- round(sum(camp$counts[camp$Cable..Y.or.N. == "Y"])/sum(camp$counts)*100,1) #calculating
percent
electric <- round(sum(camp$counts[camp$Electricity.or.Plain == "Electricity"])/sum(camp$counts)*100,1)
#calculating percent
shares <- data.frame(item = c("Shelter House", "Hall Rental", "Boat Storage", "Cable", "Electricity"),
#creating a dataframe with two columns
                     percent = c(house, hall, boat, cable, electric)) #second column using values found above
bar_base <- ggplot(data = shares, aes(x = reorder(item, -percent), y = percent)) #creating a base plot,
ordered in descending order of intensity
  bar_base + geom_bar(stat = "identity", col = "black", fill = "darkorchid4", alpha = 0.6) + #adding
geom_bar to the base plot to make a bar graph, stat = "identity" is necessary
    coord_flip() + #making the bar graph horizontal
    geom_text(aes(label=percent), vjust=0, nudge_y = 2.4) + #adding percent labels to each bar
      labs(title = "Share of Paying Visitors Using Amenities", #adding labels
         x = NULL,
         y = "Percent") +
    ggsave("amenity_percent.png") #saving the image

#bar graph of percentage of people who are out of city vs Marion vs out of state
  marion <- round(sum(camp$counts[camp$City == "Marion"])/sum(camp$counts)*100,1) #calculating
percent
  kansas <- round(sum(camp$counts[camp$State == "Kansas"])/sum(camp$counts)*100,1) #calculating
percent
  other <- round(sum(camp$counts[camp$State != "Kansas"])/sum(camp$counts)*100,1) #calculating
percent
  location <- data.frame(item = c("Marion", "Kansas", "Out of State"), #creating a new dataframe with two
columns
                       percent = c(marion, kansas, other)) #second column using values found above
  bar_base <- ggplot(data = location, aes(x = reorder(item, -percent), y = percent)) #creating a base plot,
ordered in descending order of intensity
  bar_base + geom_bar(stat = "identity", col = "black", fill = "darkorchid4", alpha = 0.6) + #adding
geom_bar to the base plot to make a bar graph, stat = "identity" is necessary
    coord_flip() + #making the bar graph horizontal
    geom_text(aes(label=percent), vjust=0, nudge_y = 3) +
    labs(title = "Where Paying Visitors Are From",
         x = NULL,
         y = "Percent") +
    ggsave("location_percent.png")

#map
city_table <- camp
city_table[c(1,2,3,6,7,8,9,10,11,12,13,14,15,16,17)] <- list(NULL) #removing unnecessary columns
city_table$City <- as.character(city_table$City) #making City column a character
city_table$State <- as.character(city_table$State) #making State column a character
city_table$locate <- paste0(city_table$City, ", ", city_table$State) #creating a new column with City, State

#city table edits
city_table_count <- table(city_table$locate) #Creating a table of counts per city

#use ggmap to find latitude and longitude and add as new columns
#geocode(city_table$locate, city_table = c("latlon"))
```

```
setwd("C:/Users/marid/Desktop/NRES/R Script")
filename <- "locations.csv" #csv file containing city names, lat, long, and counts obtained from table(camp$City)
sites <- read.csv(filename) #read the file
sites_bbox <- make_bbox(lon = sites$longitude, lat = sites$latitude, f = .2) #boundary box by latitude and longitude
sites_map <- get_map(location = sites_bbox, source = "stamen", maptype = "terrain") #set map source and type

ggmap(sites_map) +
  geom_point(data = sites, colour = "red", alpha = 0.5, mapping = aes(x = longitude, y = latitude), size = sites$count) + #create points for each city, size determined by count
  geom_point(data = sites, colour = "blue", alpha = 0.5, mapping = aes(x = long, y = lat), size = sites$count, shape = 13) + #create a point for the lake, change shape
  labs(x = "Longitude", y = "Latitude", title = "Home Location of All Paying Visitors") + #add labels
  ggsave("fullmap.png") #save the map

ggmap(sites_map) +
  labs(x = "Longitude", y = "Latitude", title = "Home Location of All Paying Visitors", color = "Visitors") + #add labels, color = "Visitors" titles the legend
  geom_point(data = sites, aes(x = longitude, y = latitude, colour= count), alpha = 0.5, size= sites$count) + #create points for each city, size determined by count
  scale_color_gradient2(low="springgreen4", mid="yellow", high="red", midpoint=15,
                        breaks=c(1,10,20,max(sites$count)), labels=c("1", "10", "20", "30")) + #add a color gradient, color determined by count
  geom_point(data = sites, colour = "blue", alpha = 0.5, mapping = aes(x = long, y = lat), size = sites$count, shape = 13) + #create a point for the lake
  ggsave("colormap.png") #save the map

ggmap(sites_map) +
  labs(x = "Longitude", y = "Latitude", title = "Home Location of All Paying Visitors", color = "Visitors") + #add labels, color = "Visitors" titles the legend
  geom_point(data = sites, aes(x = longitude, y = latitude, colour= count), alpha = 0.5, size = 3) + #create points for each city, all the same size
  scale_color_gradient2(low="springgreen4", mid="yellow", high="red", midpoint=15,
                        breaks=c(1,10,20,max(sites$count)), labels=c("1", "10", "20", "30")) + #add a color gradient, color determined by count
  geom_point(data = sites, colour = "blue", alpha = 0.5, mapping = aes(x = long, y = lat), size = sites$count, shape = 13) + #create a point for the lake
  ggsave("pointmap.png") #save the map

ggmap(sites_map) +
  geom_point(data = sites, colour = "red", alpha = 0.5, mapping = aes(x = longitude, y = latitude), size = sites$count) + #create points for each city, size determined by count
  geom_point(data = sites, colour = "blue", alpha = 0.5, mapping = aes(x = long, y = lat), size = sites$count, shape = 13) + #add a point for the lake
  labs(x = "Longitude", y = "Latitude", title = "Home Location of Paying Visitors from Kansas") + #add labels
  coord_cartesian(xlim = c(-94, -102), ylim = c(36.9, 39.8)) + #manually adjust the coordinates of the map
  ggsave("kansasmap.png") #save the map

ggmap(sites_map) +
```

```
  labs(x = "Longitude", y = "Latitude", title = "Home Location of Paying Visitors from Kansas", color =
"Visitors") + #add labels, color = "Visitors" titles the legend
  coord_cartesian(xlim = c(-94.3, -102), ylim = c(36.9, 39.8)) +
  geom_point(data = sites, aes(x = longitude, y = latitude, colour= count), alpha = 0.5, size= sites$count) +
#create points for each city, size determined by count
  scale_color_gradient2(low="springgreen4", mid="yellow", high="red", midpoint=15,
                        breaks=c(1,10,20,max(sites$count)), labels=c("1", "10", "20", "30")) + #add a color gradient,
color determined by count
  geom_point(data = sites, colour = "blue", alpha = 0.5, mapping = aes(x = long, y = lat), size = sites$count,
shape = 13) + #create a point for the lake
  ggsave("kansascolormap.png") #save the map
```