EXPLORING THE ECOLOGICAL FOOTPRINT OF THE "AVERAGE" AMERICAN STUDENT: CASE OF THE UNIVERSITY OF ALABAMA

by

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ABSTRACT

This research establishes the current consumption and environmental awareness levels associated with the use of water and energy resources for dormitory students on The University of Alabama's campus. During this study, the recently constructed Lakeside East and Ridgecrest East dormitories were analyzed by means of content analysis and subsequent ecological footprint calculations. These were performed from the available water and energy records. Pertaining to the two dormitories from 2007 to 2008, the calculations suggest that consumption levels concerning electricity have decreased; whereas, natural gas levels have increased slightly for Lakeside East and decreased slightly for Ridgecrest East. Additionally, a sample of residents from within the two dormitories was surveyed to determine environmental awareness and lifestyle behaviors associated with the use of energy and water resources. Though a majority of the students indicated they were interested in environmental issues, lifestyle behaviors and preferences did not always positively correlate to the subsequent environmental issues. Resources associated with high-tech devices were overconsumed. Thus, additional educational opportunities may promote more sustainable lifestyle choices. As a consequence, this study serves as a snapshot from which future environmental strategies may be derived.

LIST OF ABBREVIATIONS

cf	Cubic Feet
ha	Hectare
IPCC	International Panel on Climate Change
kWh	Kilowatt Hour
LEED	Leadership in Energy and Environmental Design
Mcf	One Thousand Cubic Feet
SPSS	Statistical Package for Social Sciences
UA	University of Alabama
USGBC	U.S. Green Building Council

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CHAPTER 1

RESEARCH BACKGROUND

Introduction to Research

This research investigates dormitory students' knowledge of environmental issues and their consumption of water and energy resources at The University of Alabama. As environmental issues have become more mainstream in the media, universities across the United States have started to implement green strategies to curb the environmental impact of their campuses. One such strategy has been to focus attention specifically on environmental opportunities available in green dormitories. Though The University of Alabama is not currently a green campus and no green dormitories exist on-campus, The University President has recently voiced interest in the creation of a more sustainable campus.

At this time, neither has a study been conducted to establish The University of Alabama's status concerning green initiatives, nor has the environmental impact of the University been documented. Thus, this research serves as a snapshot of The University of Alabama's dormitory students concerning environmental initiatives. This snapshot will later serve as a benchmark from which green strategies for dormitory students may

be derived as well as evaluated for effectiveness. Aptly, sustainable goals of the University may not be reached without proper planning, if an inventory is not performed.

Consequently, an inventory was established by gathering research on recognized green universities and comparing the data to that of the case of The University of Alabama. Another key component of this research included the use of surveys. Surveys were used to evaluate the environmental awareness and lifestyle behaviors of dormitory students at Lakeside East Residential Hall and Ridgecrest East Residential Hall. Additionally, consumption of energy and water resources of the two dormitories were established as a result of a content analysis of official records. The content analysis allowed for subsequent ecological footprint calculations to be performed. Together these methods resulted in a deeper understanding of the environmental awareness and impact of dormitory students at The University of Alabama. Thus, this research has provided a foundation from which green strategies can be derived.

Environmental Issues

During the past half century, mankind's demand for natural resources has led to dramatic, environmental changes ranging from chemical pollution to deforestation (Handwerk, 2005). Environmental problems result when human activities diminish the quality and/or quantity of life on earth. They can exist within the atmosphere, lithosphere, hydrosphere, cryosphere, and biosphere. When these problems capture media attention, they are labeled as environmental issues.

Global warming is an example of a recent environmental issue. The earth is becoming heated due to increased greenhouse gases such carbon dioxide, methane gas,

nitrous oxide, chlorofluorocarbons, water vapor, and ground level ozone. According to National Geographic's Website (2008), "The heat is not only melting glaciers and sea ice, it's also shifting precipitation patterns and setting animals on the move." Thus, global warming has been and continues to be a highly controversial and politically debated environmental issue. Last year the International Panel on Climate Change (IPCC), supported by efforts of more than 2,500 scientists from over 130 counties, announced "that the evidence of a warming trend is 'unequivocal,' and that human activity has 'very likely' been the driving force in that change over the last 50 years" ("Global Warming," n.d.).

Accordingly global warming is a pressing issue due to air pollutants, and it is germane to discuss the energy crisis as the source of these pollutants. Energy issues result from high consumption levels of fossil fuels, a nonrenewable resource. Consuming fossil fuels poses sustainability problems within American society by arbitrarily transferring billions of dollars out of the domestic economy to insecure foreign energy sources, depleting nonrenewable sources that may hinder future generations, and utilizing energy that causes environmental degradation. Smog and acid rain are just two negative byproducts of the burning of fossil fuels. Los Angeles, California, is a notorious example of a city known for its pollutant rich, yellow haze, otherwise referred to as "smog," hovering over the city. Moreover, "[acid rain] kills forests (miles away from the sources) and pollutes soil by making it too acidic for optimum plant growth" (Harper, 2008, p. 70). However, it is important to acknowledge that acid rain generally is not the primary method in which forests become destroyed.

Harper (2008) stated "two-thirds of the forests that existed historically around the world are gone" (p. 53). When forests are destroyed on considerable scale, this process is known as the environmental issue deforestation. Furthermore, National Geographic's Website reports "forests still cover about 30 percent of the world's land area, but swaths the size of Panama are lost each and every year". Commercial logging as well as corporate and peasant agricultural practices are the main contributors to deforestation (Harper, 2008, p. 53). Some of the most notorious examples of deforestation occur in rainforest regions. For instance "during the past 40 years, close to 20 percent of the Amazon rain forest has been cut down—more than in all the previous 450 years since European colonization began" (Wallace, 2007). When the vegetation is cleared, the land becomes barren since the topsoil is prone to erode away without protection from wind and precipitation. The rainforest not only serve as carbon sinks for mankind, but also serves as habitat to a wide array of vegetation, insects, and animals found nowhere else on the Earth.

Mayell (2002) indicated that "deforestation proceeds apace, desertification continues to edge outward, and 27 percent of the world's coral reefs are now severely damaged, up from 9 percent in 1992. The resulting loss and degradation of habitat has meant that we are also undergoing a huge loss in biodiversity." Biodiversity is an important environmental issue due to the concept that more diverse populations are better suited to adapt to a dynamically changing environment. According to the World Conservation Union, the following species are either threatened or in danger of immediate extinction: 30% of amphibian, 26% of reptiles, 20% of birds, 39% of fish, and 39% of mammals (Harper, 2008, p. 56). In addition to losing different animal

species, there has been quite a lot of media coverage concerning biodiversity loss in crops. Harper (2008) expressed that "people have historically used over 7,000 plant species for food, now reduced to largely twenty species around the world" (p. 57). Today seed vaults are being established to preserve biodiversity among crops. Certain genetic attributes of crops on the brink of extinction may prove to be an invaluable source for food for future generations. Biodiversity losses are attributed to habitat destruction and fragmentation, agriculture, and global warming. These environmental externalities are created in an effort to develop the Earth for mankind's use. During the development process, waste byproducts are typically generated.

Waste is an environmental issue that is a byproduct of human activity. Anything that no longer demonstrates utility can be categorized as waste. Waste can take various forms including that of solid wastes found from municipal sources such as residential, commercial, or institutional uses. According to the Environmental Protection Agency (2008), municipal sources alone were responsible for producing more than 251 million tons of waste within the United States. Waste can also be derived from non-municipal origins that result from agricultural, mining, or industrial activities. A major concern of waste generation is finding enough space to put the waste. Finding space to place both municipal and non-municipal waste can be hard enough, but to make matters even worse society generates hazardous waste that must be disposed of with extreme caution. Waste generation leads to subsequent air, water, and land pollution problems that can eventually lead to more environmental issues.

Looking at environmental issues from a holistic perspective, it is easy to see why some experts are concerned about the future of the Earth's systems. Wackernagel &

Rees (1996) found that "humans are facing an unprecedented challenge: there is wide agreement that the Earth's ecosystems cannot sustain current levels of economic activity and material consumption, let alone increased levels" (p. 1). The factors that have contributed and that are currently contributing to environmental problems are numerous. Nonetheless, some specific examples of these factors include: (1) man's anthropocentric nature, (2) view of having dominance over nature, (3) propensity to overconsume resources, (4) the tragedy of the commons, (5) ignorance concerning the workings of nature, and (6) demographic characteristics stemming from issues such as poverty or greed.

The first factor listed above, mankind's anthropocentric nature, can arguably be considered a key contributor to environmental degradation as this concern is intertwined with the framework of all the other factors. In general, society tends to view the environment only as how it applies to humanity. As discussed by Handwerk (2005), "The UN-backed Millennium Ecosystem Assessment Synthesis Report found that nearly two-thirds of Earth's life-supporting ecosystems, including clean water, pure air, and stable climate, are being degraded by unsustainable use." Once human life becomes jeopardized, acknowledgement of environmental issues is more likely to occur, given that degradation can be linked to humanitarian efforts.

The anthropocentric view suggests humans have power over the environment rather than seeing mankind as part of a larger ecosystem. This idea of mankind's dominance over nature is linked to the idea of manifest destiny. According to Harper, "[Manifest destiny] is a moral and economic rationale for exploiting natural resources, assuming that nature has no intrinsic value, that human welfare depends on the

exploitation and development of nature, and that human inventiveness and technology can transcend any resource problem" (2008, p. 273). Under this mindset there are very few consequences to developing and/or degrading the environment as the land and resources are to be utilized for the needs and desires of man. Furthermore, the inventiveness of man regards a technocratic mindset. If environmental degradation was to occur, then man possesses the ingenuity to remedy the problem at a later date.

Keeping in tune with the idea of a man's dominance over nature, an anthropocentric society has a greater tendency to overconsume resources. America has been highly criticized for being a throwaway economy as packaging provides quick convenience for lifestyles constantly on the go. As reported by the Environmental Protection Agency (2009b), "Between 1960 and 2007 the amount of waste each person creates has almost doubled from 2.7 to 4.6 pounds per day." Though, as prevalent as consumption oriented behaviors are within the United States, this demonstration of overuse of resources can be found all over the world. Overconsumption problems span a multitude of different cultures and have led to the overuse of a plethora of resources. Whatever they consisted of -petroleum, water, air, or land- these natural amenities are all consumed and degraded at an unsustainable rate.

Additionally, people with an inherent anthropocentric nature are also more likely to overconsume resources that would fall under the classification of common-property resources. According to Harper, common-property resources are typically free to the public in terms of usage; thus, this unobstructed access encourages overusage by the end-user, seeing that no one in particular owns resources such as the air or the water (2008, p. 233). For example, common resources such as water used for fishing grounds tend to be

overfished. This tendency is due to the fact that no immediate, economic incentives exist for fishermen to curb their consumption rates; lest, someone else may profit from their conservation minded efforts.

The tragedy of the commons can be linked to economic incentives as well as to ignorance of people concerning the workings of nature. Not only may citizens overfish an area, but also local business owners located near the fishing grounds may be unaware of the negative consequences of dumping pollutants into the water. Once again an anthropocentric mindset can lead a society to remain uneducated to the science behind ecological systems. If a society is in fact oblivious to the finiteness of a resource, then that lack of information itself warrants overconsumption.

Just as ignorance of nature promotes environmental degradation by means of overconsumption, demographic characteristics can also play a key role in the factors that contribute to environmental problems. Those who live in situations of vast poverty must make daily choices in terms of survival. Poverty stricken cultures do not have the luxury to plan out their lifestyle choices in regard to what is best for the environment. For example, "More than 1.1 billion people on the planet lack access to safe drinking water, and nearly 3 billion do not have access to adequate sanitation. In addition to the grinding poverty that this connotes, it also means that waterborne diseases claim the lives of between 14,000 to 30,000 people a day" (Mayell, 2002). Accordingly, demographic characteristics play a large role in taking on an anthropocentric mindset. Survival instincts as well as those of greed, depending on the circumstances, can promote environmental degradation.

> By now ample evidence shows that people at either end of the income spectrum are more likely than those in the middle to damage the earth's ecological health- the rich because of their affluent lifestyles are likely to lead them to consume a huge and disproportionate share of the earth's food, energy, raw materials, and manufactured goods, and the poor because their poverty drives them to damage and abuse the environment. (Harper, 2008, p. 202)

To help account for the environmental impact of a society based off demographic characteristics, the equation I = PAT was introduced by Paul Ehrlich and John Holden. Simply stated, the impact of a society equals the population, multiplied by the affluence of the population, and then subsequently multiplied by potential damage caused by the technological level of that populace (Harper, 2008, p. 204). As humans are prone to unsustainable use, numerous programs and tools have been derived as a response to environmental issues. One setting, in particular, that has served as an incubator for sustainable strategies can be found on college campuses. As a consequence, this research has been focused on the role that universities have played concerning the development of green initiatives.

Response: Greening Campuses

Thinking green has been a hot topic as of recent years. To think green is to incorporate environmental impacts into decision-making activities that affect daily lifestyles. The impact that a society imposes on the environment holds importance, as it is a key issue of sustainability. Sustainability refers to the dilemma of how to "meet the needs of the present without compromising the ability of future generations to meet their

own needs" (Wackernagel & Rees, 1996, p. 33). Fortunately, one place where sustainable initiatives have spread is on campuses throughout America. Universities have provided support to environmental issues through policies, programs, and research.

