**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 research was to provide a preliminary examination of the relationships between Greenville County block group median household income levels and the type of ‘green’ design (LEED, Energy Star, and EarthCraft) found in those block groups. The gathered data on the Greenville County block group median household income levels and list of all ‘green’ buildings in Greenville County were overlaid in Geographical Information Systems (GIS) in order to analyze the relationships between median household income levels 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 groups.

**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, 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 groups.

**III. Methodology**

This project requires that building group boundary information, a complete list of addresses of all types of buildings (residential and commercial) that are LEED, EarthCraft, certified or 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.

**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.

<table>
<thead>
<tr>
<th>Type of Building</th>
<th>Minimum Median Household Income ($)</th>
<th>Maximum Median Household Income ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LEED</td>
<td>10,984</td>
<td>68,125</td>
</tr>
<tr>
<td>Energy Star</td>
<td>25,067</td>
<td>61,879</td>
</tr>
<tr>
<td>EarthCraft</td>
<td>10,984</td>
<td>73,142</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LEED Rating (based on 100 base rating)</th>
<th>Minimum Median Household Income ($)</th>
<th>Maximum Median Household Income ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central (60–69)</td>
<td>31,483</td>
<td>56,750</td>
</tr>
<tr>
<td>Silver (50–59)</td>
<td>10,984</td>
<td>56,750</td>
</tr>
<tr>
<td>Gold (40–49)</td>
<td>31,483</td>
<td>68,125</td>
</tr>
<tr>
<td>Platinum (30–39)</td>
<td>31,483</td>
<td>68,125</td>
</tr>
</tbody>
</table>

**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 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 the energy-efficient building hot spots that change or remain the same 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 concentrated building trend. Comparing the results to the trend in the economy would provide another dimension to the research.

**VII. References**

**VIII. Acknowledgements**

The author wants to thank and acknowledge those who helped make this research possible: Amanda Davis, Mike Winkler, David Ellis (Arlington Homebuilders Association), and Mary Peti Crozier (Crozier Architecture).

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*Image 1: Greenville County Map.*

*Image 2: Greenville County Block Group Map.*


*Image 4: Greenville County Block Group Median Household Income Map.*

*Figure 1. LEED Compared to median household income. This figure illustrates the type of LEED rating in a certain median household income block group.*

*Figure 2. LEED Compared to median household income. This figure illustrates the type of LEED rating in a certain median household income block group.*

*Figure 3. LEED Compared to median household income. This figure illustrates the type of LEED rating in a certain median household income block group.*

*Table 1. Minimum Median Household Income (LEED). This table demonstrates the type of LEED rating compared to median household income. The LEED rating is based on a 100 base rating scale.*

*Table 2. Minimum Median Household Income (Energy Star). This table demonstrates the type of Energy Star rating compared to median household income.*

*Table 3. Minimum Median Household Income (EarthCraft). This table demonstrates the type of EarthCraft rating compared to median household income.*