Exploring Relationships Between Parks and Community Demographics in Ramsey County, Minnesota

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Abstract

Parks have always been an important part of a community. Because of this, informed decisions need to be made on the establishment and management of parks. It is through understanding how a park and its community interact that these decisions can be made. In order to explore this relationship, this study evaluated the extent to which county and regional park amenities are related to the socio-economic demographics of a community. Through extensive examination, this study did not show park amenities to have a statistically significant impact on a community.

Introduction

Parks are an important part of cities and urban areas. As more people moved into urban areas and cities, parks became an important part of what was considered a necessity for cities. This shift from rural to urban areas left people with few places to experience nature and open areas. As time passed and people started to move towards a more suburban lifestyle, the perceived need for parks diminished. This led to fewer parks being established and less upkeep was provided for existing parks. Recently, an interest in park maintenance and creation has resurfaced. This has caused cities, civic groups, and governments to restore and use older parks as well as attempt to increase park networks and develop new parks. Even with the renewed support for parks and similar facilities designed to bring nature to the city, the creation of new parks is slowing down along with the upkeep of existing parks due to budget cuts in government (Sherer, 2006). It is due to the limited nature of funding and space that studies need to be done in order to best use resources for the good of everyone.

With parks being an important part of an urban citizen's life, the diverse needs of a community can be challenging for a park to supply. In order to help alleviate the difficulty in visualizing park usage for management and planning purposes, Ostermann analyzed different techniques for visualizing the usage data (2010). These techniques can help a manager or planner analyze a community's usage of a park, but this is just one of the components that can be used for analysis or decision making. Parks also have an effect on property values and other benefits to citizens (Sherer, 2006). With different approaches to analysis that managers and planners use, it is important to understand the relationships between parks and their

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features on the parks and other features on the communities that surround them.

The focus of this study was the investigation of possible correlations between park amenities and community demographics. The demographics examined in this study consisted of the following: median household income, unemployment of people about sixteen, the number of families with income below poverty level, the number of households with public assistance, and the median value of owner-occupied housing. These demographics provide a good representation of the socio-economic status of communities. For this study park amenities were used to refer to the different facilities and features a park has. The facilities and features that were examined consisted of hiking trails, biking trails, picnicking, fishing, boat ramps, swimming, nature centers, golf courses, cross-country ski trails, downhill skiing, off-leash dog areas, and archery facilities. Since a number of the aforementioned amenities are available only at county or regional parks, or outside of the urban environment, the study used these large and often unique facilities to determine correlation.

Geographic Information Systems (GIS) have been an important tool in planning and management of parks and urban areas for quite some time (Gress, 2009). The challenges of managing and planning parks have a significant spatial aspect, which GIS is able to help define and evaluate. The tools of a GIS allow a user to define, visualize, and analyze both quantitative and qualitative data (Nicholls, 2001). A GIS allows an analyst different methods of analyzing parks. Nicholls (2001) used GIS to analyze the equality and equity of park access in communities, while Comber, Brunsdon, and Green (2008) used GIS to perform a network analysis to assess the accessibility of ethnic and religious groups to urban green spaces and parks. GIS has also been used to describe the characteristics of parks and how they satisfy the demands and usage of them by citizens (Lee and Graefe, 2004). A GIS is also able to provide maps and other visual products helping to inform the public as well as helping to increase the understanding between managers and planners and the community (Nicholls, 2001).

Data

Before starting the study some steps needed to be completed. These steps included defining the study area, collection of the data, and data preparation.

Data Collection

The data for the study were obtained from the Minnesota Department of Natural Resources (MNDNR), the US Census Bureau, and Ramsey County. The parks shapefile and county polygon were obtained from the DNR Data Deli website. The demographic data and census block group shapefile were obtained from the US Census Bureau's website. The park features data were collected from the Ramsey County website. These individual data sets were then used to create a comprehensive data set for this study.

Demographic Data

In order to represent the communities living in Ramsey County, demographic data from the US Census Bureau were obtained. Census data is defined through a number of differing scales – from the national level to the block level. For this project, the 2000 US Census Summary

File 3 data was used. This data set was chosen because of the need for accurate data at a smaller scale and its availability. The block group level was used because of its small scale and availability. The 2010 US Census does not include data at the Summary File 3 level (Colon, 2010). The Summary File 3 of the 2000 Census contains data obtained from the long form of the census (United States Census Bureau, 2002). The data contained in the Summary File 3 provides a representation of socio-economic data; employment data; housing data; among others. These data are now being collected every year with the American Community Survey (ACS). The ACS does not survey nearly as many people as the old census long form which results in a greater sampling error (Blodgett, 2009). Another problem with the ACS is that smaller geographic areas, such as block groups and areas with smaller populations are excluded from the yearly ACS. These excluded areas are then released as estimates for the 5 year ACS data sets (Blodgett, 2009). Due to the inaccuracies of the ACS and the discontinued support of the long form and Summary File 3 data sets for small areas and geographic regions the 2000 Census Summary File 3 was selected for use here.

The demographics used here focused on median household income, unemployment of people above 16, the number of families with income below poverty level, the number of households with public assistance, and the median value of owner-occupied housing. These five demographics were selected because of their ability to represent the socio-economic status of the community as well as their inclusion in Gress' (2009) study. This permitted a comparison between the models and findings.