Sustainable Initiatives at Select Universities

The Princeton Review has posted a Green Rating Honor Roll to document the top schools that provide a healthy and sustainable quality of life for the students, environmentally-minded and educational preparations for the future workforce, and environmentally responsible school policies for all to follow (Princeton Review, 2008). The Princeton Review ranked the following eleven colleges throughout the United States as receiving a green rating of ninety-nine points.

- Arizona State University, Tempe
- Bates College
- College of the Atlantic
- Emory University
- Georgia Institute of Technology
- Harvard University
- State University of New York at Binghamton
- University of New Hampshire
- University of Oregon
- University of Washington
- Yale University

Three universities of the eleven schools, have been selected for a more detailed analysis due to their exemplary strides towards green initiatives. Furthermore, though all the universities have displayed an extraordinary commitment to green initiatives, Harvard University located in Cambridge, MA; Emory University located near Atlanta, GA; and Bates College in Lewiston, ME, were chosen for closer examination in part due to the accessibility of online information concerning green programs as well as in respect to their diverse financial strategies for integrating sustainable principles. Since the three universities have taken great strides in terms of sustainability, an inventory was

performed encompassing a list of similarities and differences concerning green initiatives and strategies. Moreover, this inventory can serve as a framework for other colleges to follow in the future. For the investigation, the areas explored included policy, buildings, food, and recycling.

For the purpose of this research, policy was further subdivided into six areas: the requirement of sustainable initiatives, the involvement in the *Presidential Climate Change Commitment*, the possession of an environmental office or the establishment of dedicated sustainability staff, the implementation of an environmental curriculum, the development of an environmental plan, and the existence of a loan program for green ventures. To avoid confusion, a campus can promote climate change initiatives without participating in the *Presidential Climate Change Commitment*. Moreover, being a signee of the *American College and University Presidents Climate Commitment* requires campuses to take the following steps to reduce greenhouse gas emissions:

> First, complete an emissions inventory. Within two years, set a target date and interim milestones for becoming climate neutral. Take immediate steps to reduce greenhouse gas emissions by choosing from a list of short-term actions. Integrate sustainability into the curriculum and making it part of the educational experience. Make the action plan, inventory and progress reports publicly available. (American College & University Presidents Climate Commitment, 2008)

Furthermore, policy has been analyzed as it is an essential component of a university's decision to go green.

Thus in accordance to policy, Harvard has demonstrated a commitment to sustainable initiatives. For instance, Harvard has implemented a large environmental office supported by numerous employees. As discussed by the Princeton Review (2008),

Harvard has the "largest green campus organization in the world consisting of 24 full-time professional staff and 32 part-time student employees all working to assist the Harvard community in greening all areas of its campus". They have also incorporated an environmental curriculum and designed a subsequent environmental plan. What makes Harvard unique among other universities and to this study, is the existence of a green revolving loan fund. The fund encourages environmentally friendly projects on campus by providing the initial investment. The subsequent cost savings of the project repays the loan in the allotted five to ten year period (Harvard University, 2008). Consequently, this large funding initiative serves as a precedence from which other universities may strive to follow in the future.

While considering policy criteria for the analysis of the other schools, Emory University has supported sustainable initiatives as well. Emory's commitment to environmental issues has not only been supported by the existence of an on-campus sustainability office, but also integrated into the curriculum and supported by an environmental plan. Bates College shares similarities with the two other schools by demonstrating superior practices concerning environmental initiatives with the introduction of a sustainability commitment, including a sustainability office on-campus, integrating green concepts within the curriculum, and developing a detailed sustainability plan. Furthermore, Bates College stands out from Harvard University and Emory University as the school is a recognized signee participating in the *American College and University Presidents Climate Commitment*.

The next area for analysis concerning the three universities is that of buildings. The category of buildings has been broken down into three sections: green building elements, Leadership in Energy and Environmental Design (LEED) certification, and energy competitions. Harvard University has incorporated not only green building

elements, but also has implemented LEED certification for buildings and employed an energy competition. As energy usage becomes more prevalent in green issues, Harvard serves as a leader by owning more LEED-certified land than any other university. For example, a recent green building project was the residential dormitory Rockefeller Hall where a majority of the building's original structural components were preserved for reuse, and many of the new construction materials were obtained from locally supplied sources (Ireland, 2008). Also at Harvard, Reduce Your Juice is a competition between residence halls to curb energy consumption (Barrella, 2008).

Like Harvard, Emory University contains green building elements, incorporates LEED certification into projects, and participates in an energy competition. Emory is another example of a campus incorporating LEED standards into all current and future building construction (Loftus, 2007). The most recent additions of green housing include the Few and Evans Residence Halls. Storm water recycling, solar panels, and locally produced construction materials are just a few of the sustainable features that can be found in the new dorms (Gray, 2008). To help conserve energy, Emory University has created a campus wide month-long annual energy competition which is open to students, faculty, and staff (Emory University, 2008a). Bates College, similar to Harvard and Emory, integrates green building elements into their structures. However, Bates College stands out from Harvard and Emory, as the school does not seek LEED certification for projects. In fact, Bates College has designed dormitories up to LEED standards, but has not filed the proper documentation due to the additional cost basis required with the certification process (Bates College, 2008a). Bates serves as an example of how a university can promote green strategies without officially becoming LEED certified. Bates also differs from Harvard University and Emory University as it has not implemented an energy conservation contest on campus.

The next category for examining the universities is that of food which in this research pertains to the existence of a farmer's market and the provision of organic and/or local food in the cafeterias. Fortunately, all three of the schools evaluated promote these programs. For example supportive to Harvard's green status, the campus incorporates events such as a farmer's market that provides students with access to fresh produce provided by local farmers. In terms of cuisine at Harvard, green accommodations have been made available in the cafeterias by utilizing locally and organically grown food suppliers ("Graduate Green," 2007). Another example of this is Emory University, which promotes the use of organically or locally supplied food for the cafeterias as well. For instance, "Emory's sustainability vision sets an ambitious goal of 75 percent local or sustainably grown food in the hospitals and cafeterias by 2015" (Emory University, 2008b). Furthermore, Bates College distributes organically and locally grown food to students and promotes a farmer's market event. According to the Princeton Review, Bates has "28% of its food budget dedicated to local, natural, and organic purchases" (2008).

As policy, buildings, and food have been examined for all the schools, recycling is the final category to be evaluated. Recycling is examined with respect to the establishment of a recycling program and in regard to whether or not the university is a participant in the RecycleMania contest. Aptly named RecycleMania, it is a 10-week recycling and waste reduction competition open to colleges throughout North America (RecycleMania, 2009). All three of the universities have incorporated both successful recycling programs as well as been involved in the RecycleMania competition. To serve as a review for the green elements discussed in this section, Table 1, illustrates the similarities and differences among environmental programs found at Harvard University, Emory University, and Bates College. Please note that Table 1 was not designed to

encompass all the potential green programs, but rather a selection of environmental initiatives.

Table 1: *Environmental Programs at Select Universities*

	Harvard	Emory	Bates
Policy			
Sustainable Initiative	X	X	X
Presidential Climate Change Commitment			X
Environmental Office/Staff	X	X	X
Curriculum	X	X	X
Environmental Plan/Principles	X	X	X
Green Revolving Loan Fund	X		
Buildings			
Green Building Elements	X	X	X
LEED Certified	X	X	
Energy Competition	X	X	
Food			
Farmer's Market	X	X	X
Organic/Local Food in Cafeterias	X	X	X
Recycling			
Recycling Program	X	X	X
RecycleMania Participant	X	X	X

As illustrated by Table 1, the universities share many similar characteristics that are commonly associated with that of a green campus. Additionally, the variances that exist among the schools are just as important as these similarities. For example, even as fortunate as Harvard is to benefit from its large financial resources to create a sustainable campus, Bates College is an example of an institution that has also earned a position on

the Green Honor Roll despite having to pick and choose green elements based on some restrictive cost parameters. With such a prestigious sustainable ranking, the case of Bates College may encourage other schools to build up to LEED standards even if the available funding does not allow for the proper certification process. Thus, this list of environmental programs is neither all encompassing, nor is it static. As more criteria are evaluated and more advances are made in green initiatives, the list will react quite dynamically to the evolution of how to approach environmental issues. Appropriately, this list has served as a snapshot of sustainable initiatives at three of the top ranked universities throughout the country. Therefore, the snapshot is an essential component from which to measure The University of Alabama's progress in terms of sustainability and potentially for other schools as well.

Green Buildings

One area of particular interest, where all the schools evaluated in the previous section had made tremendous environmental strides is in the area of buildings. According to Glavinich (2008), "Commercial and residential buildings consume about 40 percent of the energy used in the United States" (p. 1). With one area consuming so much energy, even the smallest sustainable efforts will curb the overall level of environmental degradation. It is important to note that buildings impact more than just energy resources. As discussed by Enck and Turner (2003), traditional buildings over utilize resources, degrade the environment over a period of time, increase ownership costs of the building, decrease the inhabitants' productivity, and are not keeping pace with current design trends (p. 8). To counteract some of the deficiencies of traditional structures, green buildings are an example of a recent technological advancement that could reduce a structure's environmental impact.

Suitably named, green buildings serve as a high-performance alternative to traditional building structures by integrating environmentally friendly strategies in the lifecycle stages of design, construction, operation, and maintenance. Green buildings attempt to minimize environmental impact of the actual structures, provide a healthy and productive working environment, reduce energy consumption, as well as optimize operational expenses (Glavinich, 2008, p. 16). Buildings can become certified as green under the Leadership in Energy and Environmental Design (LEED) certification process according to the following six criteria: sustainable site, water efficiency, energy and atmosphere, materials and resources, indoor environmental quality, and innovation and design process (p. 19).

LEED certification has become very popular among developers hoping to capitalize on the marketable benefits of promoting environmental structures. Kobet et al. (1999, p. i) found that green buildings successfully and cohesively link environmental stewardship together with economic opportunity. Over a product's lifespan energy efficient technologies consume less energy or resources than their traditional counterparts. Consumers utilizing green products save money in the long run. Furthermore, Glavinich (2008) found that "as a result of the public's growing concern about the environment and rising energy costs, there is a growing movement among both public and private building owners to have their buildings LEED certified" (pp. 17-18). Given the reduced utility bills that green buildings benefit from, the Department of Energy and some financial institutions are developing energy-efficient mortgages (Spiegel & Meadows, 2006, p. 32).

In spite of the long-term cost benefits, green buildings have been highly criticized for intensifying construction costs. This is because alternative green products tend to be more expensive than their traditional counterparts. In addition to the price of the product

being higher, contractors may charge additional fees for installation of an unfamiliar product until that product becomes mainstream (Spiegel & Meadows, 2006, p. 31). As green products become more common in the marketplace, initial product costs will fall. Another reason why builders opt not to install energy efficient technology is because the initial investment made by the builder will ultimately benefit the end-user (Pinkse and Dommisse, 2008). These criticisms are legitimate concerns when calculated in terms of short-term costs. The issue of cost must be further evaluated from a holistic perspective to encompass both the short-term and long-term implications when developing a project. Spiegel and Meadows (2006) found that "when cost is discussed relative to environmental issues, it is necessary to consider both the broader societal costs, the costs each of us bears for destruction of global commons, and the costs directly borne by individuals under the current economic system." (p. 30)

To narrow the housing market into a smaller sector and to negate the criticisms introduced by way of short-term ownership, academia is a great area in which to incorporate green building design. According to Moskow, universities "look at the performance of their projects over a much longer time period than many commercial owners" (2008, p. xv). Additionally, green buildings have been attributed to be superior work environments for their inhabitants. As indicated by Enck and Turner, "Comfortable occupants are less distracted, able to focus better on their tasks/activities, and appreciate the physiological benefits good green design provides" (2003, p. 8). A healthy, productive work environment is consistent with the desired image from which universities hope to educate and house students.

Due to the fact that institutions of higher learning pride themselves on their ability to promote academic vigor, it may come as no surprise that universities have also responded to environmental issues via research. Though intellectual contributions have

been numerous, one area of particular interest has been sustainability. As a consequence of this intrigue, tools were developed to document where unsustainable uses are the most prevalent. The tool utilized in this research process is known as the ecological footprint calculation.

Ecological Footprint

The lifestyles of individuals, groups, or nations can be measured by utilizing an accounting tool known as ecological footprint. Ecological footprint refers to the productive land needed to support a given population. As discussed by Wackernagel and Rees (1996), "The ecological footprint concept is simple, yet potentially comprehensive: it accounts for the flows of energy and matter to and from any defined economy and converts these into the corresponding land/water are required from nature to support these flows" (p. 3). A concept known as "overshoot" occurs if demands by humans exceed the supply of a given biologically productive area (Turner et al., 2006). Thus, a larger ecological footprint indicates a less sustainable society.

Research on ecological footprint literature links together the concepts of footprint size and economic development. In other words, footprints represent population size and consumption levels (Wackernagel & Rees, 1996, p. 11). Furthermore, "more-developed countries contain market economies that consume greater levels of natural resources, and environmental degradation is largely driven by the growth and intensification of market economies" (Jorgenson, as cited in Jorgenson & Burns, 2006). For example, Americans when compared to the rest of the world exhibit a large ecological footprint due to an intensely consumption-oriented lifestyle. The average ecological footprint for an American is 23.68 acres as compared to the world's average of 5.53 acres (Global Footprint Network, 2003). Further research suggests an economical discrepancy between

those who possess large ecological footprints and those who possess small ecological footprints. Wackernagel et al. (2003) found that "those contributing most to climate change through their energy intensive lifestyles will most likely be less affected by, and better shielded from, the outfalls of climate change than poor people living on marginal land or in underserved urban conditions".

