

# 'Green' ville: Structured by Socio-Economic Variables

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## Abstract

'Green' development is becoming more widely known and practiced. LEED, Energy Star, and EarthCraft are leading 'green' designs that contain unique characteristics among one another, yet have a common goal of building sustainable architecture. The purpose of this study was to provide a preliminary examination of the relationships between Greenville County block group median household income levels and the type of 'green' development (LEED, Energy Star, and EarthCraft) found in those block groups. The gathered data on the Greenville County block group median household income and lists of all 'green' buildings in Greenville County were overlaid in Geographical Information Systems (GIS) in order to analyze the relationships between median household income level and type of 'green' building found in those areas. It was concluded that there is no significant correlation between the specific type of 'green' building and median household income level, but rather, a relationship between the level of 'green' rating and the level of median household income. It was found that the higher the rating, the higher the median household income. The employment of 'green' architecture provides a sustainable alternative for traditional building practices, but it also allows for various income levels to live eco-friendly.

## I. Introduction

This project is going to specifically look at 'green' developments in Greenville County, South Carolina. LEED, EarthCraft and Energy-Star developments will all be included in the data for Greenville County. It is expected that plotting this data geographically will exhibit 'green' development hot spots. Socio-economic factors, such as median household income, will be compared to areas of 'green' development. The anticipated results of the study should show a positive correlation between the various levels of 'green' building certifications with the various levels of median household incomes in the Greenville County block areas.

## II. Literature Review

Over the past several years the comparison of Energy-Star and LEED designs has been a popular topic. It has been suggested that Energy Star and LEED designs are helping to raise the standard in facility design and operation by targeting the energy and environmental efficiency of buildings. According to D'Antonio, one does not need to have state-of-the-art systems to have an energy-efficient building (D'Antonio, 2004). Despite the economic downturn, analyzing trends in LEED and Energy-Star environmental designs project continuous future 'green' developments. This claim is supported by examining investments, socio-economic factors, sale prices and eco-certified properties (Fuerst, 2009). Perhaps, due to the economic downturn, people are turning away from state-of-the-art energy-efficient systems and looking for other attractive incentives that will provide the owner with energy-efficiency at a lower cost. A mortgage incentive is one way for having an energy-efficient building (EarthCraft House, 2010). Shedding light on successful current trends in 'green' technology, the U.S. Department of Energy asserts that new 'green' building practices are being widely utilized by companies and organizations and proving to be effective. Some of the many advanced building technologies used include: high efficiency furnaces, energy recovery ventilators, low-e argon-filled windows, improved insulation, advanced wood products, and a new line of energy efficient modular homes (Department of Energy, 2001). Energy-efficient building is becoming better defined and practiced. Also, socio-economic variables, such as income and the ability to invest, are important driving forces behind the philosophies of 'green' development and determining which areas and what design of energy-efficient building will be developed.

## III. Methodology

This project requires data that contain block group boundary information, a complete list of addresses of all types of buildings (residential and commercial) that are LEED, EarthCraft or Energy-Star certified and rated, and the list of median income for each Census block group in Greenville County.

- American Fact Finder was used to find Greenville County median household income per block group.
- U.S. Census Bureau provided the Greenville County block group TIGER/Line file.
- The median household income and the Greenville County block group file were joined in ArcMap10. This resulted in a thematic map.
- Consulted U.S. Green Building Council, Energy Star and Greater Atlanta Home Builders Association (David Ellis, 20 March 2011) to obtain all certified and rated green buildings in Greenville County.
- A compiled Excel list of all the Green buildings in Greenville County (LEED, EarthCraft and Energy Star) was geocoded in ArcMap10 to then be overlaid on the median household income and Greenville County block group layer.
- Each building type was color coded based on the U.S. Census Bureau North American Industry Classification System (NAICS), and LEED, EarthCraft and Energy Star were given a specified point shape.
- The point data and polygon data were intersected to determine relationships between Green building design and median household income levels.

## VII. References

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## IV. Results and Discussion

The results demonstrate that LEED, Energy Star, and EarthCraft buildings are found among similar median household income levels in Greenville County. Although each 'green' building type does not seem to favor a particular portion of the median household income scale, there does seem to be a correlation between the level of rating and median household income. When looking more in depth into each individual 'green' building type many of the EarthCraft homes found in this area are associated with Habitat for Humanity, and LEED and Energy Star exemplify that the higher the rating, the higher the median household income. The higher median household income level that is associated with the Gold, rather than the Platinum rating, may be attributed to the idea that people find the Gold rating to be more cost efficient, especially during the economic downturn. Greenville city seems to be the only major hot spot for various 'green' building designs.

