completed the surveys, women representing 59% of the population, and men representing 41% of the population.

The fact that more women returned the survey than men is not very surprising; many religious denominations report that women are usually more likely to attend Sunday church services than men (Molloy, 2005). As such, it is possible that the survey distribution method favored women over men in that surveys were distributed prior to and after Sunday church services. More research needs to be conducted to assert that this is true at the Unitarian Universalist Church of Muncie, but a general overview of the congregation on a Sunday indicates that more women are in attendance than men. It is important to note, however, that a good deal of men also make up the congregation at the Unitarian Universalist Church of Muncie; there being more women in attendance at Sunday services than men could be coincidental.

It is also possible that women taking the survey felt more of an obligation to complete the survey, or wanted to make sure their opinions were heard. A final reason more women returned the survey than men corresponds with the idea that women are more inclined to support environmental policies because of their concern for the next generation—their children, or their grandchildren.

![Response Frequency by Gender](image)

*Figure 4.3 Response frequency of environmental surveys by gender.*
If one examines the Seven Principles of Unitarian Universalism (Table 2.1 in the Literature Review section), she/he will find that nearly half of the Principles are geared toward equality, justice, acceptance of all people, or believing that all people have worth. These Principles set the stage for equal rights for all individuals, and this congregation takes great pride in allowing women, minorities, and members of the gay/lesbian/bisexual/transgender community to have equal rights. With such an emphasis placed on the opportunity for equality in all aspects of living, it is not surprising that women in this congregation have an environmental impact level that is equal to that of men.

Age Analysis

As discussed in the Introduction, it was hypothesized that there would be a bell-shaped curve when comparing mean environmental impact levels by age group. It was hypothesized that the 36-50 age group would have the highest environmental impact because many congregants of this age group have young families. As any parent knows, young families require many resources beyond that of a single-person or even a household without children, usually because of transportation to and from school, extracurricular activities, increased amounts of groceries and laundry, and usually a larger home. In addition, young children are usually not aware of energy-saving techniques around the house and will forget to turn lights off when they leave a room, or will take longer showers; both of these practices require energy that is derived from coal-generated power plants.
The 16-20 and 21-35 age group typically represent the college-age and young singles in the Muncie community. Thus, most individuals within this age group have not started families yet, and so were hypothesized to have a lower footprint than the 36-50 age group. It was also hypothesized that the 21-35 age group would have the lowest environmental impact level of all the age groups, as many in this age group attend college and live in apartments, either by themselves or with roommates. In addition, Muncie provides free public transportation opportunities for students; this aspect resulted in the hypothesis that public transportation would be most utilized by this age group, thus resulting in a lower mean impact level.

<table>
<thead>
<tr>
<th>Descriptive Statistics</th>
<th>16-20</th>
<th>21-35</th>
<th>36-50</th>
<th>51-65</th>
<th>&gt;65</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>17</td>
<td>16.12</td>
<td>20.31</td>
<td>27.45</td>
<td>27.17</td>
</tr>
<tr>
<td>Standard Error</td>
<td>0</td>
<td>1.18</td>
<td>1.53</td>
<td>1.62</td>
<td>1.21</td>
</tr>
<tr>
<td>Median</td>
<td>17</td>
<td>17</td>
<td>21</td>
<td>27</td>
<td>26</td>
</tr>
<tr>
<td>Mode</td>
<td>No Data</td>
<td>10</td>
<td>21</td>
<td>22</td>
<td>26</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>No Data</td>
<td>4.88</td>
<td>6.13</td>
<td>7.68</td>
<td>5.79</td>
</tr>
<tr>
<td>Skewness</td>
<td>No Data</td>
<td>-0.04</td>
<td>0.22</td>
<td>0.53</td>
<td>0.19</td>
</tr>
<tr>
<td>Range</td>
<td>0</td>
<td>17</td>
<td>19</td>
<td>27</td>
<td>21</td>
</tr>
<tr>
<td>Minimum</td>
<td>17</td>
<td>8</td>
<td>12</td>
<td>17</td>
<td>18</td>
</tr>
<tr>
<td>Maximum</td>
<td>17</td>
<td>25</td>
<td>31</td>
<td>44</td>
<td>39</td>
</tr>
<tr>
<td>Count</td>
<td>1</td>
<td>17</td>
<td>16</td>
<td>22</td>
<td>23</td>
</tr>
</tbody>
</table>

The 51-65 and >65 age groups were hypothesized to have lower environmental impacts than the 36-50 age group because these individuals are beginning to reach the "empty nest" and retirement stages of their lives. This life stage is typically characterized by moving to a smaller house and not spending as much time and/or resources shuttling children from one location/activity to another, doing many loads of laundry, and cooking for four or more people during mealtimes. Thus, it was hypothesized that this age group was consuming fewer resources than the 36-50 age groups. These groups were
hypothesized to have larger footprints than the 21-35 age group, however, because of the level of economic stability that is associated with aging. As those members of the 51-65 and >65 age groups have been settled in a place of employment for a longer period of time than the 21-35 age group, they would be more willing to invest in larger homes and newer cars that require a higher level of economic commitment.

As seen in Table 4.3 and Figure 4.4, this hypothesis was partially correct. The 21-35 age group had the lowest mean environmental impact level, as much as 11 acres less than that of the 51-65 and >65 age groups. In fact, if one were to compare the mean environmental impact of the three younger age groups (17.8 acres) with that of the two older groups (27.31), the difference is still about 10 acres.

The standard deviation increased as the age level increased (Table 4.3), until it decreased in the >65 age group. This indicates that the data were clustered most closely about the mean in the 21-35 and >65 age groups, less so in the 36-50 age group, and least so in the 51-65 group. As can be expected by the standard deviation results, the 21-35 age group had the lowest range between the maximum and minimum impact levels. The 16-20 age group had a range of 0 and a standard deviation that could not be calculated because of there being only one response returned from this age group. This is not enough sufficient data to make assumptions about this age group, and so more research is required to gain additional information.
Age is a useful demographic tool in determining the demographic make-up of the Unitarian Universalist Church of Muncie’s congregation. Figure 4.5 shows the level of responses by age group, and the >65 and 51-65 age groups represent the highest amount of completed surveys. Collectively, these two age groups make up 57% of the total survey responses. This indicates that this congregation has a demographic most represented by the 51-65 and >65 age groups, which is not unusual for religious communities within the United States (Molloy, 2005). This could also be indicative of this age group’s level of environmental concern, but as the five age groups had mean concern levels that were nearly equal (3.0, 3.4, 3.3, 3.3, and 3.5, respectively), this possibility is unlikely.

There are many reasons for religious communities being skewed toward an older demographic, among these being: younger age groups may not feel as if they have the time or money to dedicate to a religious community; younger age groups may have other opportunities to be part of a community with which they may identify themselves, such as extra-curricular activities at school or in the workplace; and the older generations
may be dedicating more thought to what will happen after their lives come to an end. In-depth examinations of these few possibilities are beyond the scope of this research, but may hold promise for future research projects.

![Response Frequency by Age Group](image)

**Figure 4.5.** Response frequency by age group (n=79).

The original hypothesis must be rejected in its prediction of the manner that impact levels would be distributed. As seen in Figure 4.4, the overall trend resembled a positive correlative relationship between age and impact level instead of a normally shaped distribution. Instead of the 36-50 age group having the highest mean impact level, the 51-65 age group was the highest. The impact level of the >65 age group was lower than that of the 51-65 age group, but not as much as was predicted. This would indicate that the factors assumed to influence these levels did not play as prominent a role as had been previously hypothesized.

Seeing that there appeared to be a positive correlative relationship between age and mean environmental impact level, a Pearson’s Correlation analysis was conducted. The results of this analysis are available in Table 4.4. A one-tailed test was used for this
analysis, as it was observed that a specific directional relationship (positive) existed between the two variables. The correlation coefficient of this analysis was 0.574, indicating a strong positive relationship between the two variables. In other words, the mean environmental impact level increased as the participants’ ages increased.

Table 4.4. Pearson’s Correlation analysis of age and impact levels.