Though ecological footprint can be used as a useful tool to help measure sustainability, some scientists have criticized ecological footprint calculations for oversimplifying ecosystem processes to numerical values. Assumptions may not be valid as "the ecological footprint arbitrarily assumes both zero greenhouse gas emissions, which may not be optimal, and national boundaries, which makes extrapolating from the average ecological footprint problematic" (Fiala, 2008). Source data, upon which calculations are made, are also prone to flaws if human error is introduced. Furthermore, "official statistics may not cover 'off the books' transactions and may incompletely cover household extraction and consumption that does not enter into markets" (Kitzes et al., 2008). Another criticism of the ecological footprint is that it does not properly account for technological advancements. As expressed by Fiala (2008), "Biocapacity comparisons, such as the argument that it would take five Earths to sustain consumption if everyone consumed like Americans, assume that the average consumption of an area extends to the entire world population, with all production at the current technology level." Despite some criticisms, the ecological footprint calculation can serve as a heuristic tool for designing and implementing plans for today as well as for tomorrow. Moreover, plans that take environmental calculations into consideration will have a far greater potential of keeping the Earth as a stakeholder in the planning process than those plans without such calculations.

While formulating plans for specific projects, the ecological footprint calculation can be utilized to predict the land area required for the consumption of particular good(s) or service(s). Though the ecological footprint calculation is applicable to a plethora of goods and services, housing is one major area that could benefit from its integration. On university campuses across the United States it is generally understood that housing accommodations and dormitories provide significant opportunities for those attending classes. As a consequence, this research has incorporated the use of the ecological footprint calculation as it applies to energy and water resources concerning the housing needs of dormitory students. In addition to the ecological footprint calculation, this research created an ecological snapshot of the dormitory students at The University of Alabama.

CHAPTER 2

RESEARCH METHODOLOGY

Research Problem

The University of Alabama is in the preliminary stages of moving toward a more sustainable campus. Currently, it is difficult to track environmentally friendly progress on campus, as no study has been previously performed to establish where The University of Alabama is concerning environmental initiatives. Thus, if a snapshot of the University were established to include both consumption and environmental awareness levels, then those findings would serve as a benchmark from which the implementation of green strategies may be evaluated in terms of effectiveness. Accordingly, this research documented the environmental awareness and consumption levels of dormitory students concerning energy and water resources on The University of Alabama's campus. Moreover, findings were gathered from the dormitories Ridgecrest East and Lakeside East.

Research Goal

The goal is to measure the current ecological footprint of dormitory students on The University of Alabama campus.

Research Objectives

A. One objective is to determine the current state of students' environmental awareness.

B. Another objective is to determine the current consumption levels in terms of electricity and water usage for specific dormitories on campus.

Research Questions

1. How aware are students concerning environmental issues?
2. What environmentally friendly strategies do students utilize in their current lifestyles?
3. What are the consumption levels in terms of electricity and water usage for specific dormitories, currently and over the past couple of years?
4. Has energy and water usage in the dormitories increased, decreased, or remained the same?
5. What is the size of students' ecological footprint in terms of energy and water consumption?

Research Methods

A case study approach was utilized during this research. According to Theodorson and Theodorson (as cited in Punch, 1998) a case study is defined as "a method of studying social phenomena through the thorough analysis of an individual case. The case may be a person, a group, an episode, a process, a community, a society, or any other unit of social life" (p. 153). Described simply, a case study provides a snapshot of particular social phenomena (Hakim, 1987, p. 61). Thus, the case study approach allows for in-depth research on specific populations, such as the dormitory students that will serve as the focus for this research. This approach also permits the

researcher to evaluate subjects in a naturalistic setting as well as conduct research from a wide array of methods such as interviews, observations, numerical data, and questionnaires (Punch, 1998, p. 153). Suitably, interviews, observations, surveys, and data analysis are the primary methods utilized in this research (see Appendix C for Tables A1 & A2). Even as the case study approach proves to be a viable research tool, a limitation is the inability of the researcher to derive generalizations from specific instances (Punch, 1998, p. 155). In light of this accusation, it is of importance to note that the case study approach warrants merit as this research requires an in-depth inquiry into a particular situation that has yet to be documented.

As mentioned previously, the focus of this research is centered around dormitory students residing on The University of Alabama campus located in Tuscaloosa, Alabama. In the fall of 2008, The University of Alabama reached a record enrollment of 27,052 students (Andreen, 2008). Of the 27,052 students approximately 7,000 students are housed on campus (E. Russell, e-mail, February 24, 2009).[1] Therefore, on-campus residency accounts for approximately 26% of the student population as illustrated by Figure 1.

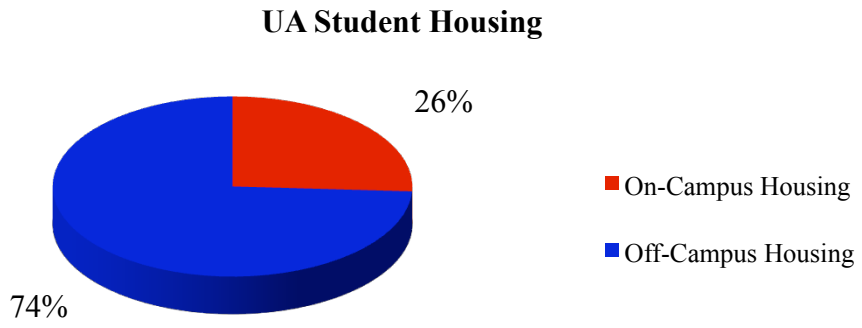


Figure 1. UA student housing.

[1] An e-mail was received from Russell, E. on February 24, 2009. This e-mail is not traceable by the reader and is therefore not found in the references per APA style.

For this study two dormitories were chosen for sampling. The selection was done by methods of random sampling. Random sampling allowed every dormitory to have an equal opportunity of being selected. The process entailed writing down the names of all the possible dormitories on campus on individual slips of paper. The dormitory names were mixed up and then drawn out of a hat. The dormitories Lakeside East and Ridgecrest East were selected for surveying as well as for an analysis of energy and water usage records. The coed student populations housed within Lakeside East and Ridgecrest East are 238 and 316 students, respectively.

Figure 2. Lakeside East Residential Hall. *Figure 3*. Ridgecrest East Residential Hall.

Survey and Data Analysis

The Environmental Awareness Survey (see Appendix B) was utilized to measure the level of students' environmental awareness and lifestyle behaviors associated with the use of water and energy resources. Before the actual survey was conducted in the dormitories, a preliminary run of the survey was tested on a practice group of approximately 25 volunteers. The volunteers were comprised of both undergraduate and graduate students. The survey results of this practice group were not documented; however, feedback was gathered concerning the general flow and scope of the questions

in the survey. As a result of the trial run, subsequent modifications were made to the survey in line with the comments of the volunteers.

With the cooperation of residential hall directors, students within Lakeside East and Ridgecrest East dormitories were asked to participate in the survey. Students were selected randomly to complete the four-page Environmental Awareness Survey. The survey consisted of 32 questions, and the major categories related to water knowledge, water habits, energy knowledge, and environmental awareness. A total of 77 surveys were completed for this study. Of the 77 surveys, 42 were from Ridgecrest East and 35 were from Lakeside East. This sample accounts for approximately 15% of the Lakeside East population and approximately 13% of Ridgecrest East population. Taking into account all the on-campus dormitory students, the sample represents approximately 1% of the total population.

Since surveying is one of the primary methods used to acquire data in this research process, it was necessary to become familiar with the proper research etiquette involving participants. At The University of Alabama there exists an Institutional Review Board to oversee ethical consideration in student projects. Ethical training and testing was completed online according to procedure. This research involved student subjects under the age of 19. Thus, a consent waiver was applied for as parental consent would not be feasibly attained during the surveying process. Permission was sought and granted for conducting research on campus with student participants. The approval number for this research was listed as the following code: IRB# 09-OR-017. The information collected from the surveys remains confidential and no references are made to individual names. In addition to the survey, as required by the Institutional Review Board, the Participant Information Sheet (see Appendix A) was provided to all survey participants. The purpose of the Participant Information Sheet was to provide students

with information concerning the scope of the research as well as to inform students of their rights to discontinue participation at any time. A brief summary of the findings was provided to each respondent who made a request for copies of the results via email. The email addresses only served as a means to convey general research information to the participants, who requested it, and was not used for other purposes.

After the participants completed the surveys, the responses were subsequently edited and coded for data analysis. The coding was then entered into a Microsoft Excel spreadsheet. From this point, the data could be easily transferred into the Statistical Package for Social Sciences (SPSS) for data analysis. Each specified code was then identified with an appropriate label. The survey response data were then run for frequency and applicable cross tabulation results.

Content Analysis

The Department of Energy Management aided in providing energy and water consumption records concerning the Ridgecrest East and Lakeside East dormitories. A content analysis of the records was performed to determine applicable themes and patterns. Additionally, the records assisted with the calculation of the ecological footprint analysis of energy and water usage in dormitories on campus. The energy records acquired reported monthly electrical and natural gas usage figures for the two dormitories from 2007 and 2008. Due to some technical problems with the water meters, only the last five months of 2008 were available for analysis. However, water usage assumptions were derived for the entire year of 2008. Ecological footprint calculations were projected from estimates of the average water usage in 2008 and from the actual natural gas and electricity usage figures from 2007 and 2008. Even from water approximations, the derived ecological footprint has the ability to serve as a benchmark

that can be utilized in future research. During the analysis of water and energy records, the data concerning the population rates for Ridgecrest East and Lakeside East during 2007 were unfortunately unattainable; consequently, the 2008 population numbers were substituted. In addition to the analysis of energy records, an interview with the Director of Energy Management was conducted in an effort to get a proper vision of the campus in terms of resource management.

Calculating the Ecological Footprint

Data, as mentioned previously, from the Department of Energy Management were utilized in the ecological footprint calculation. The following identifies the process for calculating ecological footprints:

1. Estimate the average population size.
2. Estimate the average annual consumption for a particular item.
3. Estimate the land area appropriated per capita for the production of items consumed.
4. Estimate the ecological footprint of the average person for all items consumed.
5. Multiply the population by the per capita footprint.

Limitations

One limitation of this research pertained to the setting within which the study was conducted. To guarantee randomness in the selection process, all the dormitories on The University of Alabama's campus were potential candidates for sampling. Due to the random sampling process, Lakeside East Residential Hall and Ridgecrest East Residential Hall were selected for evaluation. It may be argued that both of these dormitories are rather new structures and as a consequence may not be representative of all the residential

halls on-campus. Thus, ecological footprint calculations were based off energy and water records from new buildings. Additionally, the Department of Housing and Residential Communities provided population counts for the two dormitories. Age cohorts and gender were collected from the students surveyed. However, some descriptive data such as the gender ratio for each building and the class status of each student surveyed were not obtained.

In addition to the setting of the study and some descriptive limitations, the ecological footprint calculation comes with some restrictions. Though the ecological footprint calculation can be utilized as a useful tool to determine impact for an individual, population, or account for the land acreage required for items and goods consumed, it is important to note that the calculation must be made from some assumptions. Even the most comprehensive models or theories cannot account for every detail of the natural world (Wackernagel & Rees, 1996, p. 62). Thus, critics have suggested the ecological footprint calculation oversimplifies the complexities of nature. According to Wackernagel and Rees (1996), "Ecological footprint analyses need not include all consumption items, waste categories and ecosphere functions to have diagnostic value" (p. 63).

Furthermore, carbon sequestering in terms of the forested land area required is one of the ways to account for the consumption of resources. This research utilizes the land area requirements found in *A Study of the Ecological Footprint of Allegheny College* in order to gain a finer understanding of the impact of university students. The following figures show the amount of forested land needed to absorb the subsequent carbon dioxide for the resources consumed: 1,500 m^3/ha/yr for water consumption, 169 m^2 for every 100 kWh for electricity consumption, 8.7 m^2 for every 100 cf of natural gas (Anundson et al., 2001, pp. 11, 26).

Additionally, the ecological footprint calculation is used to calculate the impact of individuals or groups incorporating a variety of resources. For this study, only water, electricity, and natural gas resources associated with housing needs were evaluated. In view of that, this research is intended to initiate further exploration of the ecological footprint concept; however, it is not intended as an exhausted study. As noted in the book, *Our Ecological Footprint: Reducing Human Impact on the Earth,* by Dr. Wackernagel and Dr. Rees, the amount of time and explorative data necessary to complete a comprehensive ecological footprint calculation would require many additional resources. Moreover, the comprehensive calculation was beyond the scope of this research.

CHAPTER 3

RESEARCH FINDINGS

Introduction

This chapter explores the research findings based off survey results, ecological footprint calculations, and an analysis of The University of Alabama's programs concerning green initiatives. This study was targeted at dormitory students residing in Lakeside East and Ridgecrest East. During the survey-component of the research, the questions asked were intended to reveal the participants' level of environmental awareness and lifestyle behaviors concerning the use of resources. The ecological footprint calculations were performed in an effort to reveal the environmental impact of the dormitory students' consumption of energy and water resources as related to housing needs. In regard to The University of Alabama, an analysis of environmentally friendly programs was conducted to establish where the University is in terms of becoming green.