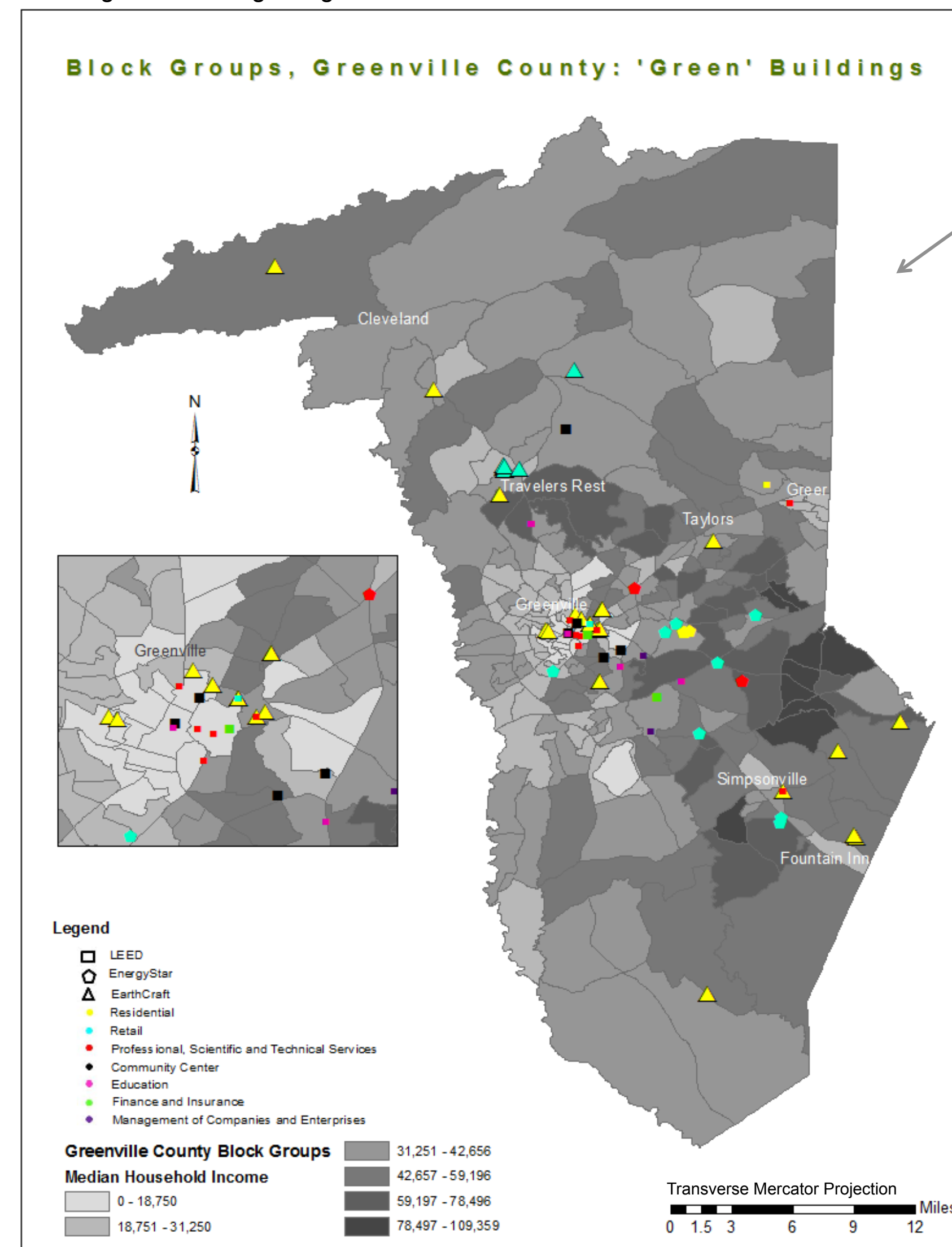


Figure 1. Type of Green Buildings In Greenville County, SC. This figure is based on median household income per block group. 94 total 'green' buildings in Greenville County, SC.

