

Furman's Carbon Footprint: Contributions by Furman Faculty and Staff During the Daily Commute to Campus

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Abstract

Sustainability has become a major issue around the world as more and more people realize the impacts of wasteful consumption and unlimited growth. As a result, colleges and universities across the country are beginning to study environmental impacts of their own operation and take steps to reduce natural resource consumption. Furman University first put a major emphasis on sustainability in 1997 with the adoption of a new strategic plan. Since that time, the Board of Trustees unanimously agreed to "strengthen our commitment to the environment by promoting sustainability through educational programs, campus operations /construction practices and public awareness initiatives" (Presidents Report, 2006). One aspect of this commitment is an effort to catalogue Furman's carbon emissions and calculate the University's total carbon footprint. This project will help with determining emissions from Furman faculty and staff resulting from the commute to and from work.

Home addresses of Furman faculty and staff were obtained from the Personnel Office at Furman and were then geocoded into lat/long coordinates. The driving distance to Furman was then calculated and analyzed. Results shows that 41% of Furman employees lived within five miles of campus. Using average fuel efficiency data obtained from the Department of Transportation, the total carbon emissions for employee commutes per year comes to 2637.5 tons of CO₂. The commute to and from Furman by its employees over the course of a year creates tremendous emissions.

Introduction

Cataloguing carbon dioxide emissions is a core area of Furman's commitment to sustainability. Furman is just one of many schools that have begun this process. The process includes cataloging emissions, finding areas where emissions can be reduced, and designing and implementing programs to reduce these emissions. One aspect of the calculating the carbon footprint of the university involves the emissions resulting from employees commuting from home to work and back. While Furman is a leader in green building and emission reductions through saving energy in its physical plant, the Committee on Sustainability is tasked with calculating all emissions related to the everyday operation of the university.

This project addresses the emissions from faculty and staff that occur during the daily commute to work at Furman. The addresses of all Furman faculty and staff were mapped in Google maps, and a webpage was set up to display this information (Figure 1). The website is currently <http://gis.furman.edu/~rutledge/facstaff.htm>, though the website address will change in the future. The information on the website is all public information, and it will be possible to continually update the data. This website can help Furman faculty and staff recognize the fact that many live in close proximity to each other and have the opportunity to carpool with one, or perhaps many, other employees.

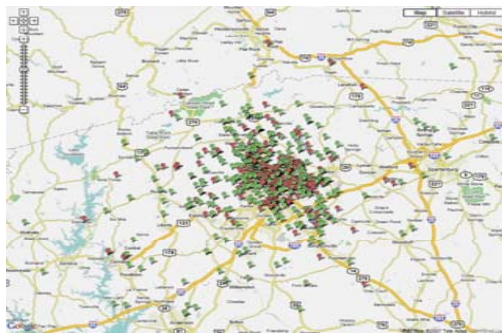


Figure 1. Google Map of home addresses of Furman employees, with faculty and staff delineated by red and green markers, respectively.

Carbon dioxide emissions from the transportation sector in the United States account for one third of total emissions. The Department of Transportation's Research and Innovative Technology Administration gives the average fuel efficiency of cars and other two-axle vehicles (trucks, SUVs). Figure 2 shows how fuel efficiency has risen, slowly, but steadily, over the last 24 years, but for cars only. It is discouraging to note that other vehicles show a decrease in fuel efficiency since 1995. Though some Furman employees walk, bike, or carpool to work, the majority drive, which contributes 19.6 lbs. of CO₂ for every gallon of gasoline burned. Therefore, the daily commute to work contributes a significant portion of carbon emissions to Furman's total carbon footprint.

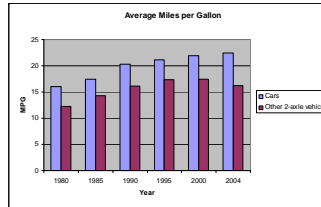
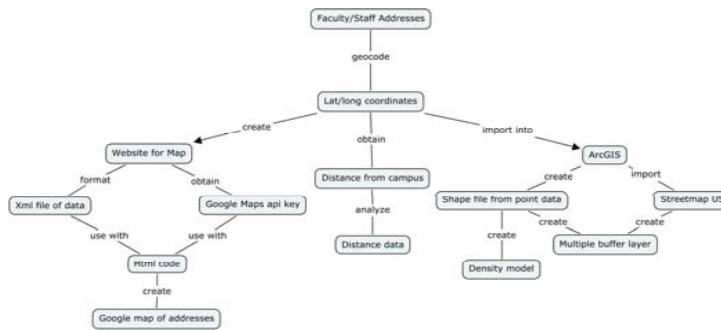


Figure 2. This chart shows the average fuel efficiency for cars and all other four wheeled vehicles from 1980 through 2004.