Environmental Awareness

This section pertains to the Environmental Awareness Surveys obtained from dormitory student participants on The University of Alabama campus. The surveys measured the level of students' environmental awareness and lifestyle associated with the use of fresh water and energy resources. A total of seventy-seven surveys were successfully completed during this research. Research participants were included from the residential dormitories Lakeside East and Ridgecrest East. Figure 4 illustrates the

number of surveys per dormitory. Lakeside East residents completed 35 surveys (45.5% of the total), while Ridgecrest East residents completed 42 surveys (54.5% of the total). In regards to gender, there was a slightly higher turnout of male respondents (54.5%) to female respondents (45.5%) during the surveying process. As expected in a college campus setting, an overwhelming majority (97.4%) of the participants fell into the age cohort of 18-22 years.

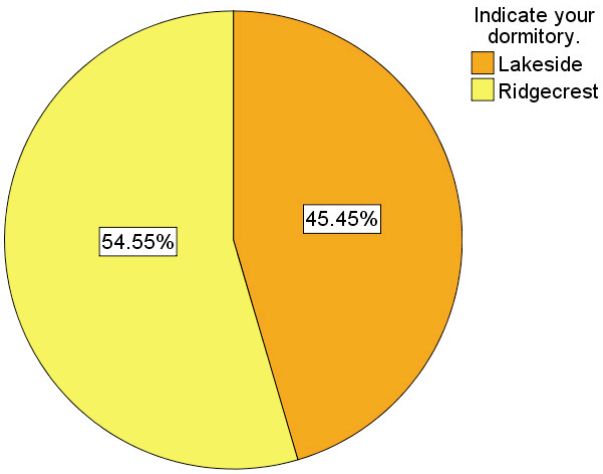


Figure 4. Dormitory distribution.

In the first section of the survey the questions attempted to establish the level of knowledge the respondents had about water. Respondents were asked, as the Earth is comprised of both fresh and salty water bodies, what percentage of water on Earth would you consider as fresh water? The largest percentage being 42.9% selected fresh water comprised less than five % of the water found on Earth, next 29.9% selected fresh water to comprise between 10-15% of the Earth's surface, followed by 19.5% selected between 20-35%, and only 7.8% chose fresh water to account between 40-55% (see Figure 5). When asked their view concerning how the majority of water in the world is utilized, nearly half (49.4%) the respondents claimed agricultural activities as their response. The second most popular answer was industrial activities (28.6%), followed by a tie (10.4%) for urban activities and recreational activities, as mining activities came in last (1.3%).

Where do you think tap water comes from was the final water knowledge question asked in the survey? The majority (81.8%) viewed a water treatment plant as the source, 11.7% viewed a sewage treatment plant as the source, 3.9% believed tap water comes straight from the Black Warrior River, and 2.6% wrote in their own responses. These responses were recorded as the origin being the sink and ground water from a well.

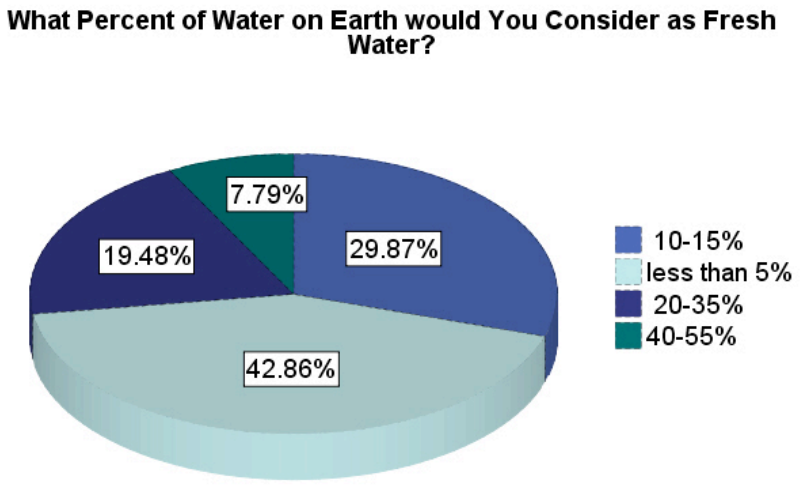


Figure 5. Earth's fresh water resources.

The second section of the Environmental Awareness Survey related to lifestyle choices and habits of the respondents concerning water resources. When asked about water usage while brushing their teeth, a majority (57.1%) demonstrated conservation toward water usage by turning off the water while brushing. Additional data that are supportive to water conservation efforts by students include 1.3% uses a cup while brushing, 2.6% uses a cup or turns off the water while brushing, and another 2.6% uses warm water and turns off the water while brushing. The above habits positively correlate to less water usage, although the act of utilizing hot water to cold water requires more energy resources. In terms of water consumptive habits, more than a quarter (27.1%) of the respondents let the water run while brushing, 2.6% use warm water, and 6.5% let warm water run while brushing. In regards to duration while brushing, a significant

amount (88.3%) brushes their teeth for three minutes or less, whereas only 11.7% brush from four to six minutes.

Shower duration varied greatly as 6.5% takes a shower lasting less than five minutes, 33.8% takes a six to ten minute shower, 23.4% takes an eleven to fifteen minute shower, 24.7% takes a sixteen to twenty minute shower, 10.4% takes a shower lasting longer than twenty-one minutes, and finally only 1.3% of all respondents prefer to take a bath with the tub full. Separating the surveyed students into gender categories, male dormitory students are much more likely to take shorter showers than their female counterparts. Well over half (61.9%) of the males indicated that their showers lasted for 10 minutes or less; whereas, only 14.3% of females take 10 minutes or less to shower. To conclude the water habit section, students were asked if they had ever paid a water bill. Considering the ages of the students surveyed, it may come as no surprise that an overwhelming majority (87%) had not paid a water bill while only 13% had ever paid a water bill.

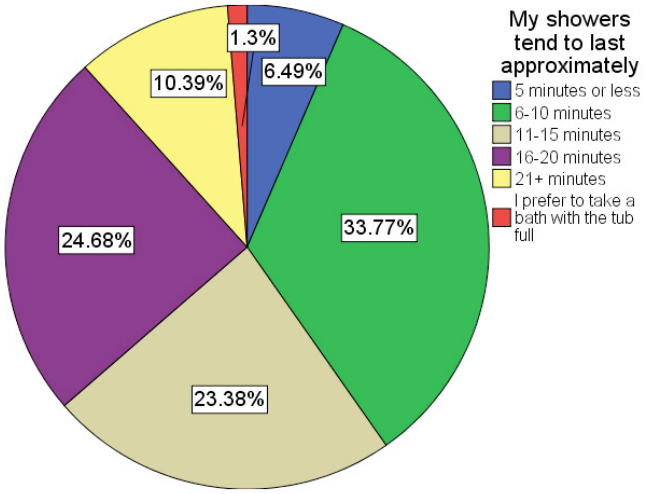


Figure 6. Shower duration.

The third section of the survey questions regarded energy knowledge of the students. As one of the more challenging questions throughout the whole survey asked, in your view the United States consumes what percentage of the world's oil? A significant number of responses were closely divided between answers as 41.6% believe

the Unites States consumes 25 percent of the world's oil and 40.3% believe the United States consumes 36 percent of the world's oil. The remaining 18.1% chose consumption levels of 15 percent, 10 percent, or 4 percent, respectively. When asked whether petroleum/oil was a renewable resource, a majority (83.1%) thought petroleum was not a renewable resource while 16.9% though it was.

When asked about energy resource preferences nearly half (46.8%) of the students surveyed selected solar, followed by nuclear (14.3%), hydropower (10.4%), petroleum (7.8%), wind (7.8%), natural gas (7.8%), geothermal (1.3%), and biomass (1.3%). The remaining 2.6% of the respondents were undecided (see Figure 7). A follow-up question to selecting an energy resource was to explain their energy choice. Over a third (37.7%) of those surveyed did not know the reason for the selection, 28.6% regarded the source as plentiful or renewable, 13% regarded their selection as either safe, environmentally friendly, or clean, 6.5% indicated efficiency as their reason, another 6.5% indicated cost as a supportive description, 5.2% provided convenience or infrastructure in place as evidence, and finally 2.6% proclaimed influence of the media, friends, or family as the reason for the energy preference.

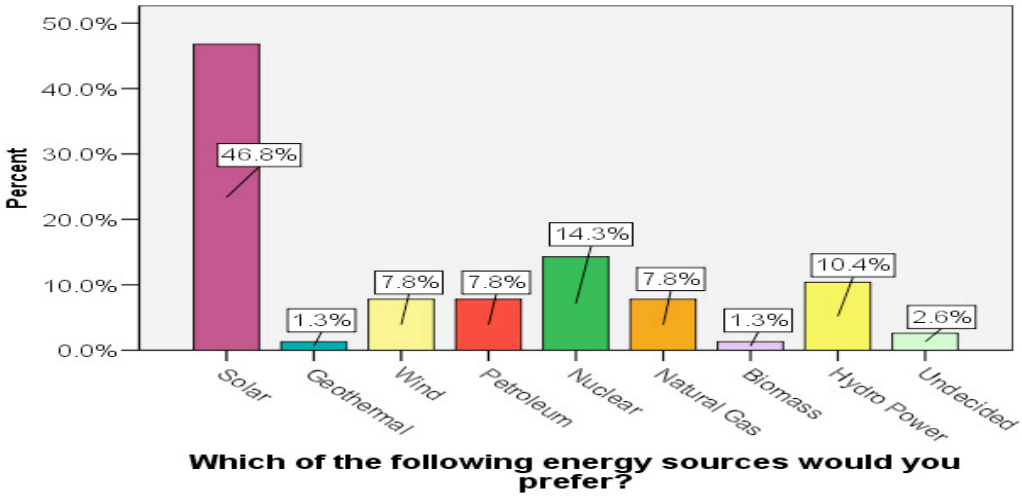


Figure 7. Energy source preference.

The fourth section of the survey explored energy consumption habits of dormitory students. A majority (87%) of respondents turn off the lights when they leave a room. Of those 87%, 61.2% always turn off the lights when they leave a room, while 38.8% responded that they sometimes turn off the light. Over half (58.4%) of the respondents claimed energy conservation was the purpose behind turning off the lights after leaving a room. Other responses concerning the motive for turning off the lights consisted of habit or parents' influence (14.3%), saving money (9.1%), to save both money and energy (7.8%), due to both habit and money savings (3.9%), and the last participants left the question unanswered (6.5%).

Television turns out to be an area where students are less environmentally conscious as only a little more than half (55.8%) actually turn off the television when they are not watching it (see Figure 8). As 44.2% of students leave the television on, 11.8% of those respondents leave the television on all the time while a majority (88.2%) sometimes leave it on when it is not in use. The reasons behind leaving the television on when it was not in use was due to background noise (22.1%), coming right back (16.9%), laziness (11.7%), and a combination of forgetfulness, carelessness, and being in a hurry (9.1%). A little more than a third (40.3%) of the participants did not provide an answer to this question.

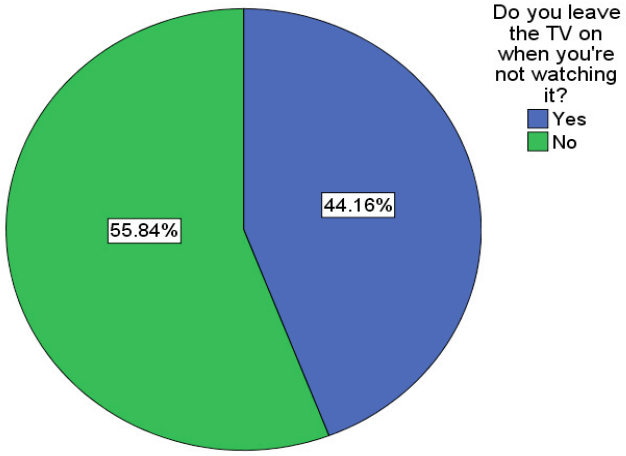


Figure 8. Leaving the television on.

A majority (89.6%) of the dormitory students surveyed utilize a power strip for electronic appliances. Of the 89.6% only 11.6% of those students actually turn off the power strip when their electronics are not charging; thus, a vast percentage (88.4%) leave the power strip turned on at all times. Next, students were asked, what is the purpose of turning the power strip off when the electronics are not in use? In regards to rationale behind shutting down the power strip, 42.9% responded to save energy, 5.2% claimed safety/fire, 2.6% indicated to save money, 7.8% had no idea why, whereas 41.6% unfortunately had no response.

It may come as no surprise that out of all the students surveyed 98.7% have a cell phone. Of those who own a cell phone a majority (80.3%) do not unplug their cell phone charger after use (see Figure 9). A further examination of the minority (19.7%) who actually unplugs their cell phone charger showed that more than half of those (53.3%) indicated they always unplug the charger while 46.7% sometimes do. Next, participants indicated how unplugging or not unplugging a cell phone charger affects energy consumption. Approximately half (50.6%) of the respondents felt that unplugging a cell phone charger saves energy. The remaining respondents indicated they are not aware of the effects (31.2%), they view unplugging as a method to save money (2.6%), or they gave no answer (15.6%).