<table>
<thead>
<tr>
<th>Correlation</th>
<th>Age</th>
<th>Impact (acres)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>1</td>
<td>0.574</td>
</tr>
<tr>
<td>Impact (acres)</td>
<td>0.574</td>
<td>1</td>
</tr>
</tbody>
</table>

It is important to consider that a correlative relationship does not imply causation. In this case, mean environmental impact increases as the participants’ ages increase, indicating that these two variables are somehow related. Age alone cannot influence one’s environmental impact; rather, this correlative relationship probably exists because those of the older age groups can afford to drive farther and more often, as well as being in a financial situation to purchase larger homes.

Overall, there were very few differences between the responses of the 51-65 age group and the 21-35 age group. Why, then, did the 51-65 age group have ecological footprints that were 11 acres higher? Table 4.5 (below) shows the fields that were most indicative of the differences. The younger age group was more likely than the older group to utilize transportation other than a personal vehicle; 35.3% of the 21-25 age group indicated that their primary mode of transportation was either walking/bicycling, riding the bus, or carpooling, whereas only 14.3% of the 51-65 age group did this. The reduction in greenhouse gases caused by not using a personal vehicle is a factor that would significantly reduce one’s ecological footprint.
An interesting observation is that as the environmental impact levels increase, the level of personal vehicle usage also increases (Table 4.5). For example, the >65 group has one of the highest personal vehicle usage (95.7 %) levels. The 16-20 age group demonstrated a higher level than the >65 age group, but this is not a significant figure because the 16-20 age group only contained one participant. It is interesting to note, however, that the >65 age group appears to drive less than the 51-65 age group. Most participants in the >65 age group indicated that they drove between 10 and 100 miles each week—and many traveled less distance than that—while every member of 51-65 drove between 10 and 100 miles per week, if not farther. This difference in distance traveled per week could be indicative for the >65 age group had a lower mean environmental impact level than the 51-65 age group.

Table 4.5. Fields of major differences between age groups (n=79).

<table>
<thead>
<tr>
<th>Parameter</th>
<th>16-20</th>
<th>21-35</th>
<th>35-50</th>
<th>51-65</th>
<th>&gt;65</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary transportation is a personal vehicle</td>
<td>100%</td>
<td>64.7%</td>
<td>81.2%</td>
<td>85.7%</td>
<td>95.7%</td>
</tr>
<tr>
<td>Mean household size (people)</td>
<td>3.0</td>
<td>2.24</td>
<td>2.94</td>
<td>1.77</td>
<td>1.87</td>
</tr>
<tr>
<td>Mean home size</td>
<td>Don't know</td>
<td>500 - 1000 sq. ft</td>
<td>1500 - 2000 sq. ft</td>
<td>1500 - 2000 sq. ft</td>
<td>1500 - 2000 sq. ft</td>
</tr>
</tbody>
</table>

The largest differences between the 21-35 age group and the 51-65 age group occur between mean home and household sizes. As seen in Table 4.5, the mean number of people living in a 21-35 household is 2.4 people, whereas this figure is 1.77 in the 51-65 age group. These differences in mean household size are indicative of children leaving the household; a mean household size of 1.77 indicates that most survey participants in the 51-65 age group either live alone, or with a spouse/partner/roommate.
At the same time, however, the mean household size within the 51-65 age group is nearly double that of the 21-35 age group. This means that, on average, the 51-65 age group has 25% fewer people living in a space that is 50% larger than that of the 21-35 age group. A large living space indicates a significant increase in the 51-65 age group's mean environmental impact level, as more resources are required to heat and illuminate the larger home. With a larger space being divided by fewer people, the impact level per person is going be higher for the 51-65 age group than the 21-35 age group.

Figure 4.6 illustrates this concept by comparing home size responses for each age group. It is quite evident that the 21-35 age group has smaller homes; the minimum home size in this age group is <500 square feet, and the maximum is 1500-2000 square feet. This age group's most common home size is in the range of 500-1000 square feet. This home size is indicative of the different life stage being experienced by the younger group; these individuals may be single, or are just starting a career and do not have the monetary or employment stability to invest in a single-family home. Thus, their homes are smaller than that of the older groups.

![Comparison of Home Size by Age Group](image-url)

**Figure 4.6.** Comparison of home size by age group (n=79).
This distribution is sharply contrasted by the >65 age group, which had a minimum home size within the range of 1500-2000 square feet, and a maximum home size that measured >2500 square feet. The 51-65 age group home size distribution resembles that of the >65 group, though it is more widely distributed throughout the home size categories. The minimum home size in the 51-65 group is 500-1000 square feet, with a maximum that falls within the >2500 square feet category. This home size is indicative of the life stage being experienced, as well; presumably, those in the >65 age group have attained long-term monetary and employment stability, having purchased a larger home to raise children. As children typically leave the home when they are grown, which usually happens between a parent’s late forties to early sixties, the home large enough for a family of four or five is now only being occupied by that parent and his/her partner or spouse. Some individuals may choose to purchase a smaller home after children leave the household to start homes of their own, but some individuals choose to keep their larger home for economic or sentimental reasons, or even convenience.

This occurrence of larger homes is one of the factors that appear to influence the results of the ecological footprint survey the most. To illustrate this point, the PI conducted the Ecological Footprint Quiz for a hypothetical individual living in different home sizes. Table 4.6 illustrates the results of this comparison. All other factors being held constant, this individual had a beginning ecological footprint of 9.6 acres. In changing this individual’s home size from the <500 square feet category to the 500-1000 square feet category, the ecological footprint increased by 4.7 acres. By the time this
hypothetical individual’s home size had increased to >2500 square feet, his ecological footprint had increased to nearly three and a half times its original amount: 33.3 acres.


<table>
<thead>
<tr>
<th>Category</th>
<th>Parameter</th>
<th>Responses of Hypothetical Individual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food</td>
<td>Frequency of eating meat</td>
<td>Daily</td>
</tr>
<tr>
<td></td>
<td>Origin of food</td>
<td>Far away, packaged, and processed</td>
</tr>
<tr>
<td>Goods and Services</td>
<td>Amount of waste production</td>
<td>Less waste than neighbors</td>
</tr>
<tr>
<td>Home</td>
<td>Household size (people)</td>
<td>2 people</td>
</tr>
<tr>
<td></td>
<td>Home size (sq. footage)</td>
<td>Variable</td>
</tr>
<tr>
<td></td>
<td>Household type</td>
<td>Free-standing home with mid- to large-size yard</td>
</tr>
<tr>
<td></td>
<td>Energy efficiency usage</td>
<td>Always</td>
</tr>
<tr>
<td>Transportation</td>
<td>Public Transportation</td>
<td>1 - 25 miles weekly</td>
</tr>
<tr>
<td></td>
<td>Motorcycle/ Scooter</td>
<td>0 miles weekly</td>
</tr>
<tr>
<td></td>
<td>Car</td>
<td>10 - 100 miles weekly</td>
</tr>
<tr>
<td></td>
<td>Walk/Bicycle</td>
<td>Most of the time</td>
</tr>
<tr>
<td></td>
<td>Airplane travel (annually)</td>
<td>3 hours</td>
</tr>
<tr>
<td></td>
<td>Vehicle's fuel efficiency</td>
<td>25 - 35 mpg</td>
</tr>
<tr>
<td></td>
<td>Frequency of carpooling</td>
<td>50% of the time</td>
</tr>
</tbody>
</table>

Clearly, this analysis supports the hypothesis that an individual’s ecological footprint increases as the size of his/her home increases, and offers valuable insight for the reason that the 51-65 age group had environmental impact levels were so much higher than that of the 21-35 age group.
General Quadrant Location

In order to determine if there was a relationship between the congregants’ ecological footprints and the location in which they resided, data was classified by quadrant location. Of the seventeen quads available for selection, the participants of this research represented only eleven quadrants. The six “empty quadrants” were removed from the analysis. Of the eleven “utilized quadrants”, three had only one participant living there. These quadrants—West Yorktown, Northeast Delaware County, and Southwest Delaware County—were included in overall statistical analyses, but were not examined in-depth due to insufficient data.