Study Area

The area chosen was Ramsey County, Minnesota. It was selected because it contains Saint Paul and a large section of the suburbs of the Twin Cities. This selection of area will give a differing set of communities within a similar area as compared to Gress' (2009) study. By including Saint Paul in the study area, an evaluation was possible to learn if expanding the community environment to the suburbs had an effect on the model that Gress (2009) built. The block group scale for the demographic data was chosen. At the block group level, census data is represented at about 800 people per block group. This allows the study at a finer resolution than any of the other data levels available from the US Census Bureau (Figure 1).

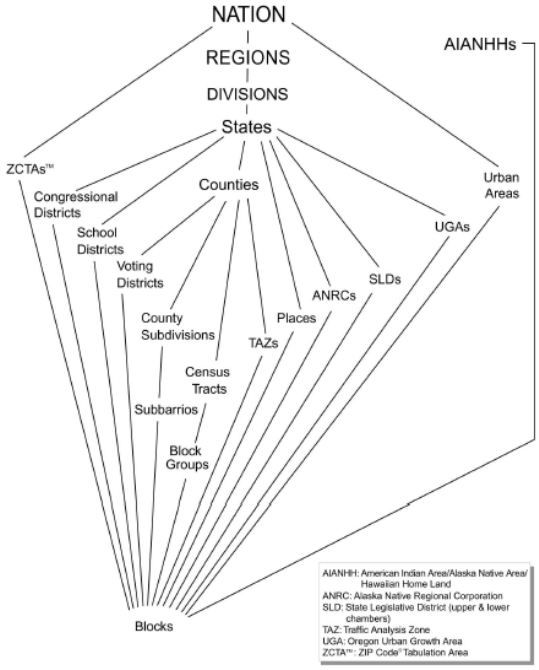

Figure 1. Graphic depicting the census hierarchy with largest geographical features at the top (United States Census Bureau, 2002).

The block group shapefile for Ramsey County was obtained from the Tiger Shapefile database of the US Census Bureau. Also required for the creation of the study area data set were the park

location and features data. These data were acquired from the DNR data deli and from the Ramsey County websites.

For this project 25 regional and county parks were chosen. The location of these parks is displayed in Figure 2. The legend for the map is displayed in Figure 3.

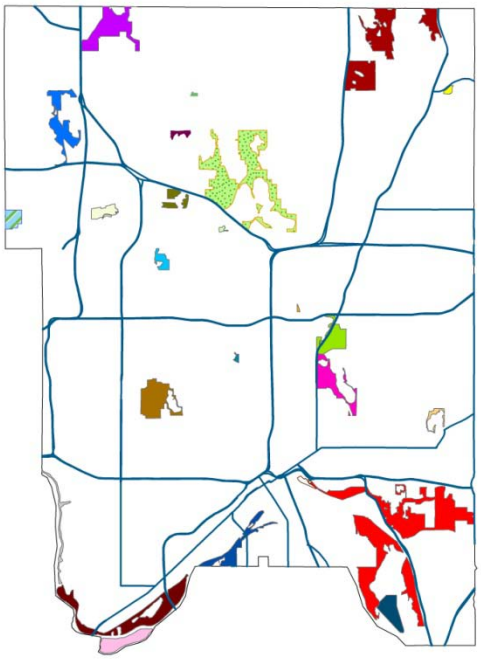

Figure 2. Map displaying the major roads and highways of the county with the selected parks.

Figure 3. Legend of parks for figure 2.

A matrix of parks and amenities is presented in Appendix A.

Methods

Data

In order to perform the spatial analysis, the data had to be prepared after it was collected. First, the demographic data were separated into different tables for individual analysis use. Then, the block group shapefile for Ramsey County was added to ArcGIS and projected to UTM NAD83 Zone 15. A polygon of Ramsey County was created using the dissolve tool on the block group shapefile layer. Next, the regional parks shapefile was added. The parks shapefile was then projected to the same coordinate system as the block group shapefile layer and clipped to the Ramsey County polygon. Some of the county parks were not represented by the regional parks shapefile and polygons of these unrepresented parks needed to be digitized. This was accomplished using the Ramsey County parks map retrieved from the Ramsey County website. The Ramsey County parks map also contained the amenity data for each of the regional and county parks. These data were entered into the data table of the parks shapefile for each of the regional and county parks. After the shapefiles were prepared, a data frame for each of the demographics was created. The parks data set, including all of the aforementioned shapefiles, was copied and added to each demographic data frame. Then the individual demographic data tables were added to the respective data frames and joined to the block group shapefiles.

Spatial Analysis

Once the data were prepared, an additional data frame was created to perform the start of the spatial analysis with the study area data set previously created. In order to discern the areas affected by each of the parks and their amenities, a distance raster

was created using the Euclidian distance raster tool. This tool used the study area data set along with a mask of the county. This produced a raster showing the distance from the parks. The average distance from a park to any point in the county is 1317.27 m (Figure 4).

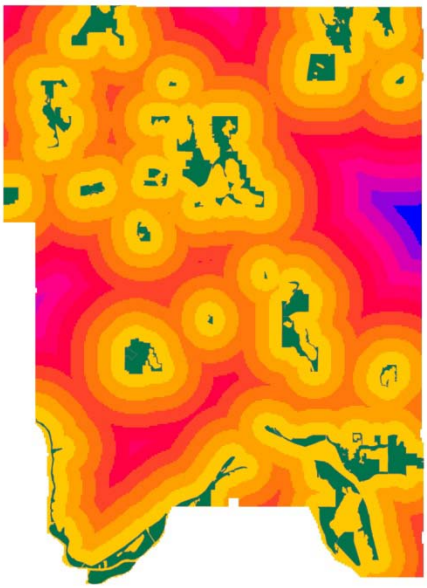

Figure 4. Map of the study area showing distance from parks (in meters). The parks are represented with green. Distance is represented from near to far by light to dark shading.