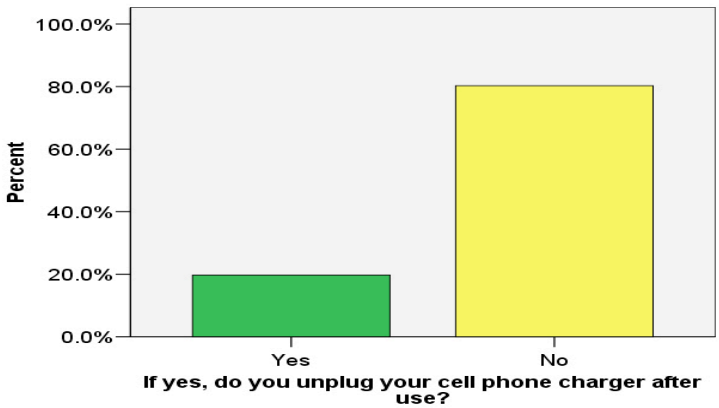


Figure 9. Unplugging the cell phone charger.

Concerning dormitory environment, 77.9% of students indicated their room has been either too hot or too cold. Approximately a third (33.8%) of students have ever used any energy saving products. Of that third, most (65.4%) have used energy saving light bulbs, 11.5% denoted power strips, 7.7% indicated blankets, 3.8% used showerheads, (3.8%) have used large energy efficient appliances, while 7.7% did not indicate the product used. An interesting cross tabulation between the questions have you ever used any energy saving products and are in you interested in environmental issues?, revealed that 34 of the students interested in environmental issues have not ever used an energy saving product. Thus, a disconnect exists between support and follow through on environmental concerns as demonstrated by the cross tabulation in Table 2.

Table 2: *Cross Tabulation of Energy Products with Environmental Issues*

Have you ever used any energy saving products?	Are you interested in environmental issues?		
	Yes	No	Total
Yes	25	1	26
No	34	17	51
Total	59	18	77

The final section in the Environmental Awareness Survey entailed questions concerning environmental awareness. More than three-fourths (76.6%) of the students are interested in environmental issues (see Figure 10). In terms of gender a slightly larger ratio of males surveyed are interested in environmental issues than females. Percentages show 83.3% of males are supportive, and 68.6% of females are supportive. In reference to all the students interested in environmental issues, energy (25.4%) was listed as the most important issue among the student population in the dormitories. After energy concern follows global warming (18.6%), recycling/wastes (15.3%), wildlife preservation (10.2%), pollution (8.5%), water issues (5.1%), population growth (1.7%), deforestation

(1.7%), and ozone layer (1.7%). Several students interested in environmental issues did not specify a response (11.9%).

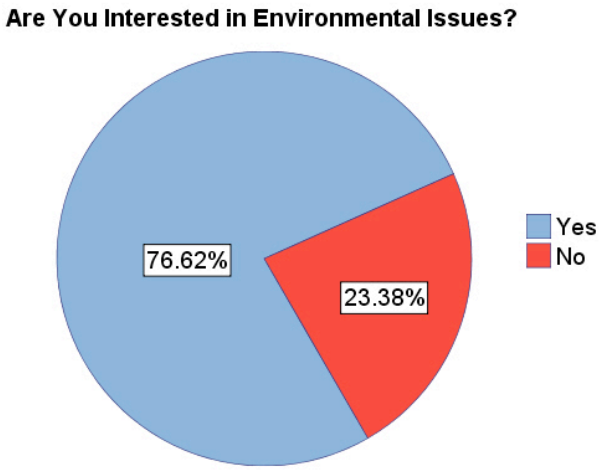


Figure 10. Interest in environmental issues.

More than half (53.2%) of the students would be interested in participating in an environmentally friendly competition between dormitories. Also more than half (58.4%) of the respondents are familiar with the concept of a green dormitory, while 3.9% indicated they might be familiar with the term. If provided the opportunity to live in a green dormitory, 45.5% of students would want to live in green housing, 40.3% would not want to live in green housing, whereas 14.3% might consider the opportunity. Surprisingly, 17 of students interested in environmental issues would not want to live in a green dormitory (see Table 3). The motives behind wanting or not wanting to live in a green dormitory were listed as: good for the environment (19.5%), ready for change/why not (15.6%), not familiar with the concept of a green dorm/undecided (14.3%), happy with current circumstances/difficult to alter habits (7.8%), experimental technologies are not effective (1.3%), graduating (1.3%), or no answer was specified (40.3%).

Overall, the survey findings proved to be very informative as more than 75 percent of the dormitory students appeared to be interested in environmental issues. In general the students had just a basic understanding of energy and water resources.

This basic knowledge could potentially be expanded by more exposure to ecological subject-matter. Interestingly, the survey provided insight that female students tended to consume more water resources more than their male counterparts due to longer bathing periods. Additionally, a common theme throughout the survey was that the students' parents have had a significant impact on their children's resource consumption habits. For instance, many students indicated that they turned off the lights when they left a room, or turned off the water while brushing their teeth due to habits derived from parental influence. However, when it came to technological devices, the students demonstrated poor conservational behaviors. Students displayed a tendency to leave televisions on when they were not watching them, kept their cell phone chargers plugged in, and left power strips turned on. Moreover, several students indicated that they were unclear of the benefits associated with turning off these devices. These findings led me to believe that much of the students' environmental awareness has been due to exposure from parents. As a consequence, additional educational opportunities may reduce the students' environmental impact.

Table 3: *Cross Tabulation of Environmental Issues with Green Dormitories*

Are you interested in environmental issues?	Would you want to be housed in a green dormitory?			
	Yes	No	Maybe	Total
Yes	33	17	9	59
No	2	14	2	18
Total	35	31	11	77

Ecological Footprint

This section has been incorporated to determine the impact of dormitory student residing in Ridgecrest East and Lakeside East. The ecological footprint calculation was utilized to determine land use requirements associated with the consumption of resources.

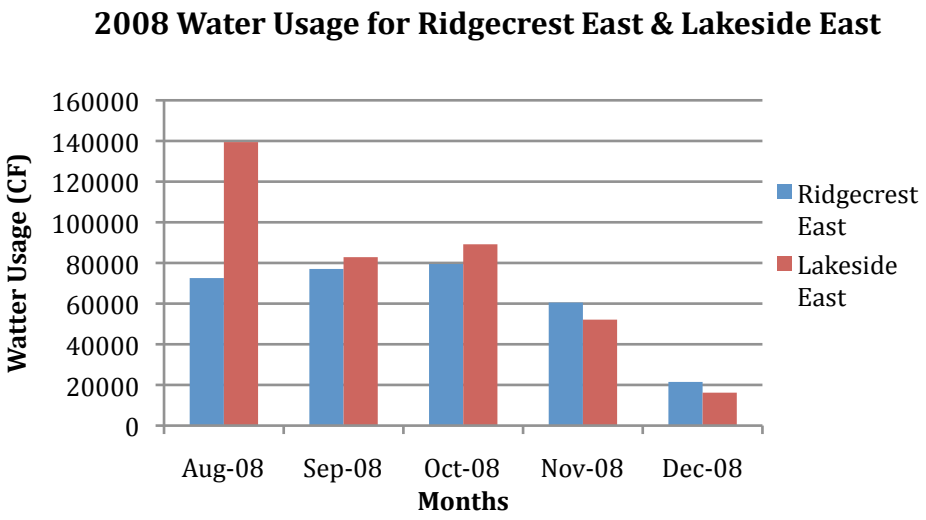
The calculation was performed utilizing water, electric, and natural gas records. All the records used in this study were obtained from the Department of Energy Management.

Water

Water usage records were acquired pertaining to Ridgecrest East and Lakeside East Residential Halls from August to December 2008. Due to some technical problems with the water meters, accurate water usage readings prior to August 2008 were unattainable. The trend for water usage at Ridgecrest East showed little variation during the months of August, September, and October as consumption ranged from approximately 72,000 to 80,000 cubic feet or approximately 538,000 gallons to 599,000 gallons. Usage dropped slightly during November followed by a dramatic decrease in December. Lakeside East Residential Hall demonstrated more drastic trends than Ridgecrest East as usage in August peaked at nearly 140,000 cubic feet followed by a marked decline in September as Lakeside levels dropped around 40%. A slight increase occurred during the month of October. In November and December consumption decreased drastically as water usage dipped below Ridgecrest levels. Figure 11 details water usage in cubic feet consumed.

Figure 12 depicts the steps that were utilized to calculate the ecological footprint of water resources consumed in the dormitories Lakeside East and Ridgecrest East. First, the populations of Lakeside East and Ridgecrest East were established. As mentioned previously, 238 students reside within Lakeside East, whereas 316 students live in Ridgecrest East. A full twelve months of records were unavailable, so estimations were used to approximate the yearly water consumption levels within the dormitories. The 2008 yearly estimations for each building were derived from taking the average amount of water used during the five months and then multiplying that average by twelve

months. For Ridgecrest East the figure 746,616 cubic feet was used as the 2008 water usage estimate, while the figure 911,496 cubic feet was used for Lakeside East.



Source: University of Alabama Department of Energy Management

Figure 11. 2008 Water Usage for Ridgecrest East and Lakeside East.

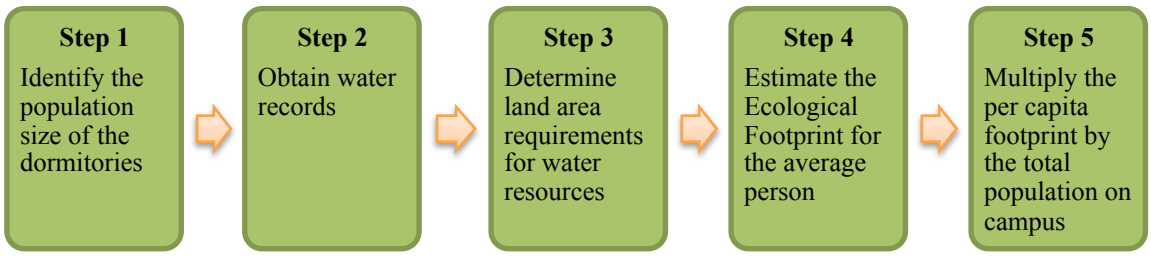


Figure 12. Ecological footprint procedure for water.

Thus, an ecological footprint calculation concerning water resources can be derived by utilizing the water consumption estimates for the two residential halls as indicated above. Initially, the amount of water consumed in cubic feet per dormitory student must be established. The number was calculated by dividing the total water estimates for each dormitory by the subsequent student populations residing in each residential hall. Consequently, the average amount of water consumed per student for

Lakeside East was 3,830 cubic feet (28,649 gallons) and 2,363 cubic feet (17,674 gallons) for Ridgecrest East.

To obtain a real-world comparison, consumption figures of the individual dormitory student are listed in gallons as well as cubic feet. The individual usage levels can further be broken down into daily usage figures by dividing by 365 to represent the approximate number of days in a year. As a result the daily consumption level for an individual residing in Lakeside East was 10.49 cubic feet or 78.49 gallons and 6.47 cubic feet or 48.42 gallons for those in Ridgecrest East. Daily usage figures are useful as they can be easily compared to the national average of the average American. According to the Environmental Protection Agency (2003), the average American consumes 90 gallons of water daily in the home, as compared to the average European consuming 53 gallons daily, and the typical Sub-Saharan African citizen consuming only 3-5 gallons per day.

After establishing the consumption levels for water resources, it was necessary to determine the amount of land required for the utilization of water resources. Thus, water resources were converted to cubic meters by multiplying by 0.0283 and then divided by 1,500 m^3/ha/yr to accommodate the amount of forested land needed to accommodate the water consumed (Anundson et al., 2001, p. 26). The result was equivalent to 0.0723 hectares (0.1785 acres) per dormitory student in Lakeside East and 0.0446 hectares (0.1101 acres) per dormitory student in Ridgecrest East.

Table 4: *Ecological Footprint for Water 2008*

Ecological Footprint for Water 2008	**Lakeside East**	**Ridgecrest East**
Total Water Usage 2008 (cubic ft)	911,496	746,616
Water Usage per Month (cubic ft)	75,958	62,218
Water per Student in 2008 (cubic ft)	3,830	2,363
Total Land Area in Hectares per Dormitory Student	0.0723	0.0446
Total Land Area in Acres per Dormitory Student	0.1785	0.1101

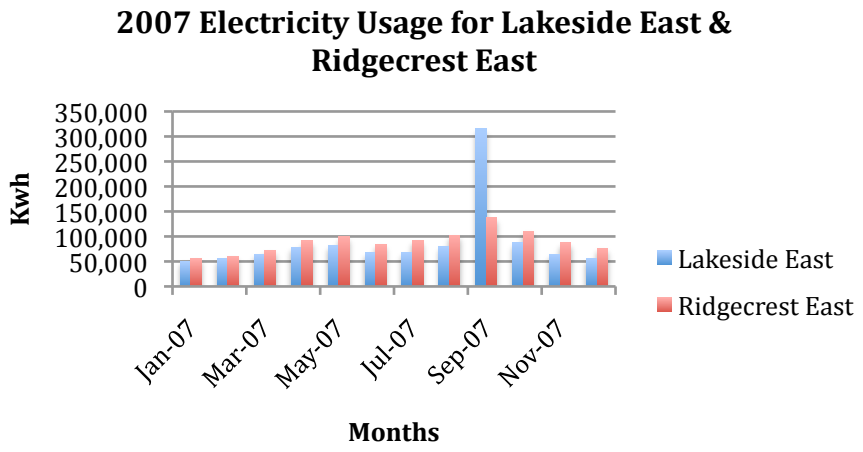
It is germane to keep in mind that all of these figures, concerning hectares/acreage required, only apply to the land required concerning water resources utilized during the consumption of housing. Accordingly, "the ecological footprint concept is based on the idea that for every item of material or energy consumption, a certain amount of land in one or more ecosystem categories is required to provide the consumption-related resource flows and waste sinks" (Wackernagel & Rees, 1996, p. 63). Thus, a complete ecological footprint calculation encompasses many different goods and services as this study looks specifically at water and energy resources associated with housing needs of dormitory students on The University of Alabama's campus.

