

Community Sustainability: Chapel Hill North Carolina

Institute for the Environment, Senior Capstone

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The following report endeavors to assess the sustainability of the Chapel Hill community. We first defined community sustainability as the ability of a community to meet its current needs without infringing on the ability to meet those needs in the future. We assessed sustainability along three key dimensions: social equity, economic vitality, and environmental health. We have included an appendix with a comprehensive list of indicators that we believe could be broadly applied and adapted to other communities. This report outlines the Analytical Hierarchy Process (AHP) we applied to a smaller set of pilot indicators to determine a sustainability rating for Chapel Hill on a scale from 1 to 5. The rating was determined by combining the weighted averages of ratings across the three aforementioned indicators. The indicators used were determined to be the most measurable and indicative of sustainability for Chapel Hill. The social equity category contained indicators measuring the percentage of the population reporting no days of poor health, health insurance, crime rates, and overall access to public transportation. These indicators yielded an overall score of 4.0, above the scale midpoint of 3.0. The economic vitality category contained indicators measuring community wealth, unemployment distribution, and housing costs. The indicators in this category yielded a score equal to the midpoint of 3.0. The environment category contained indicators measuring ozone warning days, water use, green space, waste reduction rate, and a breakdown of transportation modes. These indicators yielded a score of 4.1. Overall, we determined Chapel Hill's score to be a 3.8 out of 5.0. We would add the caveat that a great deal of the data was derived from statistics representing Orange County as a whole, including Chapel Hill as well as many other municipalities. We also made a few compromises in the data sets we used for certain indicators and have frequently notated an optimal metric that we would prefer to use instead of the data that was readily available.

For more information on the Virtual North Carolina project on which this capstone builds, and a detailed discussion of the AHP approach, visit the VNC website at http://www.ie.unc.edu/content/research/virtual_nc/index.cfm.

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INTRODUCTION

A sustainable community is one that can meet present needs without sacrificing the ability to meet those needs in the future. The stated goal of sustainability in Chapel Hill, North Carolina, is to ensure that economic prosperity, social equity, and a healthy environment are enduring characteristics of our town.

Our senior environmental capstone class attempted to put together a framework for assessing the sustainability of Chapel Hill. Sustainability requires an integrated view of the world, and a thorough assessment of the sustainability of an area requires multidimensional indicators that show links between a community's economy, environment, and society. Good indicators will point to areas in the environment, economy, and society that are not being managed sustainably, and can alert a community to problems so that they may be addressed. We thus designed a framework that utilizes indicators from all three areas of sustainability, specifically for Chapel Hill, to help provide a comprehensive look at our town's strengths and weaknesses in sustainability.

The selection of indicators for such an evaluation is inevitably biased by the judgments of those designing the evaluation. We did our best to select indicators that would provide information related to the Town's priorities and goals in sustainability, as indicated on the Town of Chapel Hill website. We also, however, attempted to select indicators that could be assessed using the data currently available in the Virtual North Carolina (VNC) database; while we endeavored to use Chapel Hill data whenever possible, our report uses data from Orange County or North Carolina as a whole when that was all we could obtain. In a couple of situations we consulted other sources, such as Chapel Hill's sustainability planner and the Orange County Solid Waste Management Department, to get information related to indicators for Chapel Hill that we felt should be involved in our evaluation, even though the data were not readily available. Overall, we tried to take into consideration the information available in reality, and not create a purely idealized system of evaluation based on information that may be difficult or impossible to attain.

After the data necessary to evaluate the indicators were gathered, we conducted research to determine what numerical values were considered sustainable for each indicator. We used these values to create a five-point scale; a 5 on our scale is "highly sustainable" and should be difficult to achieve, whereas a 1 is considered "unsustainable," which signals a very weak area that needs attention. We then used these scales and our data about Chapel Hill to see where on the spectrum of sustainability Chapel Hill fell for each of our indicators.

In order to determine how sustainable Chapel Hill was overall, we had to find a way to combine all the indicator scores into a single sustainability score. To do this, we had to give weights to all the indicators. Our weighting process had two parts: first, we assigned weights for the three dimensions (environmental, economic, social) in our AHP. The weight we assigned to each dimension was based on the percent of the total number of indicators that fell under that dimension—thus, the environment dimension received the largest weight, and the economic dimension the smallest. Then, within each dimension, we assigned greater weights to indicators that we felt told us more about the overall sustainability of Chapel Hill.

To arrive at our final sustainability score for Chapel Hill, we simply added the weighted scores of the indicators within each dimension, then multiplied these numbers by the respective weights of the encompassing dimensions, and added these three numbers together (see *Our Analytical Hierarchy Process*, pg. 5). We are left with one final number, also on a five-point scale, that provides insight on the "sustainability" of Chapel Hill.