As seen in Table 4.5, the Downtown Muncie quadrant had the lowest mean ecological footprint. Northeast Delaware County was the only quadrant to have a lower mean environmental impact level, but this is not a realistic portrayal because only one participant lived there. In addition, the Downtown Muncie quadrant had the lowest range between its maximum and minimum impact levels. This quadrant, however, was positively skewed, indicating that the mean was greater than the median. This is indicative of an outlier at the high end of the distribution.

The Southwest quadrant of Muncie had the second lowest mean environmental impact level at 20.5 acres. This data were a little positively skewed, as the mean was less than the median, but not nearly as skewed as other quadrant distributions. In this case, the minimum ecological footprint was 13 acres, and the maximum was 31 acres. The standard deviation was 5.96 acres; this was one of the lowest standard deviations, which indicates that the data were clustered more closely about the mean in this quadrant than the others.
The East Yorktown quadrant, spanning the area west of Nebo Road and east of Tiger Drive, had a moderate mean ecological footprint level of 25.6 acres. This quadrant’s impact statistics were very similar to that of the Northeast Muncie quadrant; these two quadrants had nearly identical results. In both cases, the mean environmental impact levels were about 26 acres, and there was only a one-acre difference between these quadrants’ standard deviations (Table 4.7). A probable cause for the similarity between these quadrants is that the same number of participants was represented in both, and similar distances would be traveled to get to/from the workplace from these two quadrants.

The Northwest Muncie quadrant had the third highest mean environmental impact level (23.58 acres), nearly equal to that of the entire congregation (23.35 acres). This is not surprising, as this quadrant represents nearly 50% of the returned surveys. Because there were so many surveys returned from this quadrant, there was virtually no skewness. The range, however, was very high, which is because the minimum and maximum impact levels of the entire congregation were found in this quadrant.

The highest mean environmental impact level occurred in the Southeast Muncie quadrant, and was found to be 28.5 acres. This figure, however, could be suspect because only two participants classified this quadrant as their home location. Due to this low figure, the distribution’s skewness could not be calculated. This quadrant also saw extreme differences in impact levels; one survey was reported to have an impact of 19 acres, while the other was 38 acres.
Table 4.7. Descriptive environmental impact statistics of general quad locations (n=79).

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>16</td>
<td>26</td>
<td>23.58</td>
<td>20.5</td>
<td>28.5</td>
<td>28.6</td>
<td>32</td>
<td>24</td>
<td>13</td>
<td>25</td>
<td>23.08</td>
</tr>
<tr>
<td>Standard Error</td>
<td>3.61</td>
<td>2.39</td>
<td>1.33</td>
<td>2.43</td>
<td>9.50</td>
<td>2.84</td>
<td>0.00</td>
<td>1.78</td>
<td>0.00</td>
<td>0.00</td>
<td>2.57</td>
</tr>
<tr>
<td>Median</td>
<td>13</td>
<td>28</td>
<td>23</td>
<td>19.5</td>
<td>28.5</td>
<td>25</td>
<td>32</td>
<td>23.5</td>
<td>13</td>
<td>25</td>
<td>21.5</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>6.24</td>
<td>5.34</td>
<td>8.21</td>
<td>5.96</td>
<td>13.44</td>
<td>6.35</td>
<td>No Data</td>
<td>3.56</td>
<td>No Data</td>
<td>No Data</td>
<td>8.91</td>
</tr>
<tr>
<td>Skewness</td>
<td>1.29</td>
<td>-1.61</td>
<td>0.39</td>
<td>1.02</td>
<td>No Data</td>
<td>1.39</td>
<td>No Data</td>
<td>0.27</td>
<td>No Data</td>
<td>No Data</td>
<td>0.31</td>
</tr>
<tr>
<td>Range</td>
<td>12</td>
<td>14</td>
<td>36</td>
<td>18</td>
<td>19</td>
<td>16</td>
<td>0</td>
<td>7</td>
<td>0</td>
<td>0</td>
<td>29</td>
</tr>
<tr>
<td>Minimum</td>
<td>10</td>
<td>17*</td>
<td>8</td>
<td>13</td>
<td>19</td>
<td>20</td>
<td>32</td>
<td>21</td>
<td>13</td>
<td>25</td>
<td>10</td>
</tr>
<tr>
<td>Maximum</td>
<td>22</td>
<td>31</td>
<td>44</td>
<td>31</td>
<td>38</td>
<td>36</td>
<td>32</td>
<td>28</td>
<td>13</td>
<td>25</td>
<td>39</td>
</tr>
<tr>
<td>Count</td>
<td>3</td>
<td>5</td>
<td>38</td>
<td>6</td>
<td>2</td>
<td>5</td>
<td>1</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>12</td>
</tr>
</tbody>
</table>

*Indicates that data was not considered significant and therefore not included in statistical analyses.

It is interesting to note that the quadrant with the second-most responses was the Outside of Delaware County quadrant. This quadrant had 12 participants, and a mean impact level of 23.08 acres—very close to the congregation’s average of 23.35 acres. Like the Northwest Muncie quadrant, this quadrant had very similar standard deviation and skewness values. This would indicate that these two quadrants had similar-looking distributions that resembled a normal distribution. Having a standard deviation of 8.91 acres, however, indicates that the data were not clustered as closely about the mean as seen in the Northwest Delaware County quadrant (standard deviation: 3.56 acres) or in the Northeast Muncie quadrant (standard deviation: 5.34 acres).

Because the Unitarian Universalist Church is located in the Northwest Muncie quadrant, it is not surprising that this quadrant is the one with the most responses. People typically like to attend religious organizations located close to their homes, and this congregation appears to be no different. It is important to note, however, that distance from one’s home is not the only determining factor in the location organization with which one becomes involved; this is seen in the “Outside Delaware County” being the
quadrant with the second-highest amount of responses. Clearly, these individuals travel some distance to attend services available at the Unitarian Universalist Church of Muncie.

The Northwest Muncie quadrant also has the most residential neighborhoods, as seen by a visual interpretation of the roads in Figure 4.7, as well as the amount of public transportation routes servicing the quadrant. The Northwest Muncie quadrant, shown in Figure 4.7 as a grey color, has five bus routes servicing its locations, whereas the other quadrants only have three or four routes. This allows residents in the Northwest Muncie quadrant more opportunities to take advantage of public transportation, as the top two Muncie employers—Ball State University and Ball Memorial Hospital—are also located within this quadrant.

The proximity of two major employers, the church, and public transportation routes could be reasons why this quadrant reported a relatively low distance traveled per week. In fact, the Northwest Muncie quadrant ranked second lowest when comparing the mean distance its residents traveled per week. The quadrant having the lowest mileage traveled per week was the Downtown Muncie quadrant. This is not surprising, as this quadrant is conveniently located near several commercial, employment, transportation, and religious nodes. This proximity results in the Downtown Muncie residents not having to travel far to meet their daily needs.

Despite the proximity to public transportation routes, residents of the Northwest Muncie quadrant did not appear to take advantage of available public transportation. Only one of the Northwest Muncie survey respondents indicated that public transportation was the method he most frequently utilized. Five participants indicated
that they primarily walked or rode a bicycle to travel; the rest of the survey participants—all 33 of them—used a personal vehicle as their primary mode of transportation.

The residents of the Downtown Muncie quadrant differ significantly from the distribution of primary transportation methods seen in the Northwest Muncie quadrant. Rather than utilizing a personal vehicle for transportation, these individuals identified walking/bicycling and public transportation as their primary transportation methods. This is not surprising, as the central bus station is located in the center of the Downtown Muncie quadrant, and buses that travel to every corner of Muncie will return here every 15 minutes. Traveling from one end of the Northwest Muncie quadrant to the other by bus—for example, from a home located near North Walnut Avenue to Ball Memorial
Hospital—could take as long as 45 minutes because of the need to return to the central bus station to change buses. Driving this distance in a personal vehicle usually takes no more than 15 minutes, depending on traffic and weather/road conditions.

When faced with the option of driving 15 minutes to work instead of waiting for a bus and traveling an additional 45 minutes to arrive at one's final destination, it is not surprising that nearly all residents within the Northwest Muncie quadrant choose to utilize personal transportation over public transportation. This transportation choice could result in a higher ecological footprint because of the greenhouse gas emissions associated with driving; however, it does not seem to affect the mean ecological footprints as much as the home sizes due to the smaller weekly distance traveled in this quadrant.