Electricity

In addition to supplying the water records, as indicated in the findings in the previous section, the Department of Energy Management also provided electric and natural gas records for use in this research. To assist with the analysis of Lakeside East and Ridgecrest East Residential Communities, complete electrical and natural gas records were gathered from January 2007 to December 2008. Energy consumptions records from both 2007 and 2008 show a general trend of Lakeside East utilizing slightly less electricity per month with the exception of a peak on September 2007. During September 2007, Lakeside East Residential Hall experienced a spike in usage as 315,007 kilowatt hours (kWh) were consumed. This consumption stands-out on the electrical records as neither Lakeside East nor Ridgecrest East demonstrated another usage level over 140,000 kilowatt hours during the two-year span.

Despite the September peak for Lakeside East, electricity usage throughout the 2007 year remained somewhat consistent as January through March accounted for a range of approximately 50,000 to 65,000 kWh. April to May experienced a slight

increase with consumption hovering near 80,000 kWh. June to July numbers were barely below 70,000 kWh, while August numbers increased back up to nearly 80,000 kWh. October boasted the second highest usage for 2007 at 87,151 kWh. Finally, during the months of November and December consumption ranged from 65,000 to 55,000 kWh. Interestingly, even as Lakeside East consistently consumed less power per month during 2007 with the exception of the September spike, the total 2007 energy consumption figures for Lakeside East (1,067,609 kWh) were slightly higher than Ridgecrest East (1,066,400 kWh).

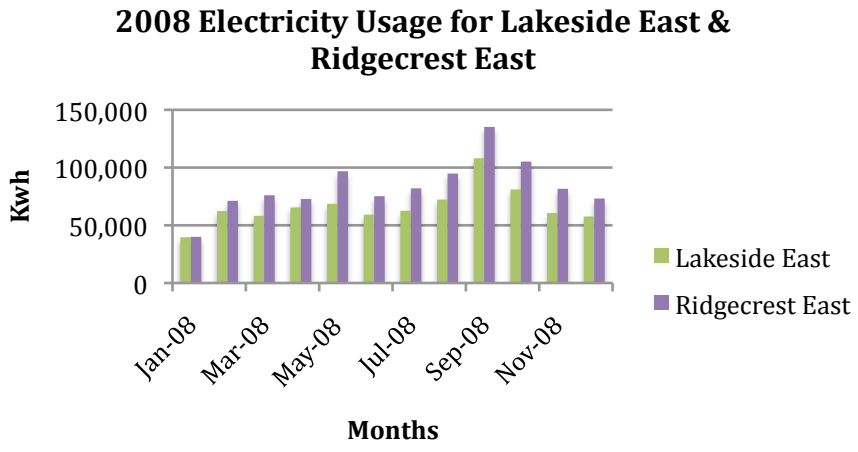


Source: University of Alabama Department of Energy Management

Figure 13. 2007 Electricity Usage for Lakeside East and Ridgecrest East.

As mentioned previously, Ridgecrest East has in general consumed a higher amount of electricity in terms of kilowatt hours per month during 2007 when compared to Lakeside East. Those higher consumption rates for Ridgecrest East are indicated as the following approximated percentages above Lakeside East's usage levels: January was 11% higher, February displayed an 8% increase, March had an 11% increase, April saw a 16% increase, May's increase jumped up 22%, June displayed a 24% increase, July had a 35% increase, October displayed a 27% rise, November increased to 35%, and finally

December had a 36% increase over Lakeside East's consumption levels. Electricity consumption for Ridgecrest East during September 2007 was only about 44% of what Lakeside East consumed.



Source: University of Alabama Department of Energy Management

Figure 14. 2008 Electricity Usage for Lakeside East and Ridgecrest East.

During 2008, Lakeside East consumed less total electricity each month than Ridgecrest East. Moreover, when the total consumption figures of 2008 for both dormitories are compared to the 2007 fiscal year, together the buildings show an overall decrease in electrical usage. Lakeside East displayed the following monthly consumption during 2008 recorded in kilowatt hours: January was 39,628 kWh; followed by February with 62,320 kWh; March consumed 58,206 kWh; April used 65,469 kWh; May was 68,613 kWh; June was recorded at 59,222 kWh; July had 62,597 kWh; August consumed 72,264 kWh; September was recorded at 108,040 kWh; October used 81,022 kWh; November had 60,623 kWh of usage; and finally during December 57,632 kWh were utilized. Consistently throughout every month of 2008, Lakeside East consumed fewer kilowatts per hour than Ridgecrest East. Ridgecrest East utilized the following percentages per month above Lakeside's usage levels: January 1% higher, February 14%

more, March 31% greater, April 11% above, May 41% more, June 27% greater, July 31% higher, August 31% more, September 25% greater, October 30% higher, November 35% above, and 27% more in December.

Similar to the methodology utilized to calculate the ecological footprint concerning water resources, Figure 15 depicts the ecological footprint procedure from which the electrical impact of students was derived.

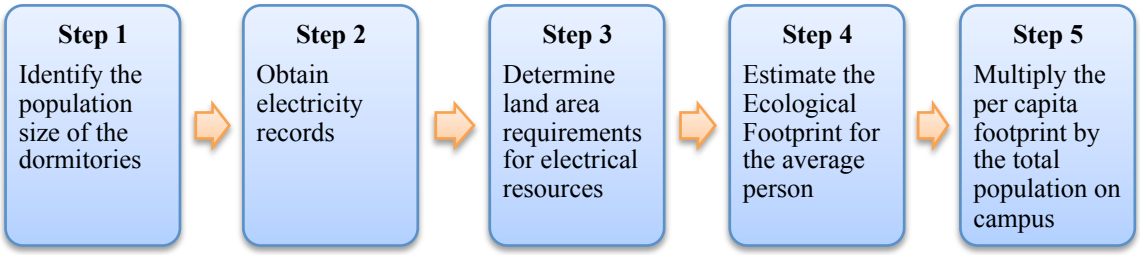


Figure 15. Ecological footprint procedure for electricity

For a more in-depth analysis of electrical usage for the two dormitories, the amount of energy utilized by each dormitory student for the year was calculated as the total electricity consumption numbers were divided by the amount of students residing within each dormitory. This accounted for the amount of electricity utilized per student to be 4,486 kWh at Lakeside East and 3,375 kWh at Ridgecrest East. It is important to note that even though the energy consumption numbers showed little variation during the 2007 fiscal year, the higher population numbers within Ridgecrest East resulted in energy usage per student that was considerably less than the those found at Lakeside East. Just as the 2007 electricity records were broken down for analysis, the 2008 electricity records were evaluated for individual usage levels. To acquire the electricity consumed per dormitory student during 2008, the electrical totals were divided by the amount of the respective residential populations. Thus, the average student consumed 3,343 kWh within Lakeside East and 3,177 kWh for Ridgecrest East. To relate student electricity

consumption rates to a real-world example the 2007 and 2008 figures were broken into monthly averages. The 2007 monthly rates per dormitory student were calculated to be approximately 374 kWh for Lakeside East and approximately 281 kWh for Ridgecrest East. For 2008 the monthly averages were approximately 279 kWh for Lakeside East and approximately 265 kWh for Ridgecrest East. According to the Energy Information Administration (2007), the average Alabama household consumes 1,305 kWh per month.

After the consumption levels were successfully calculated for electrical resources, the amount of land could be determined for the usage of electrical resources. To accommodate the carbon emissions from the utilization of electricity the rate of 169 m^2 of forest for every 100 kWh of electricity was used for the following ecological footprint calculations (Anundson et al., 2001, p.11). Thus, the individual amount of electricity per dormitory student was first divided by 100 kWh and then multiplied by 169 m^2. Accordingly during 2007 for Lakeside East, the amount of land needed per dormitory student was 7,581 m^2 (0.758 hectares or 1.873 acres) and for Ridgecrest East 5,703 m^2 (0.570 hectares or 1.409 acres). During 2008, the amount of forested land area necessary per student amounted to 5,650 m2 (0.565 hectares or 1.396 acres) for Lakeside East and 5,369 m^2 (0.537 or 1.327 acres) for Ridgecrest East. In Table 7, meters squared were converted to hectares by dividing by 10,000. Additionally, hectares were converted by multiplying by 2.471.

As a reminder, it is important to note that all the ecological footprint analysis that has been mentioned in this section pertains only to the electrical energy consumption as related to housing concerns. In reality electricity consumed for housing is only one area of a person's life where electricity is utilized. Therefore, the electrical usage and subsequent land area may in fact be larger than the estimates listed above. In general,

ecological footprint calculations encompass a variety of goods and services associated with a person's lifestyle. This research looked specifically at water and energy usage of the footprint equation as related to housing needs.

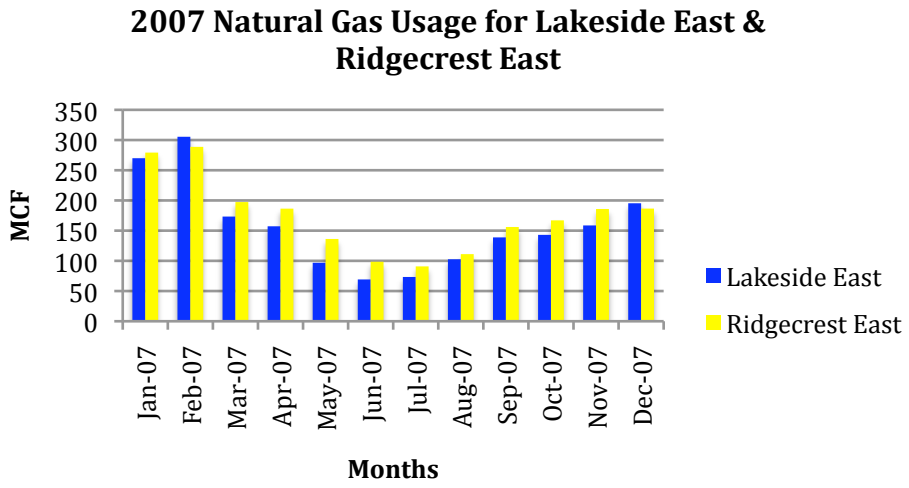
Table 5: *Ecological Footprint for Electricity 2007 and 2008*

Ecological Footprint for Electricity 2007	**Lakeside East**	**Ridgecrest East**
Total Electricity 2007 (kWh)	1,067,609	1,066,400
Electricity per Student in 2007 (kWh)	4,486	3,375
2007 Total Land $(m)^2$ per dormitory student	7,581	5,703
2007 Total Land in Hectares per dormitory student	0.758	0.570
2007 Total Land in Acres per dormitory student	1.873	1.409
Ecological Footprint for Electricity 2008	**Lakeside East**	**Ridgecrest East**
Total Electricity 2008 (kWh)	795,636	1,004,000
Electricity per Student in 2008 (kWh)	3,343	3,177
2008 Total Land $(m)^2$ per dormitory student	5,650	5,369
2008 Total Land in Hectares per dormitory student	0.565	0.537
2008 Total Land in Acres per dormitory student	1.396	1.327

Natural Gas

To complete the energy consumption analysis, natural gas records were gathered from the Department of Energy Management. The natural gas records spanned from January 2007 until December 2008 for both Lakeside East and Ridgecrest East Residential Halls. Unlike the records for water and electricity resources, natural gas usage patterns for the two dormitories almost mirrored each other. Accordingly, Lakeside East consumption rates were recorded as the following: January 269.9 Mcf (Mcf stands for one thousand cubic feet), February 305.4 Mcf, March 173.3 Mcf, April 157.2 Mcf, May 96.8 Mcf, June 69.2 Mcf, July 73.3 Mcf, August 102.6 Mcf, September 138.8 Mcf, October 143 Mcf, November 158.6 Mcf, and December 195.3 Mcf. Ridgecrest East's natural gas usage pattern during 2007 varied only a little from Lakeside East's records as all the months except February and December showed a slight increase

in natural gas consumption over Lakeside East. Moreover, February and December illustrated slightly lower usage levels for Ridgecrest East than of those rates for Lakeside East.

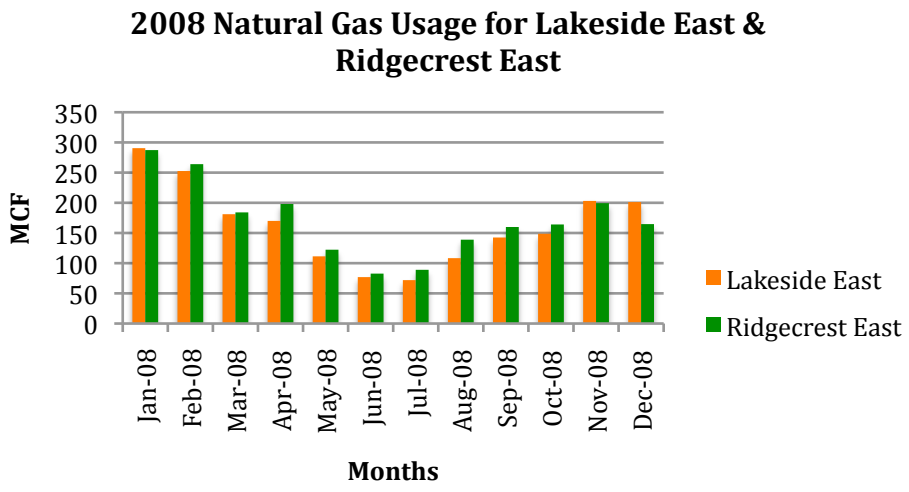


Source: University of Alabama Department of Energy Management

Figure 16. 2007 Natural Gas Usage for Lakeside East and Ridgecrest East.