We do not believe this number or our first-pass assessment is an irrefutable evaluation of Chapel Hill's sustainability, or that our project in and of itself should be used as the basis of any policy decisions. We acknowledge that this project is somewhat laden with our capstone class' values, as well as that some of the data we use is based on information about Orange County that may or may not be representative of Chapel Hill. In consideration of these limitations, we suggest that this number, and the various details of our report, be used as a starting point for discussion and action in the community. Our assessment as a whole should be strengthened for future use. Adding more insightful indicators to our analytical hierarchy process would make the assessment of Chapel Hill's sustainability more thorough. Collecting all the data necessary for such an evaluation annually would make the numbers provided by the report more useful to the community, as trends could be seen over time. Overall, we hope this report and the improvements made to it promote a better understanding of both Chapel Hill's strengths and weaknesses in the area of sustainability.

Finally, we also believe that our approach and framework for assessing the sustainability of a town may be useful to other communities, particularly in North Carolina. By basing the selection of indicators on a specific community's goals and priorities in the three dimensions of sustainability, our process can be repeated in a locally appropriate manner. Furthermore, Virtual North Carolina can serve any community in North Carolina that desires to do their own sustainability self-assessment by providing much of the necessary data. The VNC database and Analytical Hierarchy Process therefore serve as tools for a community to better understand its sustainability. This report aims to demonstrate that these tools can be used to get closer to ensuring that every decision made by a community recognizes the importance of economic vitality, environmental health, and social equity to the well-being of present and future generations.

OUR ANALYTICAL HIERARCHY PROCESS (AHP)

STEP ONE: DIMENSIONS AND INDICATORS OF SUSTAINABILITY

We began by identifying the most telling indicators of the sustainability of our demonstration community. We achieved this through a comprehensive review of (1) literature on indicators in general, and sustainability indicators in particular, (2) similar reports published by other communities who took on this task, and (3) a review of Chapel Hill's priorities via the town website and John Richardson, Chapel Hill's Sustainability Planner. We then categorized these indicators by the three main dimensions of community sustainability: Environmental Health, Economic Vitality, and Social Equity.

<u>Environmental Health</u>	<u>Economic Vitality</u>	<u>Social Equity</u>
Ozone Warning Days	Community Wealth	Health Status
Water Use	Unemployment	Health Insurance
Green Space	Distribution	Crime Rate
Waste Reduction Rate	Housing Costs	Access to Public Transportation
Transportation Mode Breakdown		

STEP TWO: METRICS

For each indicator, we chose an appropriate statistical measure, or metric, that was simple yet comprehensive. For example, to measure housing costs, we chose as a metric the percentage of individuals who spend more than 35% of their household income on housing. Those who spend more than this are likely struggling to meet their other basic needs. This is simple to measure, yet it offers an accurate picture of how affordable housing is for citizens of the community. Justifications for all the indicators and metrics are included throughout this paper.

<u>Dimension</u>	<u>Indicator</u>	<u>Metric</u>
Environmental Health	Ozone Warning Days	Air Quality Index
	Water Use	Gallons per person per day
	Green Space	Acres per 1000 residents
	Waste Reduction Rate	% Reduction since 1991
	Transportation Mode Breakdown	% who use alternative transport
Economic Vitality	Community Wealth	Median household income (\$)
	Unemployment Distribution	% unemployed (ratio black:white)
	Housing Costs	% who spend >35% of income on housing
Social Equity	Health Status	% with no unhealthy days per month (ratio non-white:white)
	Health Insurance	% with health insurance (ratio non-white:white)
	Crime Rate	Crime acts per 100,000 people
	Public Transport Access	% within 0.25 miles of bus stop

STEP THREE: INDICATOR WEIGHTS

<u>Environmental Health</u>	<u>Weight</u>	<u>Economic Vitality</u>	<u>Weight</u>	<u>Social Equity</u>	<u>Weight</u>
Ozone Warning Days	0.15	Community Wealth	0.40	Health Status (ratio non-white:white)	0.30
Water Use	0.30	Unemployment	0.30	Health Insurance (ratio non-white:white)	0.30
Green Space	0.05	Distribution		Crime Rate	0.20
Waste Reduction Rate	0.25	Housing Costs	0.30	Access to Public Transport	0.20
Transp. Mode Breakdown	0.25				
Total:	1.00	Total:	1.00	Total:	1.00

Within each of the three dimensions, we weighted the indicators relative to each other based on the degree of sustainability reflected by each indicator. For example, we decided that water use, and its corresponding metric, tells us more about the environmental health of Chapel Hill than green space. Thus, Chapel Hill’s water use score was weighted to determine 0.30, or 30%, of the score for Environmental Health, while its score for green space was weighted to determine only 5% of this overall dimension score. These weights are justified throughout this report.

STEP FOUR: DIMENSION WEIGHTS

With the indicators weighted within each dimension, assigning weights to each of the three dimensions was a straight-forward process. We weighted each dimension based upon the number of indicators out of all the indicators placed within each dimension; we did this because we put more value on the number of indicators in each dimension than on their dimensional organization. For example, the Environmental Health category encompasses 5/12 indicators, thus it is weighted to determine 0.42, or 42% of Chapel Hill’s total sustainability score. However, this process is different from categorical organization because by intentionally choosing indicators that blurred the lines of the dimensions (e.g., health status, unemployment by racial identity), we were able to let the indicator weights carry through to the dimensions to determine weights. This process is not rigid; other users of the AHP can choose to weight categories differently based on their own community priorities.