This average distance was used to define the areas affected by each park and its amenities. It was done by creating a buffer zone around the parks with a distance of 1317.27 m. The resulting affected areas comprised 292 of the 401 block groups of the county (Figure 5).

For each of the park amenities, a selection was performed to find the block groups within the average distance of 1317.27 m. The resulting areas are shown in Figures 6 through 10. After the block groups were isolated for the respective amenities, the demographic data lists were used to find the mean value of each demographic within area of effect for each park amenity. These demographic data sets were then split into those higher than and those lower than the mean value. The data tables containing the actual value of the demographics for the selected block groups split into higher and lower groups were then exported for statistical analysis.

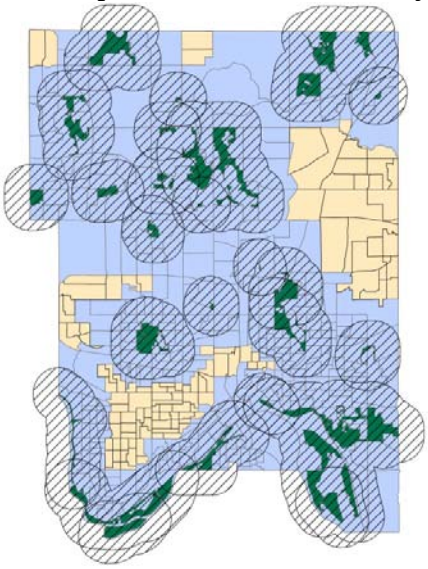

Figure 5. Map of the included block groups within the buffer zone surrounding the parks. Parks are represented in green with the buffer zone represented by hash marks. The included block groups are displayed in blue with the non-included block groups in beige.

Statistical Analysis

The statistical analysis SPSS 18 (Statistical Package for the Social Sciences) was used to process the demographic data tables. This was accomplished using Microsoft Excel to open the demographic data and extract the specific data columns for input into SPSS. The data entered into SPSS were then prepared for statistical analysis by creating two lists for the block groups residing in each park amenity area. One list contained the lower category and the other list contained the higher category. These data lists were then summed for each amenity in the higher and lower categories respectively and inserted into a data table. The number of parks that contained each

amenity and the total from the lower and higher entries was then added to these tables. After the data were prepared they were analyzed using descriptive statistics and the Pearson's Parametric Correlation Coefficient.

The descriptive statistics used in this study were the sum, mean, median, and standard error. These statistics give a better understanding of the data sets.

The Pearson's Parametric Correlation Coefficient is a test of the strength of a correlation or relationship between data sets. The value of the Correlation Coefficient ranges from 1 to -1. This value describes a strong or weak positive or negative relationship. The test was also subjected to a test of significance at the .95 confidence level (or .05 error rate) to determine if results are due to chance. In order to explore correlations between park amenities and the demographic variables of this study, the higher and lower data were paired by park amenity and correlated.

Results

The results of the spatial analysis portion of the project included a number of maps representing the study area. These maps display the demographic information in the defined area of effect. This allows for a quick visualization of the project and indication of possible relationships. As Figures 6 through 10 illustrate, there are areas that show a possible correlation to areas within Ramsey County that are more predisposed to a specific demographic. The map for unemployment shows a fairly even distribution throughout the county (Figure 6).

Now while the map shows a fairly even distribution, it must be taken into consideration that a portion of St. Paul was left out of the study. While the distribution of unemployment is fairly even, the distribution of households with public assistance is more concentrated in the Saint Paul area (Figure 7).

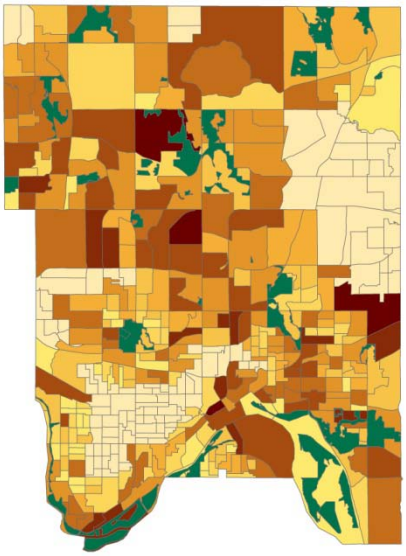

Figure 6. Map of unemployment of people over 16. Higher unemployment levels are represented by darker shades while the lower unemployment areas are represented by lighter shades. The beige block groups were not included in the spatial and statistical analysis and the green areas are the parks.

This shows that there is a spatial difference of the areas but with the parks and amenities distributed fairly evenly, the actual effect of park amenities is evenly distributed through the county.

The distribution of households with income below poverty level is similar to the distribution of households with public assistance which can be seen in Figures 7 and 8. This relationship was expected as the need for public assistance is created by a variety of reasons, one of them being low income.

The Saint Paul area in Ramsey County again shows a greater concentration of households in the lower right corner of the county. This area is

similar to the concentration of households with public assistance.

The map of the median value of owner occupied housing units shows a greater concentration of lower value housing units in the central and eastern Saint Paul area (Figure 9). While the northern part of the county displays a greater concentration of higher value homes than the rest of the county.