Similar to the 2007 natural gas records, during 2008 the two dormitories' natural gas consumption levels nearly mirrored their usage levels again. The following natural gas usage were recorded for Lakeside East: January 290.5 Mcf, February 252.6 Mcf, March 181.1 Mcf, April 170 Mcf, May 111.3 Mcf, June 76.9 Mcf, July 71.9 Mcf, August 108.3 Mcf, September 142.5 Mcf, October 148.7 Mcf, November 203.1 Mcf, and December 201.2 Mcf. Resembling Lakeside East, Ridgecrest East demonstrated a similar usage pattern with only slightly higher rates during all of 2008, except for the months of January, November, and December. During these months Ridgecrest East showed consumption levels to be a little lower than those of Lakeside East. It may come as no surprise that the general trend of natural gas levels for both 2007 and 2008 indicated

increased consumption during the cold winter months and lower usage rates during the hot summer months when the majority of students reside off-campus.



Source: University of Alabama Department of Energy Management

Figure 17. 2008 Natural Gas Usage for Lakeside East and Ridgecrest East.

Just as all the applicable water and electrical resources have been analyzed utilizing the ecological footprint diagram in Figure 18, so has the consumption of natural gas in relation to the housing needs of dormitory students.

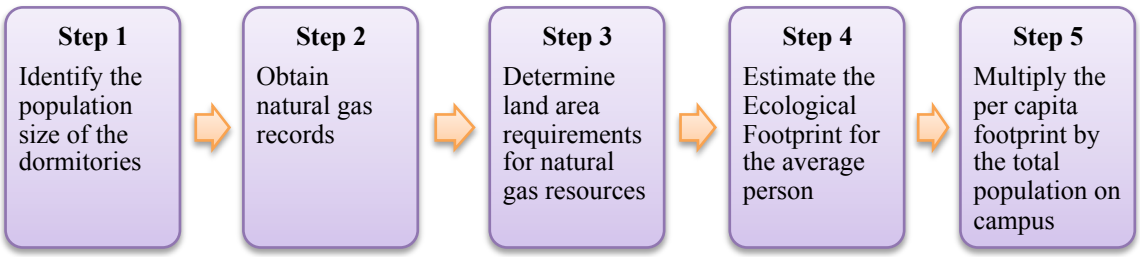


Figure 18. Ecological footprint procedure for natural gas.

First, as all the records were issued in Mcf a simple conversion was performed to convert these numbers into cubic feet (cf). Thus, the total amount during 2007 of natural gas consumed in Lakeside East amounted to 1,883,400 cf and 2,083,500 cf for Ridgecrest

East. To acquire the individual consumption levels, the total 2007 natural gas figures were divided by the subsequent residential population of each building. This calculation resulted in an average usage of 7,913 cf per dormitory student residing within Lakeside East and 6,593 cf per resident within Ridgecrest East. Just as the natural gas records for 2007 were broken down for analysis, so too were the 2008 records. During 2008 the total natural gas usage for Lakeside East was 1,958,100 cf while Ridgecrest East was 2,054,400 cf. Even though the raw numbers entail a larger consumption rate for Ridgecrest East than for Lakeside East, the actual environmental impact of individual students at Ridgecrest East was less severe. To achieve the individual impact per student the total natural gas usage levels were divided by the applicable dormitory population. Thus, individuals within Lakeside East consumed an average of 8,227 cf per year, while those residing within Ridgecrest East only utilized 6,501 cf on average. According to the Energy Information Administration (2001), the average household consumption levels of natural gas in the southern United States were 59,000 cf during 2001.

Table 6: *Ecological Footprint for Natural Gas 2007 and 2008*

Ecological Footprint for Natural Gas 2007	**Lakeside East**	**Ridgecrest East**
Total Natural Gas 2007 (cf)	1,883,400	2,083,500
Natural Gas per Student 2007	7,913	6,593
2007 Total Land $(m)^2$ per dormitory student	688	574
2007 Total Land in Hectares per dormitory student	0.069	0.057
2007 Total Land in Acres per dormitory student	0.170	0.142
Ecological Footprint for Natural Gas 2008	**Lakeside East**	**Ridgecrest East**
Total Natural Gas 2008 (cf)	1,958,100	2,054,400
Natural Gas per Student 2008	8,227	6,501
2008 Total Land $(m)^2$ per dormitory student	716	566
2008 Total Land in Hectares per dormitory student	0.072	0.057
2008 Total Land in Acres per dormitory student	0.177	0.140

After successfully determining the natural gas consumption levels for the dormitory students, the amount of land can be determined to accommodate resource

usage. Anundson et al. (2001) found "the amount of forest needed to absorb the carbon emitted from burning natural gas is 8.7 m^2 for every 100 cubic feet of gas" (p.11). Accordingly, the amount of forested area required for an individual dormitory student can be calculated by dividing the individual consumption numbers by 100 cf and then multiplying the answer by 8.7 m^2. During 2007, 688 m^2 (0.069 hectares or 0.170 acres) of forested land would be needed to sustain the average student living in Lakeside East, while 574 m^2 (0.057 hectares or 0.142 acres) would be needed for the average Ridgecrest East resident. During 2008, 716 m^2 (0.072 hectares or 0.177 acres) would be needed for an individual residing in Lakeside East as 566 m^2 (0.057 hectares or 0.140 acres) of forested area would sustain a Ridgecrest East occupant in regard to natural gas requirements related to housing needs. While reviewing Table 6, please note the ecological footprint calculation is based only from natural gas usage of the dormitory students as related to housing needs.

To conclude the ecological footprint analysis of the dormitory students, the individual land area requirements per dormitory students were recalled. The following numbers were calculated as land needed per individual resident at Lakeside East: 0.179 acres for water resources in 2008, 1.873 acres for electricity in 2007, 1.396 acres for electricity in 2008, 0.170 acres for natural gas in 2007, and 0.177 acres for natural gas in 2008. Furthermore, Ridgecrest East's numbers were 0.110 acres for water in 2008, 1.409 acres for electricity in 2007, 1.327 acres for electricity in 2008, 0.142 acres for natural gas in 2007, and 0.140 acres for natural gas in 2008. Thus, if the entire student population that resides on-campus of approximately 7,000 individuals adopted the consumption habits of either Lakesides East or Ridgecrest East residents, then the land acreage as illustrated in Table 7 would have been needed.

When evaluating these figures it is important to understand that Lakeside East and Ridgecrest East are both relatively new buildings found on The University of Alabama's campus. As this study represents a sample of consumption levels taken from the new and therefore more efficiently constructed dormitories, the land requirement estimations for the students living on-campus are likely to be a best-case scenario. Overall, from the ecological footprint calculations utilized, Ridgecrest East displayed a lower environmental impact or land requirement than Lakeside East for water, electricity, and natural gas. Additionally, land requirements decreased for electricity needs for both dormitories from 2007 to 2008. On the other hand, during the two year-span the land requirements for natural gas showed only a slight decrease for Ridgecrest East while Lakeside East showed an increase in demand. Acreage for water resources were not compared from 2007 to 2008 as the required data were unattainable.

Table 7: *Ecological Footprint for the On-Campus Population*

Ecological Footprint: Land Requirements in Acres for the Dormitory Student Population	**Lakeside East**	**Ridgecrest East**
From 2008 Water Consumed	1,253	770
From 2007 Electricity Consumed	13,111	9,863
From 2008 Electricity Consumed	9,772	9,289
From 2007 Natural Gas Consumed	1,190	994
From 2008 Natural Gas Consumed	1,239	980

University of Alabama

The University of Alabama, located in Tuscaloosa, Alabama, served as the focus for this environmental awareness research. To create a snapshot of The University of Alabama, research was gathered by way of interviews, articles from the University's newspaper the Crimson White, and seminar attendance at the UA National Teach-In Climate Dialogue. Similar to the analysis of the three universities in chapter one of this

research, green initiatives and programs were collected from the areas of policy, buildings, food, and recycling. The information gathered reflect the views and opinions of the researcher alone. Thus, the data collected reflects environmental programs that were accessible to a student in an on-campus setting. Programs and initiatives available to the University outside the traditional campus environment have not been documented in this study.

In accordance with policy, The University of Alabama has shown support through sustainable initiatives and curriculum. In recent years environmental issues have become more prevalent on Alabama's campus. For instance, "before starting classes this fall, students received an e-mail from UA President Robert Witt on Aug. 14 highlighting the University's commitment to creating and supporting a sustainable environment" (Bralley, 2008). The initiatives can be seen in the increased awareness via utilizing busing systems in campus transportation, implementing Green Fairs, updating cafeterias within university dining programs, promoting the farmer's market as it relocated closer to campus, and developing recycling strategies on football game days. Additionally, the curriculum is strong as The University of Alabama promotes environmental studies on campus through the Department of New College.

After policy, the next area evaluated concerning the University is that of buildings. The University of Alabama supports green initiatives through the energy competition. An energy conservation competition within the residential halls has been launched as of January 2009. Bursch (2009) reported, "Residence halls around campus will be in a competition to try to reduce their energy consumption by at least 10 percent. Whichever dorm reduces its energy consumption by the highest amount will receive its choice of a Wii or an Xbox 360 that will be available for community usage." Since dormitory students have been targeted for this research, this section has been evaluated in

relation to on-campus residential needs. Furthermore, in terms of energy consumption The University of Alabama uses 27% less energy than the national average for college campuses (UA Department of Energy Management, personal communication, February 6, 2009). [2]

Currently, there are no green dormitories that exist on The University of Alabama's campus. However, Ridgecrest South is a new residential building currently under construction that will host more green elements than any other dormitory on Alabama's campus. Ridgecrest South will include a more efficient heating and air system as well as low-flow toilets (Bralley, 2008). Additionally, Ridgecrest South is making use of once unsuitable land as the building is being constructed on top of a brownfield site (Leopard, 2008). According to the Environmental Protection Agency (2009a), "Brownfields are real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant."

In support of sustainability and green building principles, The University of Alabama joined the U.S. Green Building Council (Wymer, 2008). However, as a member of the USGBC the University has opted not to seek LEED certification due to the costs associated with the documentation procedure (Bralley, 2008). Similar to the case of Bates College, buildings can be considered green without the official LEED documentation. These buildings are often referred to as LEED equivalent. Thus, Alabama can strive to implement green strategies within dormitories even without the proper administrative paperwork.

As residential halls impact university students, likewise, food services are a large part of campus life. Under the category of food, The University of Alabama has

[2] A personal interview was conducted within the Department of Energy Management on February 6, 2009.

benefitted from a farmer's market that has located near the edge of campus in respect to seasonal offerings. Though organic and locally grown foods are sometimes used within the cafeterias, the University must also consider cost factors when making purchases. Nevertheless, environmental strides have been made in the on-campus dining services. Trays have been removed from the cafeterias in an effort to conserve water resources. Fryer oil is currently being recycled. Furthermore, dining services launched a green logo competition. A new program involving composting of cafeteria wastes is also in the works due to collaborative efforts among dining services, New College, and the arboretum. [3]

In regard to reuse of wastes, recycling is the last category evaluated for The University of Alabama. Though Alabama has yet to enter the RecycleMania competition discussed previously by the Green Honor Roll Universities, recycling efforts have made leaps and bounds in recent years. During the 2006-2007 academic year total revenue received from recycling efforts totaled $6,800, while the 2007-2008 year yielded $47,467.05. This dramatic increase is due to the following efforts: an expansion of products collected, an improvement in the appearance of the recycling receptacles, an implementation of cardboard dumpsters for move-in days, and a deployment of recycling strategies for game days (UA National Teach-In Climate Dialogue, February 5, 2009). [3]

All the sustained progress in terms of policy, buildings, food, recycling, as well as the numerous other programs not documented by this study are all in line with the University's new initiative to become a greener campus. Table 8 creates a snapshot of where The University of Alabama is at concerning green programs. The table is a useful tool as it illustrates the strengths and opportunities as presented against more established green schools. Additionally, Table 8 reflects a selection of environmental programs

[3] A seminar was conducted on the University of Alabama campus on February 5, 2009.

found on-campus from research compiled from the fall academic semester of 2008 to the start of the spring academic semester of 2009.

Table 8: *Environmental Programs at Harvard, Emory, Bates, and University of Alabama*

	Harvard	**Emory**	**Bates**	**UA**
Policy				
Sustainable Initiative	X	X	X	X
Presidential Climate Change Commitment			X	
Environmental Office/Staff	X	X	X	
Curriculum	X	X	X	X
Environmental Plan/Principles	X	X	X	
Green Revolving Loan Fund	X			
Buildings				
Green Building Elements	X	X	X	
LEED Certified	X	X		
Energy Competition	X	X		X
Food				
Farmer's Market	X	X	X	X
Organic/Local Food in Cafeterias	X	X	X	
Recycling				
Recycling Program	X	X	X	X
RecycleMania Participant	X	X	X	

CHAPTER 4

RECOMMENDATIONS

Though much progress has been made in recent years there is more that The University of Alabama can do in support of sustainable practices, as exemplified by green universities across the country. The first step toward becoming a green campus merely entails setting the goal of wanting to be more sustainable. President Witt's message to the student body during fall of 2008 was the initial step required to set the tone for the campus. Now that a goal has been set, a subsequent plan will need to be developed. Objectives will need to be established in order to facilitate progress toward the end goal.