Figure 4.3. Comparison of mean environmental impact levels in statistically significant Delaware County quadrants. Cartography by Lisa Nicklas.
The Downtown Muncie quadrant had the lowest mean ecological footprint (Figure 4.8) due to this quadrant’s proximity to the central bus station and major employment nodes. The major employment node for this quadrant is Ball State University. Nearly 66% of the residents within this quadrant were between 21 and 35 years of age, and thus is possible to conclude that the individuals living here are currently students at Ball State, or are recent graduates. Being students, these individuals possess special public transportation benefits, such as riding the bus for free. Most students, if they live a convenient distance from major campus bus routes—Route 16: Wal-mart, Route 14: Riverside/Rural King, and Route 1: Ball State University—will utilize this benefit because it is more economic than purchasing a parking permit from the University. This is an example of individuals making more environmentally friendly transportation decisions due to economic incentives/constraints.

Similarly, the individuals living in the Downtown Muncie quadrant have the smallest home size of any Muncie quadrant: between 300 and 550 square feet per person. This figure is vastly different than the home size per capita in the Northwest Muncie quadrant: between 745 and 990 square feet. The difference in home size can be attributed to the domicile types found within these quadrants; the Downtown Muncie quadrant has many apartment buildings or homes converted into apartments, whereas the Northwest Muncie quadrant consists of single-family homes. As discussed in the Age section, a smaller home will require fewer resources to heat and illuminate it, thus reducing one’s ecological footprint.
Total Footprints

As discussed in previous sections, the current mean ecological footprint level at the Unitarian Universalist Church of Muncie was 23.35 acres. Because the sample size represented about 32% of the total congregation (250 members), one may assume that the sample size can represent the total population. Thus mean environmental impact levels were extrapolated to determine the total land area required to support this population.

Table 4.8 shows a comparison of ecological footprints on three levels: current, goal, and sustainable. The current category represents the congregation’s current footprint, while the goal footprint category represents the congregation’s footprint if every person within the congregation voluntarily reduced his/her footprint to 12 acres—half of the current mean footprint. This goal is perfectly attainable for most Americans; nearly 13% of the survey participants had ecological footprints at or below 12 acres. This land area also represents the mean ecological footprint level of most Western Europeans, who arguably experience a higher quality of life than the average American (Thomson et al., 2007). The sustainable footprint category is purely theoretical, as very few individuals in the United States have a footprint that is currently at or below the sustainable level: 4 acres per person. Because of current employment, economic, social, and transportation limitations, it is highly unlikely that this environmental impact level can ever be reached in the United States. However, it is interesting to imagine what a sustainable footprint might look like.

The current footprint of the average UU is familiar, because it represents the typical American lifestyle (Table 4.8). The average UU will eat meat at least once a day,
purchase inorganic food in pre-packaged containers from producers living far away, live in a medium-sized single-family home with a spouse or partner, and utilize personal transportation to drive between 10 and 100 miles per week. This personal vehicle is usually a mid-size car or small van, having a moderate fuel efficiency of 15 to 25 miles per gallon.

<table>
<thead>
<tr>
<th>Footprint Category</th>
<th>Parameter</th>
<th>Average UU Footprint (23.35 acres)</th>
<th>Goal Footprint (12 acres)</th>
<th>Sustainable Footprint (4 acres)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food</td>
<td>Frequency of eating meat</td>
<td>Daily</td>
<td>Daily</td>
<td>Infrequently/ Vegetarian</td>
</tr>
<tr>
<td></td>
<td>Origin of food</td>
<td>Far away, packaged, and processed</td>
<td>Far away, packaged, and processed</td>
<td>Local and unprocessed</td>
</tr>
<tr>
<td>Goods and Services</td>
<td>Amount of waste production</td>
<td>Less waste than neighbors</td>
<td>Less waste than neighbors</td>
<td>Less waste than neighbors</td>
</tr>
<tr>
<td></td>
<td>Household size (people)</td>
<td>2 people</td>
<td>2 people</td>
<td>2 people</td>
</tr>
<tr>
<td></td>
<td>Household size (sq. footage)</td>
<td>1,500 - 2,000 sq. ft.</td>
<td>500 - 1000 sq. ft</td>
<td>&lt; 500 sq. feet</td>
</tr>
<tr>
<td></td>
<td>Household type</td>
<td>Free-standing home with mid- to large-size yard</td>
<td>Apartment</td>
<td>Green design residence</td>
</tr>
<tr>
<td></td>
<td>Energy efficiency usage</td>
<td>Often</td>
<td>Always</td>
<td>Always</td>
</tr>
<tr>
<td>Transportation</td>
<td>Public Transportation</td>
<td>0 miles weekly</td>
<td>1 - 25 miles weekly</td>
<td>25 - 75 miles weekly</td>
</tr>
<tr>
<td></td>
<td>Motorcycle/Scooter</td>
<td>0 miles weekly</td>
<td>0 miles weekly</td>
<td>0 miles weekly</td>
</tr>
<tr>
<td></td>
<td>Car</td>
<td>10 - 100 miles weekly</td>
<td>10 - 100 miles weekly</td>
<td>0 miles weekly</td>
</tr>
<tr>
<td></td>
<td>Walk/Bicycle</td>
<td>Seldom</td>
<td>Most of the time</td>
<td>Most of the time</td>
</tr>
<tr>
<td></td>
<td>Airplane travel (yearly)</td>
<td>3 hours annually**</td>
<td>3 hours annually</td>
<td>Never</td>
</tr>
<tr>
<td></td>
<td>Vehicle’s fuel efficiency</td>
<td>15 - 25 mpg</td>
<td>25 - 35 mpg</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>Frequency of carpooling</td>
<td>50% of the time**</td>
<td>75% of the time</td>
<td>100% of the time</td>
</tr>
<tr>
<td></td>
<td>Total Land Area</td>
<td>9.1 square miles</td>
<td>4.7 square miles</td>
<td>1.6 square miles</td>
</tr>
</tbody>
</table>

** Indicates that these fields were assumed during data analysis.
This current lifestyle may not sound extravagant, but it is not as healthy or community-friendly as it could be. The average UU may spend half of his/her time driving alone in the personal vehicle, and seldom walks or uses a bicycle to travel. These lifestyle choices prevent the UU from daily community interactions that might be available in the other footprint scenarios, such as talking to someone on the bus or interacting with the people in the neighboring apartment. Research conducted in Europe indicated that those individuals living closer to their neighbors and traveling with them on a daily basis (using public transportation) not only improved those individuals’ social interaction abilities, but also created a stronger sense of community and resulted in individuals feeling more satisfied and fulfilled (Thompson et al., 2007). Furthermore, this lifestyle, if lived by the entire congregation, would require a land area of 9.1 square miles—an area equal to a circle with a radius of 5.35 miles. This means that the impact radius of only 250 people is larger than the entire diameter of the Muncie city limits (Figure 4.9)!

As seen in Table 4.6, minimal changes would be needed to reduce the average footprint to the goal footprint of 12 acres per person. Eating habits and purchasing habits would remain the same, as would waste generation habits. The only differences would be in the type and size of home, as well as transportation habits. Rather than having two people living in a single-family home, they could choose to live in a one or two bedroom apartment ranging between 500 and 1000 square feet. A 500 square foot residence is one having length and width equal to 22 feet per side, and a 1000 square foot residence is one having a length and width equal to 32 feet per side. This is a perfectly comfortable
arrangement, particularly if one spends more time walking or bicycling outdoors and uses the home only for sleeping, relaxing during evening hours, and preparing/eating meals.

Transportation habits would change only in the fact that walking and bicycling would occur more often, and public transportation would be utilized more. Rather than never using public transportation, individuals could use the bus to travel between 1 and 25 miles per week—enough to run a few simple errands or travel to work a couple days each week. If the bus route does not pass directly by one’s residence or place of employment, bicycles can be used to make up the difference. The MITS encourages its riders to utilize bicycle power, and have even equipped their buses with specialized bike racks. The resulting reduction in car traffic would reduce road congestion, particularly during morning and evening rush hours, and would help improve one’s physical health.