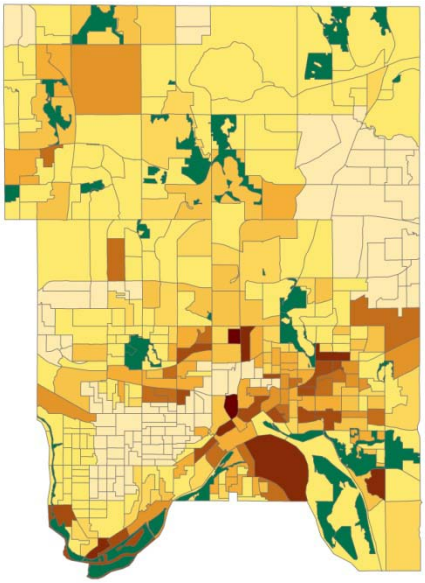

Figure 7. This map displays the distribution of households with public assistance. The darker shades indicate a higher number of households with lighter shades representing fewer households. The beige block groups were not included in the spatial and statistical analysis and the green areas are the parks.

Figure 10 displays the median household income. This map shows a larger concentration of higher incomes in the upper part of the county.

As with median household value, median household income shows a greater concentration of lower incomes in the south eastern parts of the county around the Saint Paul area.

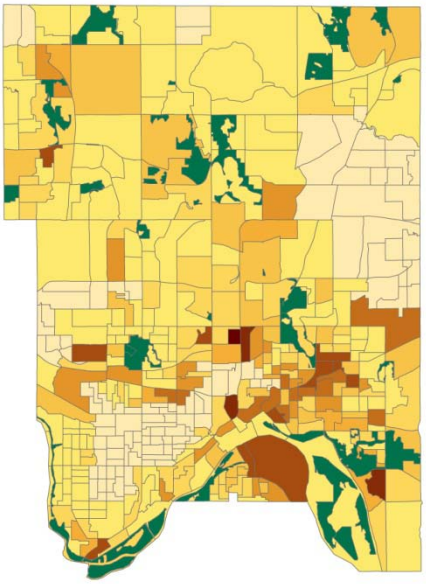

Figure 8. A map of households with income below poverty level. The darker shades indicate a higher number of households with lighter shades representing fewer households. The beige block groups were not included in the spatial and statistical analysis and the green areas are the parks.

This map is very similar to the median value of owner occupied housing units. These results are as expected since a higher income allows for a more expensive housing unit. The higher income concentration in the northern part of the county is worth noting as the area is sub-urban, while the lower income values are located in the Saint Paul area.

To better understand the distributions implied by the spatial analysis, a statistical approach was used. The methods of analysis allows for a better understanding of the relationships between parks and their surrounding communities. For each of the demographics a table of the data sets and descriptive statistics and then a table of the Pearson's Parametric Correlation Coefficient (r-value) was created.

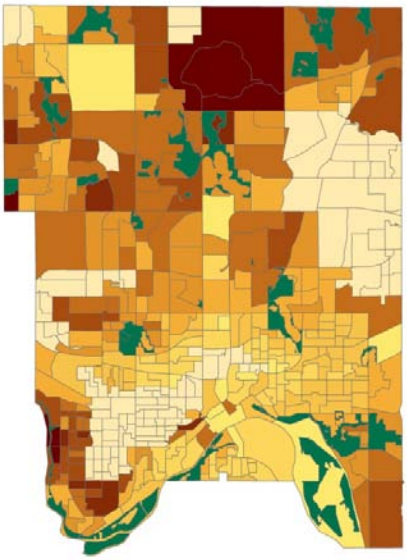

Figure 9. A map of the median value of owner occupied housing units. The darker shades indicate a higher number of households with lighter shades representing fewer households. The beige block groups were not included in the spatial and statistical analysis and the green areas are the parks.

These tables outline the impacts each of the park amenities have on the surrounding communities. Table 1 displays the descriptive statistics for the unemployment of people over 16 demographic. This data table was then used to explore for possible correlations that might exist within the data set. Appendix B graphs the number of people in the lower and upper halves for each amenity.

After the spatial analysis, a correlation between unemployment and park amenities was not expected. This was due to the evenly distributed nature of the demographic within the county.

Table 2 shows the data set collected for the number of households receiving public assistance. It also contains the descriptive statistics for the data set. The graph produced for table 2 also displays the data set of the number of households in the lower half with those in the upper half paired by amenity (Appendix C).

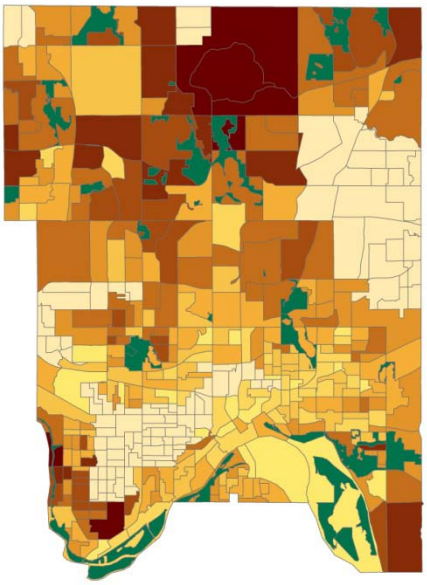

Figure 10. A map of median household income. The darker shades indicate a higher number of households with lighter shades representing fewer households. The beige block groups were not included in the spatial and statistical analysis and the green areas are the parks.

The data set for the number of households with income below poverty level demographic is displayed in table 3. This table also displays the descriptive statistics of the demographic. A graph was produced to display the number of households from the lower half along with the upper half by amenity (Appendix D).

The spatial distribution of the households with public assistance and income below poverty level both suggested that data sets would be very similar between park amenities and the two respective demographics. This is supported by very similar descriptive statistics for both data sets.

The spatial analysis also suggested that the data sets between the median household income and value demographics would be similar.