Before any other steps of the plan can be formulated lest carried out, it is essential to stop and take an inventory. The inventory determines where the campus is now so that progress may be more accurately measured. Thus, this research has served as a snapshot of where the campus currently is, during the academic semesters of fall of 2008 to early spring of 2009 in terms of sustainability. The snapshot is a useful tool as it was used to compare The University of Alabama to the top green schools. These prestigious universities were utilized in this analysis to serve as the pinnacle of where The University of Alabama may strive to be concerning environmental initiatives.

Taking the other schools analyzed in this research into consideration, my first recommendation is to formulate an official environmental plan that involves a variety of stakeholders in the planning process. Initiatives taken on behalf of The University of Alabama affects students, faculty, staff, alumni, investors, and the community as a whole.

During the planning process, objectives must be set that are measurable as well as supportive to the overall goal of the plan. If these objectives are in fact quantifiable, then they will later serve as milestones to denote the University's progress. Research, such as the ecological footprint calculations as used in this study, will be beneficial for formulating objectives. Hence, years from now the footprint calculations can be performed again to establish whether or not progress has been made in regard to the land requirements associated with water and energy resources needed for on-campus housing.

My second recommendation is to strive to establish a recognizable environmental office on campus supported by a full-time staff. In this manner as the student population keeps filtering through year after year, there exists knowledgeable staff to assist with inquiries from environmentally-aware students and community members as well as to address sustainability issues in accordance with the campus's environmental plan. To clarify, offices do exist that promote sustainability such as the Department of Energy Management. The Department of Energy Management maintains a goal to efficiently manage and reduce the consumption of energy by The University of Alabama.[4] That noted, my suggestion is to have an actual Sustainability Office located on The University of Alabama's campus. According to data gathered on sustainable universities by the Sustainable Endowments Institute (2009), "A considerable number of schools have recognized the need for full-time campus sustainability administrators. Currently, 56 percent report having dedicated sustainability staff."

My third recommendation concerns green buildings. As this study explored green buildings or more specifically green dormitories, the incorporation of green building elements within residential student housing just makes sense. Universities are in general long-term owners; thus, looking at the costs over the period of a product's life cycle will

[4] A personal interview was conducted within the Department of Energy Management on February 6, 2009.

help displace some of the additional costs associated with green building methods. According to Moskow (2008), "Sustainable developments are more cost-effective in the long term and, therefore, ultimately, more valuable" (p.xv). This is especially true as the price of resources such as electricity and natural gas continue to rise. Additionally, green buildings have been noted to promote a healthy, productive work environment that would benefit the welfare and academic status of The University of Alabama.

Fortunately, The University of Alabama has already begun incorporating some green features in buildings such as low flow toilets, low flow faucets, low flow showerheads as well as plans for lighting controls and high efficiency hoods for new projects. Though those efforts are commendable, my recommendation is to use Bates College as an example to strive toward concerning green buildings. Due to cost restrictions, Bates College has not filed for the proper LEED certification for their structures. Despite not having filed, Bates College has used the LEED criteria as a standard in which to construct LEED equivalent buildings. Furthermore, green is marketable, and green building designs are a good way to promote The University of Alabama's image.

My fourth recommendation regards education. When dealing with planning issues on a university campus, the student population represents a significant stakeholder. During this study a sample of the dormitory students were provided the opportunity to voice their opinions toward green issues. The results of this research allowed insight into whether or not the students are supportive of elements towards the goal of creating a greener campus. An important finding of the research revealed that over 75 percent of the dormitory students surveyed are interested in environmental issues. Given that statistic, it was interesting to learn that only 55.8% of the students surveyed turn off their television when they are not watching it, 80.3% of those surveyed who own a cell phone

do not unplug their charger after use, and many of students who are actually interested in environmental issues would not want to be housed in a green dormitory if they had the opportunity. In general, the dormitory students tended to overconsume resources associated with high-tech devices. On the other hand, 87% of the students surveyed reported that they do turn off the light when they leave a room. This finding led me to believe that parental influence had a large impact on their resource consumption habits. Not only did some of the students surveyed indicate parental influence as a reason for turning off the lights, but also the students have just a basic understanding of water and energy knowledge. For example, 42.9% of those surveyed knew that less than 5% of the water found on Earth is considered fresh. Thus, The University of Alabama has the opportunity to pick up where the parents have left off concerning expanding students' knowledge base concerning the consumption of resources.

Additional educational opportunities may in fact reduce the environmental impact of the University. Due to the fact that the role of academic institutions is to educate and facilitate in the development of tomorrow's leaders, this is a prime environment within which to integrate green technologies. Leaders that are unable to recognize the mismanagement of resources will be incapable of solving environmental problems. If environmentally friendly strategies are to be incorporated into future policies, then exposure to sustainable education is essential.

Keeping educational opportunities in mind, my final recommendation for The University of Alabama is to encourage the expansion of research concerning green initiatives. The expansion of research concerning the ecological footprint and subsequent calculation methodology would be beneficial in an effort to determine the environmental impact of the campus. Though food and recycling strategies were only briefly discussed in this study, a more in-depth analysis may be needed to evaluate whether or not the

University should try to promote locally or organically supplied food in the cafeterias and whether or not to participate in the RecycleMania competition. Additionally as only dormitory students were analyzed in this study, more sample groups could be evaluated and include both on-campus and off-campus students. Studies on climate change, transportation issues, student led initiatives, and a plethora of other opportunities exist for exploration.

The results of explorative research efforts may lessen the ecological footprint of The University of Alabama. This research was compiled in the hopes of opening the door to new research which may formulate objectives as to what kinds of environmental issues the University would likely tackle. Thus, later the University may turn those objectives into measurable milestones of sustainable progress. If The University of Alabama is able to lessen its ecological footprint, then the University will ultimately have a greater potential impact on the future of humanity.

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Appendix A

Participant Information Sheet

"Exploring the Ecological Footprint of Students on The University of Alabama's Campus"

You are invited to participate in a research study conducted by Crystal Brown, from The UNIVERSITY OF ALABAMA Department of Geography & City/Regional Planning. I hope to learn about the level of students' environmental awareness and lifestyle behaviors associated with the use of water and energy resources. You were selected as a possible participant in this study because of your residence in a dormitory.

If you decide to participate, you will be asked to take a survey to measure your environmental awareness and lifestyles behaviors associated with the use of water and energy resources. The survey may take approximately 10 minutes to complete and may be completed on campus.

Taking time out of your day to complete this survey is greatly appreciated. If ecological awareness issues interest you, I would be more than happy to email you a copy of the results upon your request. However, I cannot guarantee that you personally will receive any benefits from this research.

Subject identities will be kept confidential, as the only descriptive indicators needed include your dormitory, gender, and age cohort.

Your participation is voluntary. Your decision whether or not to participate will not affect your relationship with The University of Alabama. You are free to discontinue participation at any time without penalty.

If you have any questions, please feel free to contact me at (417) 576-0684, University of Alabama Box 870322 Tuscaloosa, AL 35487. You may also contact my advisor Dr. Appiah-Opoku at (205) 348-2278, University of Alabama Box 870322 Tuscaloosa, AL 35487. Both of these addresses are located within Farrah Hall. If you have any questions about your rights as a research participant you may contact Ms. Tanta Myles, The University of Alabama Research Compliance Officer, at 205-348-5152

Please detach this letter from the survey and keep for your records

Appendix B

Environmental Awareness Survey

This survey is intended to measure the level of students' environmental awareness and lifestyle associated with the use of fresh water and energy resources.

The information collected will be used for a University of Alabama student's masters thesis entitled, "Exploring the Ecological Footprint of an Average Student on The University of Alabama's Campus."

The information collected is confidential and no direct references will be made to individual names. A brief summary of the results of the study will be provided to each respondent who makes a request for a copy of the final report.

Water Questions

1. The Earth is comprised of both fresh and salty water bodies. What percentage of water on Earth would you consider as fresh water?

   a) between 10-15%
   b) less than 5%
   c) between 20-35%
   d) between 40-55%

2. In your view the majority of water in the world is used for one of the following: (circle one choice only)

   a) Urban Activities
   b) Mining Activities
   c) Agricultural Activities
   d) Recreational Activities
   e) Industrial Activities

3. Where do you think tap water comes from?

   a) A water treatment plant
   b) Sewage treatment plant
   c) Straight from the Black Warrior River
   d) Straight from the Ocean
   e) Other _____

Water Habits

4. When you brush your teeth, which of the following behaviors do you demonstrate? (choose one or more)

   a) Use a cup
   b) Let the water run, while brushing
   c) Turn off the water, while brushing
   d) Use warm water

5. I brush my teeth for approximately

a) 3 minutes or less
b) 4-6 minutes
c) 7+ minutes

6. My showers tend to last approximately

a) 5 minutes or less
b) 6-10 minutes
c) 11-15 minutes
d) 16-20 minutes
e) 21+ minutes
f) I prefer to take a bath with the tub full
g) I prefer to take a bath with the tub half full

7. Have you ever paid a water bill? Yes [ ] No [ ]

Energy Questions

8. In your view the United States consumes what percentage of the world's oil?

a) 10%
b) 15%
c) 4%
d) 25%
e) 36%

9. Do you think Petroleum/Oil is a renewable resource? Yes [ ] No [ ]

10. Which of the following energy sources would you prefer? (circle <u>one</u> choice only)

Solar *Geothermal* *Coal* *Wind* *Petroleum*

Nuclear *Natural Gas* *Biomass* *Hydro Power*

Please Explain Your Choice Below:

Energy Habits

11. Do you turn off the lights when you leave your room? Yes [ ] No [ ]

12. If yes, how often do you turn off the lights when you leave a room?

a) Sometimes
b) Always

13. What is the purpose behind turning off the lights when you leave a room?

14. Do you leave the TV on when you're not watching it? Yes [ ] No [ ]

15. If yes, how often do you leave the TV on?

a) Sometimes
b) Always

16. Give an example of why you might leave the TV on when you leave the room.

17. Do you utilize a power strip for your electronic appliances? Yes [ ] No [ ]

18. Do you turn the power strip off when your electronics are not in use?

Yes [ ] No [ ]

19. What is the purpose of turning the power strip off when your electronics are not in use?

20. Do you have a cell phone? Yes [ ] No [ ]

21. If yes, do you unplug your cell phone charger after use? Yes [ ] No [ ]

22. How does unplugging or not unplugging a cell phone charger affect your energy consumption habits?

23. If yes, how often do you unplug your cell phone charger when you're not using it?

a) Sometimes
b) Always

24. Is your room ever too hot or too cold for you? Yes [ ] No [ ]

25. Have you ever used any energy saving products? Yes [ ] No [ ]

If so what kinds?

Environmental Awareness

26. Are you interested in environmental issues? Yes [ ] No [ ]

If yes, what sort of environmental issues are important to you?

Give Reasons…

27. Would you be interested in participating in an environmentally friendly competition between dorms?

Yes [ ] No [ ]

28. Are you familiar with the concept of a green dormitory? Yes [ ] No [ ]

29. Would you want to be housed in a green dormitory if you had the opportunity?

Yes [ ] No [ ]

Give Reasons…

Demographic Data

30. Indicate your dormitory_____

31. What is your gender? Male [ ] Female [ ]

32. Indicate your age cohort.

a) Below 18
b) 18 – 22
c) 23 – 25
d) 26 +

Are you interested in receiving a summary of the results? If so please indicate your email address on the following line:

_____

Appendix C

Tables

Table A1: Research Framework for Data Collection Based on Objective A

Research Objective B	Research Question	Source of Information	Data Collection	Mode of Analysis
To determine the current state of students' environmental awareness.	• How aware are students concerning environmental issues?	Survey	Survey, Content Analysis	Qualitative
	• What environmentally friendly strategies do students utilize in their current lifestyles?	Survey	Survey, Content Analysis	Qualitative
	• What is the size of students' ecological footprint?	Survey, Energy/Water Records	Survey, Content Analysis	Qualitative, Quantitative

Source: Compiled by researcher

Table A2: Research Framework for Data Collection Based on Objective B

Research Objective A	Research Questions	Source of Information	Data Collection	Mode of Analysis
To determine the current consumption levels in terms of electricity and water usage for specific dormitories on campus.	• What are the consumption levels in terms of electricity and water usage for specific dormitories currently and over the past couple of years?	Department of Energy Management (UA)	Personal Interview, Content Analysis of Secondary Data	Time Series Analysis
	• Has energy and water usage in the dormitories increased, decreased, or remained the same? How does this relate to energy and water costs?	Department of Energy Management (UA)	Content Analysis	Time Series Analysis

Source: Compiled by researcher

Table A3: Proposed Budget

Budget Proposed to University of Alabama Graduate School and Geography Department

Item	*Description*	*Count*	*Cost*
Stationary			
Copy Paper	500 sheets/ream	8	$60.00
Photocopying			$230.00
Binder		1	$5.44
Printer Ink	Ink (black & color)	3	$196.17
Poster/Supplies			$10.00
Thesis Binding			$45.00
Sending documentation to IRB			
FedEx Kinkos	Scans		$6.53
FedEx Kinkos	internet time while uploading		$4.67
Hylton Library	internet time		$25.00
Transportation			
Gas			$85.00
		Total	$667.81

Additional Supplies

Use of Geography Department Digital Camera