By reducing the average UU footprint to 12 acres instead of 23.35 acres, the land area required to support daily practices would also be reduced by half. As seen in Figure 4.9, the goal footprint level is a land area of 4.7 square miles, or a circle with a radius of 3.8 miles. Though this land area is still larger than the city limits of Muncie, it represents a significant reduction in the land area impacted by the congregants’ daily practices.

Changing habits to support a sustainable footprint of only 4 acres per person would require drastic changes not only in individual lifestyles, but also in the economic, social, and transportation infrastructure of Muncie. A sustainable footprint at the Unitarian Universalist Church of Muncie would require all congregants to eat meat sparingly or not at all, live in small green-design residences with a spouse or partner, utilize only public transportation, walk or bicycle to meet their basic transportation needs, and never utilize airplane travel (Table 4.6). Though this scenario would reduce the total
environmental impact of the Unitarian Universalist Church of Muncie to only 1.6 miles—
the only impact level to be completely contained by the Muncie city limits (Figure 4.9)—
this impact level is currently improbable given the amount of changes in the current state
of the city's political, economic, and social infrastructures that would be needed to ensure
this level of sustainability.

Because ecological footprints are a visual concept, the total land areas seen in
Table 4.6 were combined using Geographic Information Systems (GIS) technology. The
radii of each ecological footprint scenario were overlain with data layers containing
Muncie's political boundaries, as well as prominent roads and water bodies in Delaware
County. This visual clearly illustrates the magnitude of impact that only 250 people have
upon the environment surrounding the city of Muncie.

It is important to remember, however, that cities—by their very nature—a will
require more land area than their political boundaries in order to sustain the people living
inside them. This is caused by urban dwellers not being able to cultivate their own food
or manufacture all the products they require, instead transporting food, goods, and
services from the surrounding agricultural and industrial areas. Thus, it is not uncommon
for cities like Vancouver or London to have footprints easily 300 times that of their
political boundaries (Groe, 2007; Moore, Nye, and Rydin, 2007).
Despite this fact, Figure 4.9 illustrates the magnitude by which cities can reduce their ecological footprints. With each theoretical reduction of the congregants' footprint levels, the total land area being utilized to support their lifestyles is also being reduced.

This visual aspect is the true educational power behind the Ecological Footprint Analysis,
as it provides individuals with a visual tool for comparison, and opens up opportunities for discussion.

If the combined environmental footprints of only 250 people resulted in a total footprint that was larger than the city of Muncie, what would the entire city of Muncie’s footprint look like? Figure 4.10 was created to answer that question, and utilized the same techniques and parameters used to create Figure 4.9. The visual results’ magnitudes were somewhat surprising, as many would not imagine the impact of Muncie to be quite as large as it is in reality.

Figure 4.10 illustrates the concept that cities consume resources from the surrounding areas, and thus have footprints far larger than their political boundaries. If the average UU footprint, which is nearly equal to that of the average American, is applied to the estimated 2006 population of Muncie—67,430 people—Muncie’s ecological footprint would cover the entirety of East Central Indiana, and even parts of Ohio! This impact area, equal to 2460 square miles, is 100 times larger than Muncie’s current political area of 24.1 square miles.

Not surprisingly, if every person in Muncie decided to make minimal changes in their home sizes and transportation habits such that a goal footprint of 12 acres per person could be attained, Muncie’s ecological footprint would decrease by half. Rather than having an impact area that was 100 times larger than the city limits of Muncie, the impact area would be only 52 times larger. This area still represents the entirety of East Central Indiana, and some of Ohio, but not to the extent seen at the current environmental impact level.
Muncie’s total ecological footprint would be further reduced if every person in Muncie was to reduce his/her individual footprint to the sustainable level, but this scenario is purely theoretical. Poverty is a real problem in Muncie—there are currently 21.5% of families living below the poverty level, and 31.2% of individuals living below the poverty level (US Census Bureau, 2007)—and choosing sustainable alternatives over the conventional is not the most economically appealing at the outset. Sustainable/energy efficient products, such as compact fluorescent light bulbs and hybrid vehicles, require more up-front capital than their conventional equivalents; capital that many families in Muncie do not have available. Despite energy-efficient products being the most economic option over the course of its lifetime, many families and individuals living in poverty do not feel as if they could put up enough initial capital to take advantage of that long-term investment.
This economic barrier is just one of the many examples of challenges in attaining the sustainable impact level of 4 acres per person. There are other barriers, including
transportation infrastructure, politics, population growth trends, existing urban
development plans, societal norms and cultural expectations, and countless others. The
sustainable impact level is not designed to be a possible feat; it is designed to be a
guideline for making changes in individual lives. Just as the Ecological Footprint
Analysis is not designed to pose solutions to the problem, but rather to open up
discussion about the ways in which individuals can make changes, the sustainable impact
level is meant to be a method of opening doors for future discussions.
CONCLUSION

This research was effective in rejecting most hypotheses about the Unitarian Universalist Church of Muncie’s ecological footprint. Rather than the average ecological footprint magnitude being less than that of the American community, for example, there was no significant difference between the congregation’s footprint and the American footprint. The original hypothesis concerning age analysis was also rejected. Rather than footprint magnitudes forming a normally distributed curve with the middle-aged participants having the greatest footprint magnitude, mean footprint magnitudes increased as age increased.

Generalizations influencing the original hypothesis about gender were also rejected. There appeared to be no significant differences in footprint magnitude upon the basis of gender. This would indicate that men and women have similar lifestyle choices that influence their ecological impacts levels. Further research must be conducted to determine any attitude differences toward environmental concern/awareness based upon gender.

The hypothesis about general quadrant locations was rejected upon insufficient data to support it. Though the quadrants within the Muncie city limits experienced significant response rates, the quadrants outside the city limits were not well represented.
This was not entirely unexpected, as the Delaware County quadrants have a lower population density than the Muncie quadrants. This hypothesis was further rejected due to the quadrant with the second-highest response rate was the Outside Delaware County quadrant, which was not specific enough in its geography to be used in analysis.

Despite the original hypothesis being rejected, the Muncie quadrants exhibited many interesting footprint patterns, particularly in transportation. Individuals living within the Downtown Muncie quadrant, for example, were most likely to utilize public transportation, and had the lowest ecological footprint magnitude. The Northwest Muncie quadrant had the highest response rating, and exhibited a mean ecological footprint nearly equal to that of the overall congregation impact (23.35 acres). This quadrant was also the most likely to utilize personal transportation, though individuals did not usually drive their vehicles more than 100 miles per week.

Research indicated that home size and daily transportation methods were among the strongest determinants of high footprint magnitude. Individuals having only two people living in a large home had larger footprints than individuals living in smaller homes, presumably due to the increased resources required to illuminate, heat, and cool the structure. It was found that older individuals had larger homes than younger individuals, a relationship that is not surprising due to it being customary that older individuals purchase larger homes while raising families. Once these individuals’ children left the home, however, it appeared that the survey participants remained in the larger home rather than relocating to a smaller one.

In Muncie, the lowest realistic housing footprint magnitude can be achieved when two individuals reside in a 500 to 1000 square foot apartment or single-family home. A
similar footprint magnitude can be attained when four individuals reside in a 1000 to 2000 square foot home. This is because the people residing there are dividing the resources being consumed; higher density in a smaller space results in a smaller footprint magnitude per capita. It is possible to attain the minimum realistic housing footprint in Muncie because there are many 1000 to 1500 square foot homes currently available on the housing market. Encouraging individuals to leave their larger homes for a smaller one, however, may be more difficult.

Transportation habits are one of the strongest determinants of footprint magnitudes, and are one of the factors easiest to change. Most survey participants drove between 10 and 100 miles per week, indicating that they rarely left Delaware County—possibly even the Muncie/Yorktown city limits—during that time. Research indicates that the most frequent trips via personal vehicle occur when the distance is less than three miles from the home (Groe, 2007). By eliminating or reducing the frequency of these trips, survey participants can reduce their time spent driving, as well as their transportation footprints. Simple lifestyle changes like planning a supply list before leaving the house could increase efficiency while running errands, as well as decrease one’s environmental impact caused by forgetting items and making several a “quick run to the store” to retrieve them.