Table 1. Unemployment of people over 16. The data set is the combination of all block groups within the selected area of each amenity. The descriptive statistics describe the sum, mean, median, and standard error of the data set.

Amenity	Number of Parks	People in Lower Half	People in Upper Half	Total People
Swimming	14	20389	51044	71433
Picnicking	22	32676	60247	92923
Boat Ramp	15	18857	41435	60292
Fishing	20	28534	52817	81351
Hiking Trails	20	32380	60691	93071
Bike Trails	17	29327	57859	87186
Nature Center	3	1910	14536	16446
Archery	1	2279	3865	6144
Golf Course	4	13196	19140	32336
Cross-Country Skiing	6	10359	30198	40557
Downhill Skiing	1	6438	5767	12205
Off-Leash Dog Area	4	5336	14833	20169
Totals	127	201681	412432	614113
Mean	10.58	16806.75	34369.33	51176.08
Median	10	16026.50	35816.50	50424.50
Standard Error	2.350	3407.155	6369.615	9684.663

Table 2. Households with Public Assistance. The data set is the combination of all block groups within the selected area of each amenity. The descriptive statistics describe the sum, mean, median, and standard error of the data set.

Amenity	Number of Parks	Families in Lower Half	Families in Upper Half	Total Families
Swimming	14	1069	4923	5992
Picnicking	22	1429	6025	7454
Boat Ramp	15	838	3995	4833
Fishing	20	1241	5093	6334
Hiking Trails	20	1386	5953	7339
Bike Trails	17	1348	5837	7185
Nature Center	3	132	1915	2047
Archery	1	71	279	350
Golf Course	4	521	2694	3215
Cross-Country Skiing	6	621	2709	3330
Downhill Skiing	1	233	686	919
Off-Leash Dog Area	4	251	1604	1855
Totals	127	9140	41713	50853
Mean	10.58	761.67	3476.08	4237.75
Median	10	729.50	3352.00	4081.50
Standard Error	2.350	150.766	605.098	753.527

Table 3. Households with Income Below Poverty Level. The data set is the combination of all block groups within the selected area of each amenity. The descriptive statistics describe the sum, mean, median, and standard error of the data set.

Amenity	Number of Parks	Families in Lower Half	Families in Upper Half	Total Families
Swimming	14	1029	4070	5099
Picnicking	22	1443	4710	6153
Boat Ramp	15	983	2949	3932
Fishing	20	1229	3945	5174
Hiking Trails	20	1335	4412	5747
Bike Trails	17	1201	4332	5533
Nature Center	3	216	1068	1284
Archery	1	100	305	405
Golf Course	4	516	2094	2610
Cross-Country Skiing	6	511	1988	2499
Downhill Skiing	1	188	564	752
Off-Leash Dog Area	4	258	1274	1532
Totals	127	9009	31711	40720
Mean	10.58	750.75	2643.58	3393.33
Median	10	749.50	2521.50	3271.00
Standard Error	2.350	144.728	468.342	611.369

Table 4. Median Household Value of Owner Occupied Units. The data set is the combination of all block groups within the selected area of each amenity. The descriptive statistics describe the sum, mean, median, and standard error of the data set.

Amenity	Number of Parks	Value in Lower Half	Value in Upper Half	Total Value
Swimming	14	10750400	12738600	23489000
Picnicking	22	14446900	20149000	34595900
Boat Ramp	15	8529200	12122200	20651400
Fishing	20	12832300	16014000	28846300
Hiking Trails	20	14308900	30436300	44745200
Bike Trails	17	13847300	18112700	31960000
Nature Center	3	1935500	2013700	3949200
Archery	1	1441000	751300	2192300
Golf Course	4	7183400	3733400	10916800
Cross-Country Skiing	6	5998800	7966500	13965300
Downhill Skiing	1	2633100	2299200	4932300
Off-Leash Dog Area	4	3191600	3807100	6998700
Totals	127	97098400	130144000	227242400
Mean	10.58	8091533.33	10845333.33	18936866.67
Median	10	7856300	10044350	17308350
Standard Error	2.350	1464337.673	2634900.415	4022128.307

Table 5. Median Household Income. The data set is the combination of all block groups within the selected area of each amenity. The descriptive statistics describe the sum, mean, median, and standard error of the data set.

Amenity	Number of Parks	Income in Lower Half	Income in Upper Half	Total Income
Swimming	14	10912000	12577000	23489000
Picnicking	22	16418400	18177500	34595900
Boat Ramp	15	8630200	12021200	20651400
Fishing	20	12697900	16148400	28846300
Hiking Trails	20	15691600	1953600	17645200
Bike Trails	17	14837100	18122900	31960000
Nature Center	3	2884900	1064300	3949200
Archery	1	979700	1212600	2192300
Golf Course	4	6400800	4516000	10916800
Cross-Country Skiing	6	2292669	3415396	5708065
Downhill Skiing	1	2462100	2470200	4932300
Off-Leash Dog Area	4	2798700	4200000	6998700
Totals	127	97006069	94879096	191885165
Mean	10.58	8083839.08	7906591.33	15990430.42
Median	10	7515500	4358000	14281000
Standard Error	2.350	1687612.407	1944547.025	3390201.278

Following the descriptive analysis, a Pearson's Correlation was performed on the data sets (Table 6). These correlations define how the demographic data interacts with the park amenities. The correlations show if the park amenities affect the community through the interaction of the demographic data over the lower and upper halves. If there is a strong positive correlation it means that if the upper half increases the lower half increases. If all the data is positively correlated the park amenities would have no real effect on the surrounding community as it is expected that the lower half and upper half of each demographic would increase with an increase of the other variables. While if the correlations are negative or differing throughout the variables there would be some effect by the park amenities.