Methodology



Results

Individual employee addresses were mapped using ArcGIS and the total driving distance from their homes to the campus was calculated. Using ArcGIS, a map was created showing those addresses that lie within ten miles of the campus, with zones under five miles subdivided by mile (Figure 3).

Figure 3 shows that the majority of Furman employees live in the immediate vicinity of the campus. The map containing the buffers delineates mile wide zones around a central location on the campus (the center of the mall, in front of the Chapel) up to five miles, followed by a five mile wide zone up to ten miles. The total number of employees who live in a ten mile radius around Furman campus was found to be 618, out of a total of 866, or 71.4%, with 41% living within five miles.

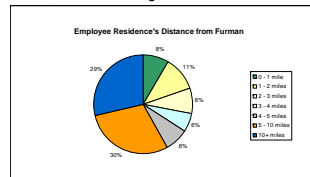


Figure 4. Percentages of employees and the distances they live from the Furman campus. A substantial number live over ten miles from campus.

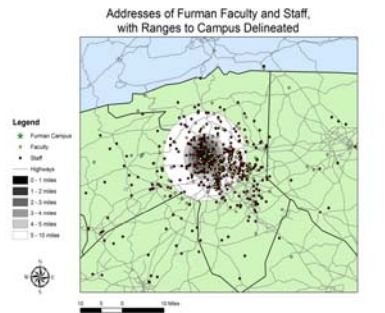


Figure 3. Map view of northwestern South Carolina with the addresses of Furman faculty and staff marked. Circles represent distance from Furman up to ten miles with those below five subdivided by mile.

Figure 4 breaks down the distribution of faculty and staff addresses throughout the six buffer layers. One fact that could be of interest to the Committee on Sustainability is the number of faculty and staff who live within one mile of the center of the campus. This opens the possibility of encouraging employees to walk or bike to campus, which could significantly reduce emissions.

One interesting feature that became apparent from the data is that there is a difference between faculty and staff in the distance each group lives from campus. A larger percentage of faculty, 78.3%, live within ten miles of campus, while for staff the percentage is only 67.2%. This discrepancy may reflect a range of factors, but the University needs to be aware of this fact and its implications.

Density Map of Home Addresses for Furman Faculty and Staff

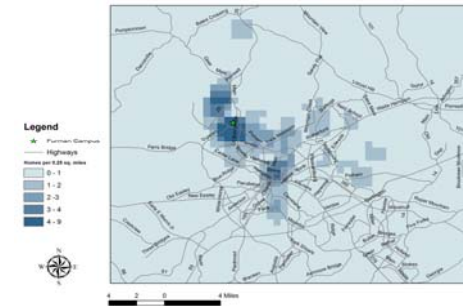


Figure 5. Density map of home addresses of Furman employees. The greatest concentration lives near the campus.

The address locations of Furman employees were used to calculate a density layer. This can be a useful tool in determining proximity between Furman employees and the campus. If employees live close by others who also commute to Furman everyday, it stands to reason that a carpool could be implemented with a neighborhood focus, thereby reducing carbon emissions significantly. One aspect of the data though, is that the areas with the greatest densities are those closest to the campus, but the greatest reduction in emissions could be achieved by implementing a carpool for those over five miles from campus.

Discussion and Conclusions

The majority of Furman faculty and staff, 71.4%, live within ten miles of the campus and 8% live within one mile. However, there is a difference between faculty and staff, with 78% of faculty and only 67% of staff living within ten miles. The calculation of the total emissions given off by Furman employees on the daily commute to work involves summing the total miles traveled, followed by using an average value for fuel efficiency to calculate the total amount of gasoline used. Using a value of 17.3 mpg from the Department of Transportation, an assumption of 250 days of commuting to and from campus, and the value of 19.6 lbs. of CO₂ given off from burning one gallon of gasoline, Furman's yearly emissions reach 2637.5 tons. This number is just a rough estimate and probably underestimates the total emissions from the daily commute of all employees. Ultimately the Committee on Sustainability at Furman will use the distance data calculated in this project, combined with an employee survey to determine the number of faculty and staff who walk, bike, or carpool to Furman to calculate carbon emissions using a standard formula to enable comparisons between schools.

Sources

Furman Faculty and Staff addresses – Furman University Personnel Office
 Fuel efficiency data – U.S. Department of Transportation, Research and Innovative Technology Administration
 CO₂ emissions data – U.S. Department of Energy, Energy Information Administration
 2006 President's Report: Sustainability and Furman University – Furman University
 Latitude/Longitude coordinates for each address – Batch Geocoding
 Streetmap USA, South Carolina state and county maps – ESRI data
 Map projections:
 -Coordinate system: GCS_North_American_1983
 -Datum: NAD 1983

Acknowledgements

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