This research project could have been improved had more statistics been performed, notably the Chi-square analysis for testing response variances. This test would provide a more accurate determination and comparison of categorical responses than means, variances, or standard deviations alone. Central tendency and data distribution methods are not in-depth enough statistical methods to accept or reject a
hypothesis. Despite these weaknesses, however, comparisons of basic statistics alluded to relationships between the data, such as the determining factors in footprint magnitude. It would also have been helpful to research a group of individuals not associated with the Unitarian Universalist Church of Muncie in order to obtain sufficient data supporting the Global Footprint Network’s research that the average American has an ecological footprint of 24 acres.

Furthermore, this research could have been improved had the PI been able to examine some of the calculations used to determine ecological footprint results in the online Ecological Footprint Quiz. As discussed previously, the parameters used in this footprint analysis program were vague and generalized; this resulted in potential error and/or inaccuracy of this project’s research. This issue one of the main criticisms of the ecological footprint analysis; thus, the issue is receiving the most attention from ecological footprint organizations like Redefining Progress and the Global Footprint Network. Researchers are working to standardize, expand, and create more specific parameters that will improve the accuracy of ecological footprints the world over (Wackernagel, 2005).

More research is required to determine which lifestyle factors most influence one’s individual ecological footprint, particularly at the local level. As more reliable data becomes available, and as more research is conducted in this area, ecological footprints will become more accurate. As for the Unitarian Universalist Church of Muncie, further research could be conducted to compare the congregation’s ecological footprint with those of other local faith communities.
REFERENCES


Appendix A. Materials submitted for IRB review.

A.1. Survey

1. How would you describe your knowledge level about global environmental issues (e.g. accelerated climate change/global warming, deforestation, biodiversity loss, ozone layer hole, etc.)?

   ______ Extremely knowledgeable
   ______ Very knowledgeable
   ______ Somewhat knowledgeable
   ______ Not at all knowledgeable

2. How would you describe your knowledge level about local environmental issues (e.g. recycling programs, watershed pollution, soil erosion, energy conservation, CAFOs, etc.)?

   ______ Extremely knowledgeable
   ______ Very knowledgeable
   ______ Somewhat knowledgeable
   ______ Not at all knowledgeable

3. How would you describe your concern about environmental issues and/or problems?

   ______ Extremely concerned
   ______ Very concerned
   ______ Somewhat concerned
   ______ Not at all concerned

4. - 8. How do the following statements describe you?

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
</table>

4. My actions/practices will not impact the environment.

5. It is difficult to recycle in my area.

6. It is too expensive to invest in energy-efficient products (e.g. compact fluorescent bulbs, water-saving showerheads, Energy Star products).
7. I would like to decrease my environmental impact, but I do not know how to begin.

8. I do not worry about environmental issues because others (e.g. future generations) will solve the problem instead.

9. How often do you recycle?
   - Always
   - Often
   - Sometimes
   - Seldom
   - Never

   Which products do you recycle?
   - Newspaper
   - #1 Plastics (e.g. soda bottles)
   - #2 Plastics (e.g. milk jugs, grocery bags)
   - #5 Plastics (e.g. yogurt containers)
   - #6 Plastics (e.g. Styrofoam)
   - Aluminum cans
   - Glass
   - Junk mail
   - Glossy magazines
   - #1 Plastics (e.g. soda bottles)
   - #2 Plastics (e.g. milk jugs, grocery bags)
   - #5 Plastics (e.g. yogurt containers)
   - #6 Plastics (e.g. Styrofoam)
   - Steel cans
   - Cardboard
   - Newspaper
   - #1 Plastics (e.g. soda bottles)
   - #2 Plastics (e.g. milk jugs, grocery bags)
   - #5 Plastics (e.g. yogurt containers)
   - #6 Plastics (e.g. Styrofoam)
   - Steel cans
   - Cardboard

10. How much waste do you generate, in comparison with your neighbors?
   - Less waste
   - About the same amount
   - More waste
   - Don’t know

11. Which best describes your daily transportation habits?
   - Walk/bicycle
   - Personal transportation (car, van, SUV, truck)
   - Public transportation
   - Other (please list):
   - Carpool/vanpool

12. Which best describes your primary vehicle?
   - Motorcycle/moped
   - Hybrid car
   - Compact car
   - Mid-size car
   - Large car/minivan
   - SUV/small truck
   - Large truck/van

13. What is your vehicle’s average fuel efficiency?
   - < 15 miles per gallon
   - 15 – 25 miles per gallon
   - 25 – 35 miles per gallon
   - 35 – 50 miles per gallon
   - > 50 miles per gallon
   - Don’t know

14. On average, how many miles do you drive each week?
   - < 10 miles
   - 10 - 100 miles
   - 100 - 200 miles
   - 200 – 300 miles
   - 300 – 400 miles
   - > 400 miles

15. Do you practice energy conservation in your home (e.g. turn off lights when leaving a room, use compact fluorescent bulbs, reduce water temperature to 110° F, etc.)?
   - Always
   - Often
   - Sometimes
   - Seldom
   - Never
16. Which of these best describes your home?

- Multi-story apartment
- Free-standing house with mid- to large-size yard
- Mobile home
- House in a subdivision
- Duplex/townhouse
- Other (please list): ___________

17. What is the approximate size of your home?

- < 500 square feet
- 500 - 1,000 square feet
- 1,000 - 1,500 square feet
- > 2,500 square feet
- Don’t know

18. How many people currently live in your household?

- 1 person
- 2 people
- 3 people
- 4 people
- 5 people
- 6 people
- 7 or more people

19. How often do you eat animal-based products (e.g. beef, pork, chicken, fish, eggs, milk/cheese)?

- Never (vegan)
- Infrequently (strict vegetarian)
- Occasionally (no meat or occasional meat, but eggs/dairy almost daily)
- Often (meat once or twice a week)
- Very often (meat daily)
- Almost always (meat and eggs/dairy in almost every meal)

20. To the best of your knowledge, where does most of your food come from?

- Local producers (Farmer’s market/local produce stand)
- Regional producers (organic or inorganic)
- Organic producers from far away
- Inorganic producers from far away (Wal-mart)
- Don’t know

21. What is your gender? 

- Male
- Female

22. How old are you?

- 16 - 20 years
- 21 - 35 years
- 36 - 50 years
- 51 - 65 years
- > 65 years

23. Are you involved with any church committees/regular activities? 

- Yes
- No

Which one? Check all that apply.

- Board of Trustees
- Program Council
- Adult Religious Ed.
- Caring
- Community Service
- Fellowship
- Finance
- Green/Seventh Principle
- Hospitality
- Investment & Development
- Ministerial Relations
- Marketing
- Membership
- Personal Advisory
- Nominating
- Property Maintenance
- Religious Ed.
- Social Justice
- Stewardship
- Bazaar
- Communications
- Dinner Discussion
- Kitchen
24. Please indicate the quadrant in which you live on the list below. Use the map as a reference.

1: Downtown Muncie  
2: Northeast Muncie  
3: Northwest Muncie  
4: Southwest Muncie  
5: Southeast Muncie  
6: East Yorktown  
7: West Yorktown  
8: Daleville  
9: Selma  
10: Albany  
11: Eaton  
12: Gaston  
13: NW Delaware County  
14: NE Delaware County  
15: SE Delaware County  
16: SW Delaware County  
Outside Delaware County

*******

You have completed the survey! If you have any comments, questions, or concerns, please write them in the space below. Thank you for your participation.
A.2. Informed Consent Form

The purpose of this research project is to measure the participants’ environmental awareness and current ecological impact level, and will indicate the levels at which environmental education programs may need to be implemented. For this project, you will be asked to complete a survey about your current environmental awareness level and concern about environmental issues/problems, as well as answering questions about your daily practices at home (e.g. recycling, how much you drive, the size of your household, etc.). It will take approximately 10 minutes to complete.