Discussion

The correlations found between the lower and upper halves of the data sets show that there is a significant strong positive correlation. This indicates that as the higher half of the data sets gets larger so to does the lower half. The relationship defined by the study for the demographics indicate that if the total population were to be increased the lower and upper halves would also increase by near similar amounts to each other. While most of the correlations show a similar high

Table 6. Correlations for each of the demographics between the higher and lower block groups. All values are significant at the 0.01 level (2-tailed).

Unemployment of People Over 16	.959
Households with Public Assistance	.981
Households with Income Below Poverty Level	.919
Median Household Values of Owner Occupied Units	.919
Median Household Income	.741

correlation value, above .91, the median household income correlation was only .741. This is a significant positive correlation but could indicate that median household income has a greater variation than the other demographics.

While the average distance used in this study to the county and regional parks was 1317.27 m, the actual impact of the parks on the community could be on a smaller area. With a smaller area of effect, it would be less likely the demographics would overlap as they do now. This would end up an increased resolution between parks and their locations. A smaller area of study would also allow for less overlap between the communities surrounding the parks.

As the spatial analysis suggests, there are certain areas of the county which correlate to certain socio-economic demographics. This is evident in Figures 6 through 10, which display a greater spatial correlation with certain demographics in differing area of the county. Figure 6 shows a fairly even spatial distribution of unemployment throughout the county. Figures 7 and 8 show a greater concentration of income below poverty level and households with public assistance around the Saint Paul area.

Figures 9 and 10 show a greater concentration of high income and housing value in the northern part of the county. While the Saint Paul area show a greater concentration of lower income and housing values.

Parks and their amenities are an important part of a community. This is evidenced by how widespread and evenly distributed these parks and their amenities can be, especially so given the distances between them.

Conclusion

The purpose of this study was to investigate possible relationships between park amenities and socio-economic demographics. This study is useful in helping to explore park impacts on a surrounding community. It allows park and city planners and managers to understand how a park affects its community and whether the amenities added will have an impact on the community.

A full understanding of how a park and its features affect its surrounding community is an invaluable asset to planners and managers as well as the citizens within a community. It is through the understanding of how a community is developed and how each piece affects the others that informed decisions can be made for the good of all in a community. The results found help form those decisions through its findings. This allows planners and managers, as well as citizens, to make informed decisions on what amenities current and future parks provide and the community will interact with its parks.

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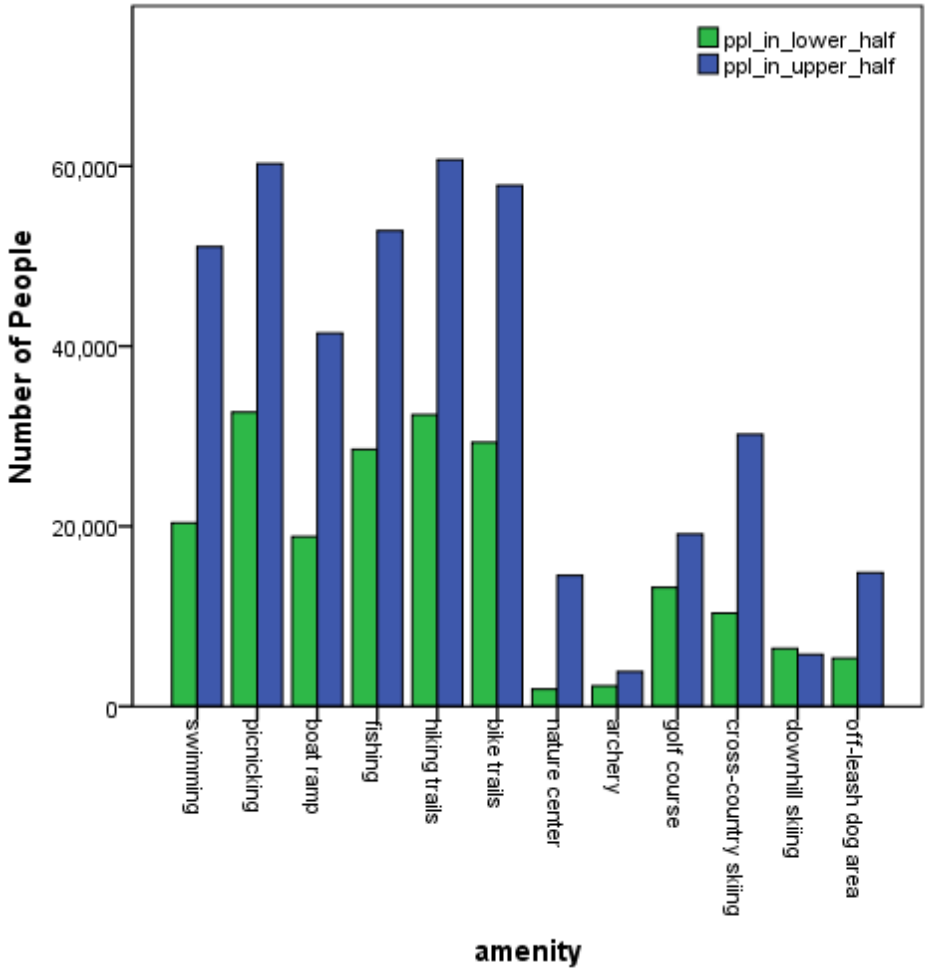
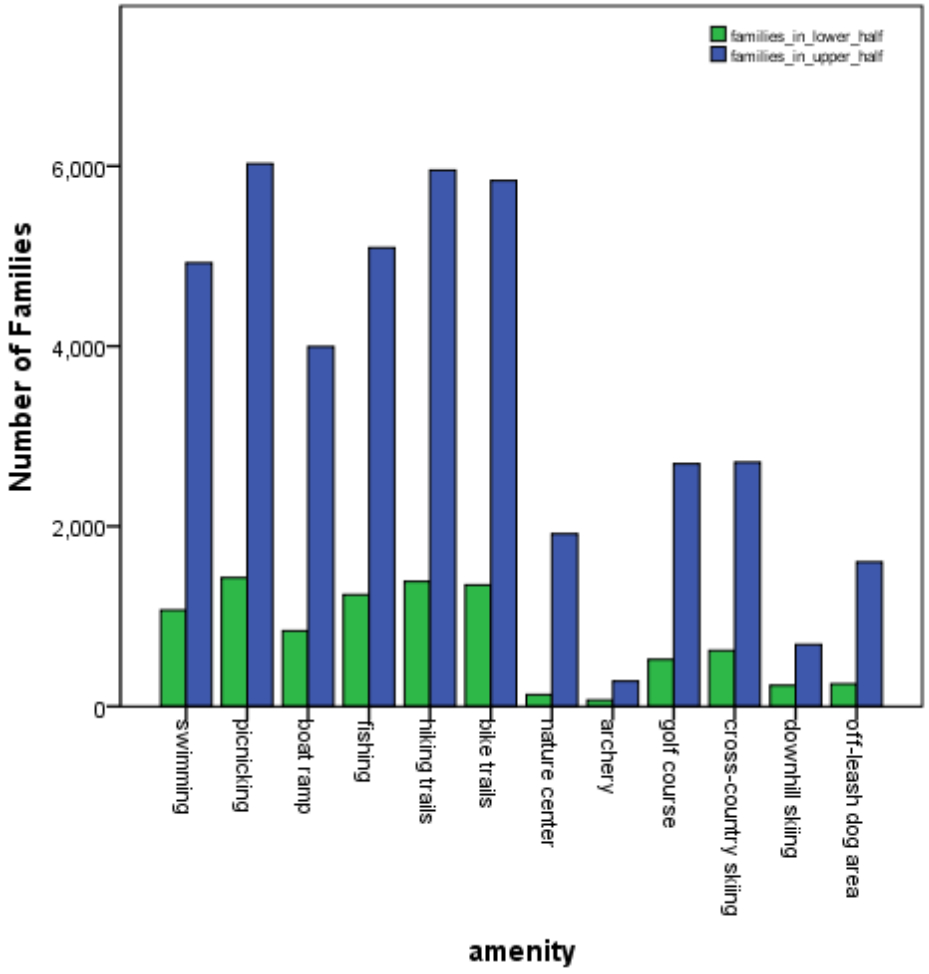
Appendix A. Table of the parks included in this study and the associated park amenities.