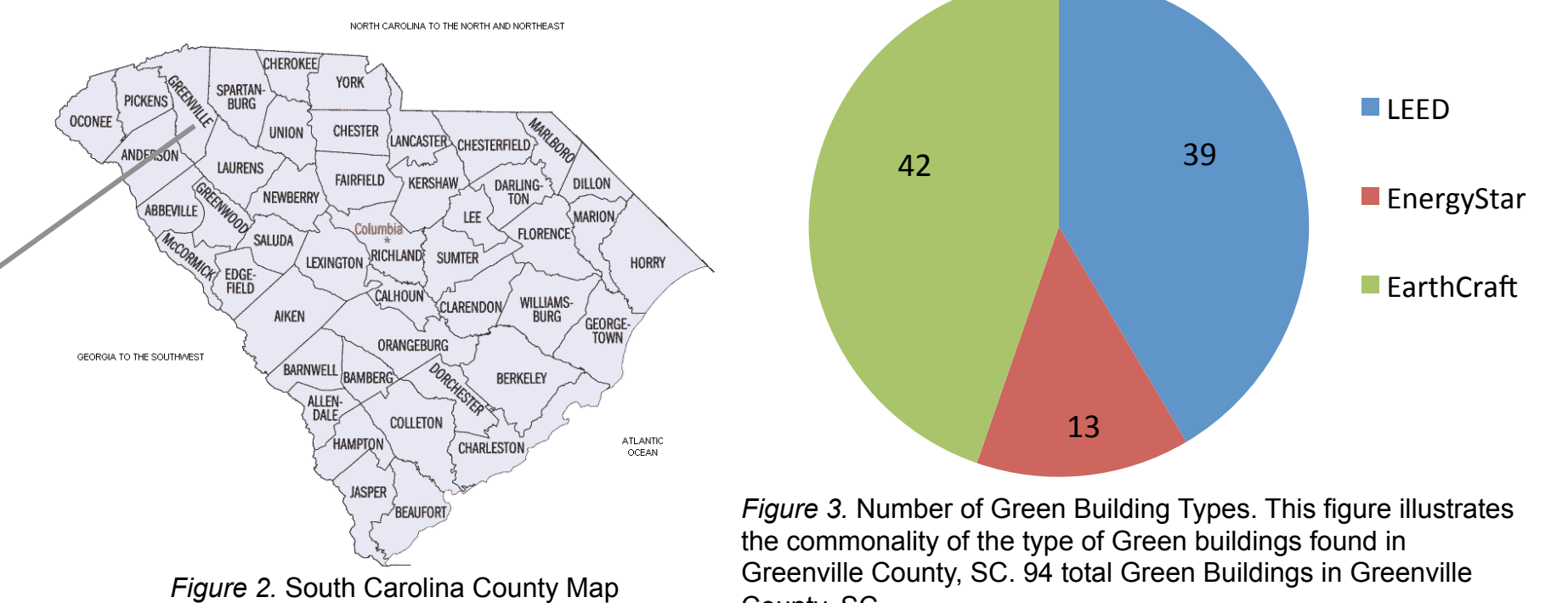


Figure 2. South Carolina County Map

Type of Green Building	Minimum Median Household Income (\$)	Maximum Median Household Income (\$)
LEED	10,984	68,125
Energy Star	25,987	61,979
EarthCraft	10,984	73,542

Figure 4. Relation of Green Building Type to Median Household Income. This figure illustrates the type of Green Building Compared to Minimum and Maximum median household income.

LEED Rating (based on 100 base points)	Minimum Median Household Income (\$)	Maximum Median Household Income (\$)
Certified (40-49)	31,853	31,853
Silver (50-59)	10,984	58,750
Gold (60-79)	33,940	68,125
Platinum (80+)	31,853	31,853

Figure 5. LEED Compared to median household income. This figure illustrates the type of LEED rating that is prevalent in certain median household income levels. LEED point system is based on satisfying specific green building criteria: Sustainable Sites (SS), Water Efficiency (WE), Energy and Atmosphere (EA), Materials and Resources (MR), Indoor Environmental Quality (IEQ), and Innovation in Design (ID).

Energy Star Rating	Minimum Median Household Income (\$)	Maximum Median Household Income (\$)
75-84	25,987	61,979
85-94	39,597	60,455

Figure 6. Energy Star Compared to median household income. This table demonstrates the type of Energy Star rating that is commonly found in certain median household income levels. Rating system based on 1-100. Rating of 50 indicates average energy performance, while a rating of 75 or better indicates top performance. A rating of 75 or better is eligible for the Energy Star label. Statistically representative models are used to compare your building against similar buildings from a national survey known as the Commercial Building Energy Consumption Survey (CBECS) to determine Energy Star rating, and it is conducted every four years.

## V. Conclusion

This preliminary study focused on the relationship between the type of 'green' design and the median household income level in Greenville County, SC. The results yield a correlation between the level of certification level and the level of median household income. Although there is no strong relationship between the type of 'green' design found in certain median household income levels, this research does support the claim that people do not need to have the state-of-the-art systems in order to have an energy efficient building. The results also support the idea that energy-efficient designs are beginning to be used in a variety of housing and commercial type buildings.

## VI. Future Research

It would be interesting to update this research every 5-10 years to see how the trends stay the same or change, and see if there becomes a greater correlation with the type of 'green' design with the median household income level. The updated data set would provide more information on how energy-efficient building hot spots remain the same or change over time. Having a larger dataset would allow for residential and commercial data points to be separated and allow for deeper analysis on factors that yield a correlation between building type and location. Comparing the results to the trend in the economy would provide another dimension to the research.

## VIII. Acknowledgements

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