All data will be maintained as confidential. Data will be stored in a locked filing cabinet in the researcher’s home.

The foreseeable risks or ill effects from participating in this study are minimal. There is a small possibility that answering some of the question on the questionnaires may evoke some feelings of anxiety. Should you experience any feelings of anxiety, there are counseling services available to you through the Ball State Counseling Center in Muncie, (765) 285-1736.

One benefit you may gain from your participation in this study is a better understanding of the environmental impact of your daily practices, as well as your current environmental awareness level. The results of this survey will be used in recommending better environmental education programs within the Unitarian Universalist Church of Muncie, as well as other religious communities in the region.

Your participation in this study is completely voluntary and you are free to withdraw from the study at any time, for any reason, without penalty or prejudice from the investigator. Please feel free to ask any questions of the investigator before signing the Informed Consent form and beginning the study, and at any time during the study.

For one’s rights as a research subject, the following person may be contacted: Melanie Morris, Coordinator of Research Compliance, Office of Academic Research and Sponsored Programs, Ball State University, Muncie, IN 47306, (765) 285-5070.

**********

I, ____________________________, agree to participate in this research project entitled, “Analysis of Environmental Awareness and Ecological Impact at the Unitarian Universalist Church of Muncie”. I have had the study explained to me and my questions have been answered to my satisfaction. I have read the description of this project and give my consent to participate. I understand that I will receive a copy of this informed consent form to keep for future reference.

__________________________________________  ______________________
Participant Signature                      Date

__________________________________________  ______________________
Principal Investigator’s Signature          Faculty Supervisor:

Lisa Nicklas, Undergraduate Researcher
Natural Resources and Environmental Management
Ball State University
Muncie, IN 47306
Telephone: (219) 363-3579
Email: lknicklas@gmail.com

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Office of Academic Research and Sponsored Programs
Ball State University
Muncie, IN 47306

November 18, 2007

To Whom It May Concern:

Please accept this letter of support for Lisa Nicklas's application for an Exempt Review of the Human Subjects Research. Lisa has discussed her project, "Analysis of Environmental Awareness and Ecological Impact at the Unitarian Universalist Church of Muncie," with other prominent members of the Program Council, Board of Trustees, and myself at the Unitarian Universalist Church of Muncie, and we have acknowledged a need for it within our congregation. We believe that this study of our congregation will be beneficial not only in determining a current level of environmental awareness within the congregation, but will also determine the need for future education and outreach programs—both within our congregation and in nearby religious communities. We also hope to use the results of this study in future community outreach initiatives, as well as including these results in an application to become a Certified Green Sanctuary.

As the President of the Unitarian Universalist Church of Muncie, Lisa Nicklas has my permission to conduct her survey before and after worship services for a month's time beginning in January 2008. She also has permission to recruit participants via the congregation's weekly newsletter, The Unigram, as well as in the congregation's Order of Service, which is distributed during worship services.

If you have any problems or concerns, feel free to contact me by phone (765)747-9867 or by email at burtonm1@aol.com.

Sincerely,

Mona Burton, Church President

1807 N. Brentwood
Muncie, IN 47304
A.4. Printed Recruitment Materials

The Unigram Announcements

Two weeks prior:

Church-wide Environmental Awareness and Ecological Impact Survey, Jan 6th - Feb 3rd
Our congregation’s level of environmental awareness is being studied to help us sponsor environmental education programs and become a UUA Certified Green Sanctuary. Lisa Nicklas is distributing a short, confidential questionnaire asking about your daily practices and level of concern about environmental issues. She will be distributing her survey at a table at the back of the church before and after worship services, beginning on January 6 and ending on February 3. Anyone is welcome to take this survey; we’d like to have as many people as possible participate! Contact Lisa Nicklas (lknicklas@gmail.com or 282-3740) if you have any questions.

One week prior:

Church-wide Environmental Awareness and Ecological Impact Survey, Jan 6th – Feb 3rd
Help our church become a UUA Certified Green Sanctuary! Lisa Nicklas will be distributing a short, confidential questionnaire asking about your environmental awareness and daily practices to determine our church’s impact on the environment. Beginning this Sunday, Lisa will be distributing her survey at the back of the church before and after worship services. Please take 5 or 10 minutes to complete this survey! We need as many people as possible to participate so we can have accurate results.

During event:

Church-wide Environmental Awareness and Ecological Impact Survey
All this month, Lisa Nicklas will be distributing a short, confidential questionnaire about your environmental awareness and daily practices. The results of this survey will help our church implement environmental education programs and become a UUA Certified Green Sanctuary, so every opinion counts! Please see Lisa at the back of the church before and after worship services, or contact her (lknicklas@gmail.com or 282-3740) if you have any questions!

Last week of event:

Church-wide Environmental Awareness and Ecological Impact Survey
This Sunday is your last chance to participate in the short, confidential questionnaire that will help us implement environmental education programs and become a UUA Certified Green Sanctuary! Lisa Nicklas will be distributing her survey at the back of the church before and after the worship service, and needs as many participants as possible! Make your opinion count!

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Order of Service Announcement (during event)
Church-wide Environmental Awareness Survey
Come see Lisa Nicklas at the back of the church today and fill out a short, confidential questionnaire about your environmental awareness and daily practices. Make your opinion heard, and help us become a UUA Certified Green Sanctuary! Questions? Contact Lisa Nicklas (lknicklas@gmail.com or 282-3740), or talk to her after the service.

Completion Certificate

This is to certify that

Lisa Nicklas

has completed the Human Participants Protection Education for Research Teams online course, sponsored by the National Institutes of Health (NIH), on 11/14/2007.

This course included the following:

- key historical events and current issues that impact guidelines and legislation on human participant protection in research.
- ethical principles and guidelines that should assist in resolving the ethical issues inherent in the conduct of research with human participants.
- the use of key ethical principles and federal regulations to protect human participants at various stages in the research process.
- a description of guidelines for the protection of special populations in research.
- a definition of informed consent and components necessary for a valid consent.
- a description of the role of the IRB in the research process.
- the roles, responsibilities, and interactions of federal agencies, institutions, and researchers in conducting research with human participants.

National Institutes of Health
http://www.nih.gov
Appendix B. Questions contained within the Redefining Progress and Earth Day Network's Ecological Footprint Quiz.

B.1. Food Footprint

How often do you eat animal based products? (beef, pork, chicken, fish, eggs, dairy products)

_____ Never (vegan)
_____ Infrequently (no meat, and eggs/dairy a few times a week) (strict vegetarian)
_____ Occasionally (no meat or occasional meat, but eggs/dairy almost daily)
_____ Often (meat once or twice a week)
_____ Very often (meat daily)
_____ Almost always (meat and eggs/dairy in almost every meal)

How much of the food that you eat is processed, packaged and not locally grown (from more than 200 miles away)?

_____ Most of the food I eat is processed, packaged, and from far away
_____ Three quarters
_____ Half
_____ One quarter
_____ Very little. Most of the food I eat is unprocessed, unpackaged and locally grown.

B.2. Goods/Services Footprint

Compared to people in your neighborhood, how much waste do you generate?

_____ Much less
_____ About the same
_____ Much more

Do you have electricity in your home?

_____ No
_____ Yes
_____ Yes, with energy conservation and efficiency
B.3. Shelter Footprint

How many people live in your household?

____ 1 person       ____ 5 people
____ 2 people       ____ 6 people
____ 3 people       ____ 7 or more people
____ 4 people

What is the size of your home?

____ 2500 square feet or larger       ____ 1000-1500 square feet
____ 1900-2500 square feet          ____ 500-1000 sq. feet
____ 1500-1900 square feet          ____ < 500 square feet

Which housing type best describes your home?

____ Free-standing house without running water
____ Free standing house with running water
____ Multi-story apartment building
____ Row house or building with 2-4 housing units
____ Green-design residence

B.4. Mobility Footprint

On average, how far do you travel on public transportation each week (bus, train, subway or ferry)?

____ 200 miles or more       ____ 1-25 miles
____ 75-200 miles          ____ 0 miles
____ 25-75 miles

On average, how far do you go by motorbike each week (as a driver or passenger)?