Parks	Swimming	Picnicking	Boat Ramp	Fishing	Hiking Trails	Biking Trails	Nature Center	Archery	Golf Course	Cross-Country Skiing	Downhill Skiing	Off-Leash Dog Area
Pig's Eye Island	*	*			*	*				*		*
Long Lake	*	*	*	*	*	*						
Keller		*	*	*	*	*		*	*			
Phalen	*	*	*	*	*	*			*			
Battle Creek	*	*			*	*				*		*
Lilydale-Harriet Island		*	*	*	*	*						
Hidden Falls – Crosby Farm		*	*	*	*	*						
Rice Creek					*	*						*
Vadnais-Snail Lake				*	*	*				*		
Mississippi Gorge		*			*	*						
Bald Eagle-Otter Lake		*	*	*	*							*
Silverwood		*		*	*		*					
Como	*	*		*	*	*			*	*	*	
Fort Snelling	*	*	*	*	*	*	*		*	*		
Tony Schmidt	*	*	*	*	*	*						
Snail Lake Marsh	*	*	*	*	*	*				*		
Vento Sanctuary					*	*	*					
White Bear Lake	*	*	*	*								
Turtle Lake	*	*	*	*								
Island Lake		*	*	*	*	*						
Lake Josephine	*	*	*	*	*							
Lake Owasso	*	*	*	*								
Beaver Lake		*		*	*	*						
Lake Gervais	*	*		*								
Lake McCarrons	*	*	*	*								

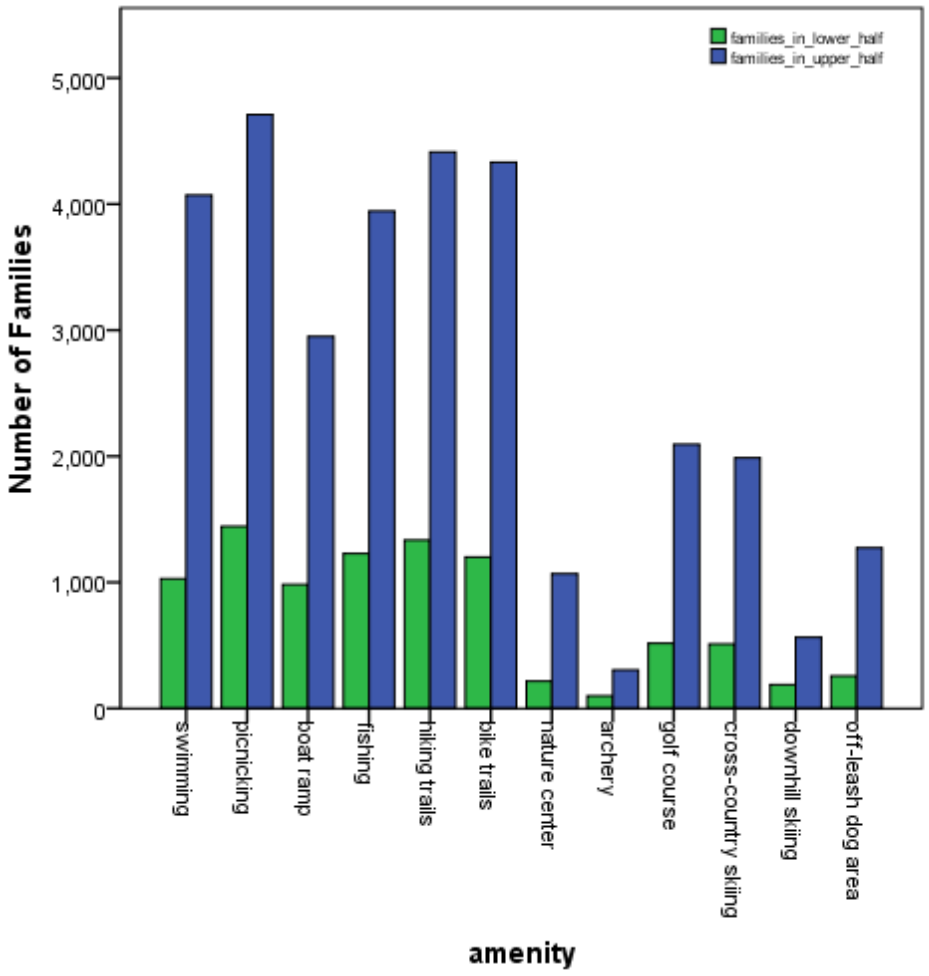
Appendix B. This graph displays the lower half and upper half values of the number of people unemployed by park amenity. The lower half is represented by green and the upper half is represented by purple.



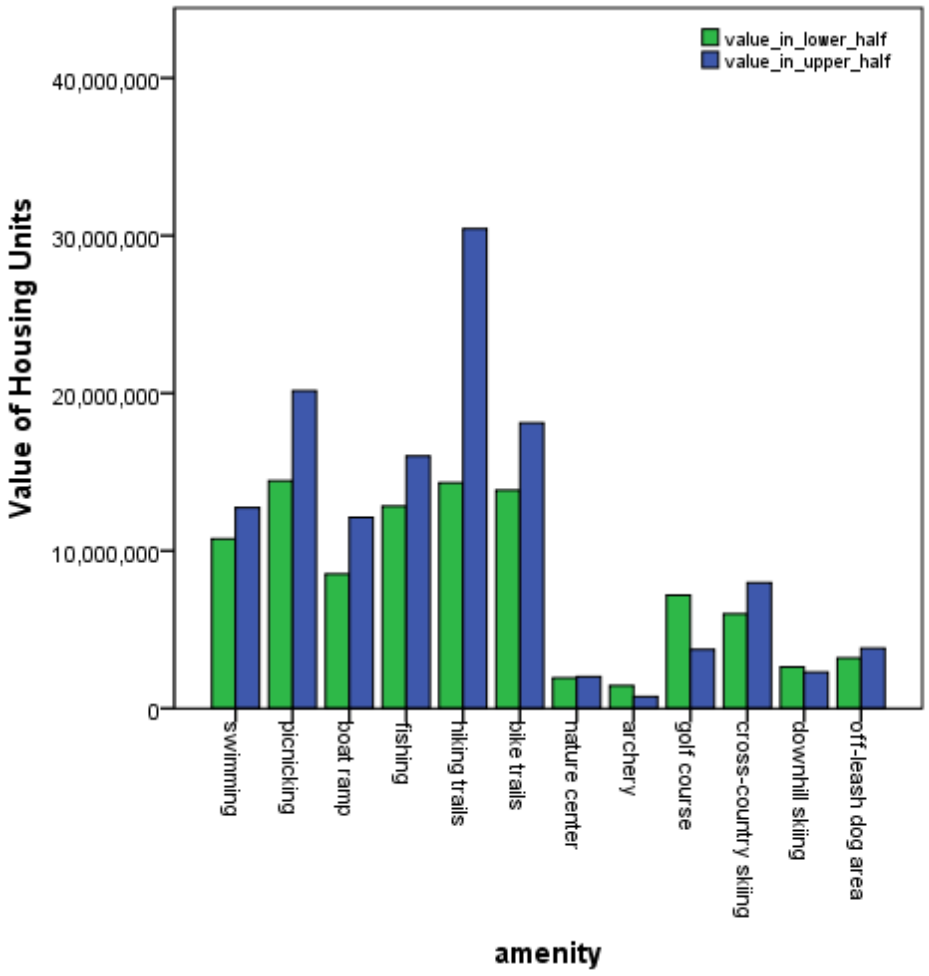
Appendix C. This graph displays the lower half and upper half values of the households with public assistance by park amenity. The lower half is represented by green and the upper half is represented by purple.



Appendix D. This graph displays the lower half and upper half values of the households with income below poverty level by park amenity. The lower half is represented by green and the upper half is represented by purple.



Appendix E. This graph displays the lower half and upper half values of the median household value of owner occupied units by park amenity. The lower half is represented by green and the upper half is represented by purple.



Appendix F. This graph displays the lower half and upper half values of the median household income by park amenity. The lower half is represented by green and the upper half is represented by purple.