____ 200 miles or more       ____ 1-25 miles
____ 75-200 miles          ____ 0 miles
____ 25-75 miles

On average, how far do you go by car each week (as a driver or passenger)?

____ 400 miles or more       ____ 100-200 miles
____ 300-400 miles          ____ 10-100 miles
____ 200-300 miles          ____ 0 miles

Do you bicycle, walk, or use animal power to get around?

____ Most of the time
____ Sometimes
____ Seldom

Approximately how many hours do you spend flying each year?

____ 100 hours       ____ 3 hours
____ 25 hours        ____ Never fly
____ 10 hours

How many miles per gallon does your motorbike get?

____ More than 80 mpg       ____ 30-45 mpg
How often do you ride your motorbike with someone else, rather than alone?

- Almost never
- Occasionally (about 25%)
- Almost always
- Often (about 50%)

How many miles per gallon does your car get? (If you do not own a car, estimate the average fuel efficiency of the cars you ride in.)

- More than 50 mpg
- 35-50 mpg
- Fewer than 15 mpg
- 25-35 mpg

How often do you drive in a car with someone else, rather than alone?

- Almost never
- Occasionally (about 25%)
- Almost always
- Often (about 50%)
Appendix C. Sample calculations included in the analysis of this research.

C.1. SI to English Unit Conversions

Conversion factors

- 1 acre = 0.0015625 square miles
- 1 hectare = 2.471 acres
- 1 hectare = 10,000 square meters

Sample calculation: convert an ecological footprint of 15 acres into its equivalent units in hectares, square meters, and square miles.

1. Acres → Hectares: 
   \[ 15 \text{ ac} \times \frac{1 \text{ ha}}{2.471 \text{ ac}} = 6.07 \text{ ha} \]

2. Acres → Square Meters: 
   \[ 15 \text{ ac} \times \frac{10,000 \text{ sq. m}}{2.471 \text{ ac}} = 60,704 \text{ sq. m} \]

3. Acres → Square Miles: 
   \[ 15 \text{ ac} \times \frac{0.0015625 \text{ sq. mi}}{1 \text{ ac}} = 0.0234 \text{ sq. mi} \]

C.2. Central Tendency: Mean, Median, Skewness

Arithmetic mean: sum of a dataset divided by the sample size.

Formula: 
\[ X = \frac{\sum x}{N} \]

N is the sample size, and x are individual data values.

Median: middle number of the dataset when arranged in ascending/descending order.

Skewness: measure of the data distribution's symmetry (or asymmetry) by comparing the arithmetic mean and the median.

Sample Calculation: Find the mean and the median in the following dataset. Is the data positively skewed, negatively skewed, or neither?
Skewness: Mean (20.78) < Median (21) = not enough difference to be considered skewed

C.3. Standard Deviation: Standard Deviation, Range, and Variance

Standard deviation (sample): the root mean square distance from the arithmetic mean, divided by one less than the sample size. This statistic is reported in the same units as the arithmetic mean.

\[ s = \sqrt{\frac{1}{N-1} \sum_{i=1}^{N} (x_i - \bar{x})^2} \]

Formula:

N is the sample size, x is the data value, and \( \bar{x} \) is the arithmetic mean.

Range: the spread of the dataset, found by subtracting the minimum value from the maximum value.

Variance: describes distance from the arithmetic mean; is calculated as the square of the standard deviation.

Sample calculation: Given the dataset above, find the range, standard deviation, and variance of the dataset.
Range = 32 - 10 = 22 acres

Variance = \( 7.3617 = 54.19 \)

### C.4. Frequency

**Frequency:** measure of the frequency a specific response was given in the sample, using an appropriate class size to represent the sample's distribution.

Sample calculation: given the dataset above and a class range of 5.
C.5. Pearson's Correlation

**Correlation**: measurement of the degree of linear relatedness, or correlation, between two sets of variables. Data is returned between values of -1 and +1, where ±1 is a very strong relationship, and 0 is no relationship.

\[
r = \frac{\sum x \cdot y - \frac{\sum x \cdot \sum y}{N}}{\sqrt{\left(\sum x^2 - \frac{(\sum x)^2}{N}\right) \cdot \left(\sum y^2 - \frac{(\sum y)^2}{N}\right)}}
\]

**Formula:**

- \(x\) is variable 1 and \(y\) is variable 2, \(N\) is the sample size.

Sample calculation: given the dataset below, calculate the correlation coefficient.

<table>
<thead>
<tr>
<th>EF (acres)</th>
<th>Age (years)</th>
<th>X squared</th>
<th>Y squared</th>
<th>(x \times y)</th>
</tr>
</thead>
<tbody>
<tr>
<td>((x))</td>
<td>((y))</td>
<td>(x^2)</td>
<td>(y^2)</td>
<td>(xy)</td>
</tr>
<tr>
<td>10</td>
<td>19</td>
<td>100</td>
<td>361</td>
<td>190</td>
</tr>
<tr>
<td>12</td>
<td>26</td>
<td>144</td>
<td>676</td>
<td>312</td>
</tr>
<tr>
<td>15</td>
<td>40</td>
<td>225</td>
<td>1600</td>
<td>600</td>
</tr>
<tr>
<td>20</td>
<td>32</td>
<td>400</td>
<td>1024</td>
<td>640</td>
</tr>
<tr>
<td>21</td>
<td>65</td>
<td>441</td>
<td>4225</td>
<td>1365</td>
</tr>
<tr>
<td>24</td>
<td>70</td>
<td>576</td>
<td>4900</td>
<td>1680</td>
</tr>
<tr>
<td>25</td>
<td>32</td>
<td>625</td>
<td>1024</td>
<td>800</td>
</tr>
<tr>
<td>28</td>
<td>21</td>
<td>764</td>
<td>441</td>
<td>588</td>
</tr>
<tr>
<td>32</td>
<td>38</td>
<td>1024</td>
<td>1444</td>
<td>1216</td>
</tr>
</tbody>
</table>

| Sums       | 187         | 343       | 4319      | 15695         | 7391          |

\[
r = \frac{7391 - (187 \cdot 343)/9}{\sqrt{(4319 - (187^2)/9) \cdot (15695 - (343^2)/9)}}
\]

\[
r = \frac{264.222}{\sqrt{433.56 \cdot 2622.89}} = \frac{264.222}{1066.39}
\]

\(r = 0.248\); very weak correlation

C.6. Total Impacted Area
Total impacted area is the combined land area of the sample's ecological footprints (measured in square miles). This parameter is calculated by extrapolating the mean and frequency distribution to a population.

Sample calculation: given the previous dataset and frequency, find the total impacted area for a population of 30 individuals.

<table>
<thead>
<tr>
<th>EF (acres)</th>
<th>Extrapolation Constant</th>
<th>Area (acres)</th>
<th>Area (sq. mi)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population (30) / sample size (9)</td>
<td>EF (acres) * extrapolation constant</td>
<td>Area (acres) * 0.0015625</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>3.33</td>
<td>33.3</td>
<td>0.05203125</td>
</tr>
<tr>
<td>12</td>
<td>3.33</td>
<td>39.96</td>
<td>0.0624375</td>
</tr>
<tr>
<td>15</td>
<td>3.33</td>
<td>49.95</td>
<td>0.078046875</td>
</tr>
<tr>
<td>20</td>
<td>3.33</td>
<td>66.6</td>
<td>0.1040625</td>
</tr>
<tr>
<td>21</td>
<td>3.33</td>
<td>69.93</td>
<td>0.109255625</td>
</tr>
<tr>
<td>24</td>
<td>3.33</td>
<td>79.92</td>
<td>0.124875</td>
</tr>
<tr>
<td>25</td>
<td>3.33</td>
<td>83.25</td>
<td>0.130076125</td>
</tr>
<tr>
<td>28</td>
<td>3.33</td>
<td>93.24</td>
<td>0.1456875</td>
</tr>
<tr>
<td>32</td>
<td>3.33</td>
<td>106.56</td>
<td>0.1665</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Sum of area</strong></td>
<td><strong>0.972984375</strong> (sq. miles)</td>
</tr>
</tbody>
</table>