<u>Dimension</u>	<u>No. Indicators</u>	<u>Weight</u>
Environmental Health	5	5/12 = 0.42
Economic Vitality	3	3/12 = 0.25
Social Equity	4	4/12 = 0.33
	Total:	12/12 = 1

STEP FIVE: SCORING RUBRIC

We scored Chapel Hill’s sustainability for each indicator on a scale from 1-5, with a score of 5 reflecting the ideal metric value, and a score of 1 reflecting a completely unsustainable metric value. These scales are justified throughout the report, drawing on published research, accepted standards, best management practices and other valuable resources (see appendix D for resources used). Some of the indicators have scales with different directionality because some indicators measure “good things” (green space), while other indicators measure “bad things” (ozone days). Although some indicators have different scales, the end result is maintained throughout the AHP so that the higher score always signifies a more sustainable condition.

<u>Indicator</u>	<u>Metric</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>
Ozone warnings	Air Quality Index	301-500	201-300	101-200	51-100	0-50
Water use	Gallons per person per day	>370	221-370	171-220	61-170	<60
Green space	Acres per 1000 residents	<10	10-30	30-50	50-70	>70
Waste Reduction Rate	% reduction since 1991	<15	15-29	30-44	45-60	>60
Transp. Mode Breakdown	% non-SOV use journey to work	<15%	15-34	35-54	55-75	>75
Community Wealth	Median household income (\$)	<30459	30459 - 38148	38149- 53893	53894- 77643	>77644
Unemployment	% unemployed (ratio black:white)	>3.00	2.50-3.00	1.70-2.49	1.10-1.69	1.00-1.09
Housing Affordability	% who spend >35% of income on housing	>32.6	30.9-32.6	27.5-30.8	25.7-27.4	<25.7
Health Status	% with no unhealthy days per month	<54	55-69	70-79	80-89	>90
Health Insurance	% with health insurance	<54	55-69	70-79	80-89	>90
Crime Rate	Crime acts per 100,000 people	>8,000	5001-8000	3001-5000	1001-3000	1001-0
Access to Public Transport	% within 0.25 miles of bus stop	<30	30-50	50-70	70-90	>90

STEP SIX: ASSIGNING A SUSTAINABILITY SCORE

We applied the actual values for Chapel Hill to the scoring rubric in order to determine the sustainability score for each indicator. We then multiplied each score by its corresponding indicator weight and summed these values to give us sustainability scores for each dimension. To finish, we multiplied the dimension score by its weight, and summed these to give our total score for Chapel Hill. For some indicators where no data were available for Chapel Hill or where regional data were appropriate (e.g., ozone days), Orange County and North Carolina (e.g., water use) data were used. In the table below, indicators for which Orange County data and North Carolina data were used are indicated. It is important to note that where the data were not available for Chapel Hill, replacing it with Orange County data or other regional data might skew results. Further, since we used water use in the Netherlands to help define our scale for the water use indicator, our water use score may seem worse than one may expect; after all, practices and policies pertaining to water use are different for the United States and the Netherlands. Therefore, it is important to pay attention to how we score the data and where the data come from, especially if the local data are replaced with broader regional data; unfortunately, this had to be done for several indicators due to limitations in the data available.

<u>Metric</u>	<u>CH Value</u>	<u>Score</u>	<u>Weight*Score</u>
*Air Quality Index	37.4	5	0.75
**Gallons water per person per day	145	4	1.20
Acres green space per 1000 residents	21	2	0.10
">% Reduction since 1991	45	4	1.00
% non-SOV use journey to work	55.8	4	1.00
Environmental Health Score:			4.1/5
			1.20
Median household income (\$)	39,140	3	
">% unemployed (ratio black:white)	2.67	2	0.60
">% who spend >35% of income on housing	25.68	4	1.20
Economic Vitality Score:			3.0/5
			1.20
">% with no unhealthy days per month (ratio)	80.4	4	
">% with health insurance (ratio)	84.5	4	1.20
*Crime acts per 100,000 people	4,103	3	0.60
***% within 0.25 miles of bus stop	90%	5	1.00
Social Equity Score:			4.0/5
Total Score:			3.8/5

*Orange County Data

**North Carolina Data

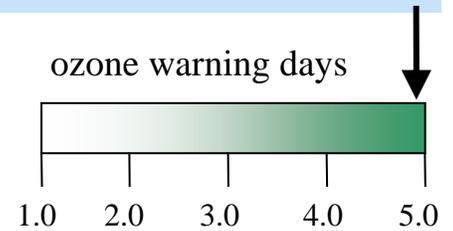
***Estimate; data not available

SUSTAINABILITY DIMENSION ONE: ENVIRONMENTAL HEALTH

When considering a community's sustainability, the status of its environment is very crucial. We rely on the environment for our day to day survival. It plays a key role in the future since coming generations are depending on us to use the resources available today in a responsible manner. We must acknowledge that we are not the only species on this planet and that our actions have an impact on almost every part of the environment. Indicators for this dimension were chosen with metrics that would comprehensively show how sustainable a given community is. For our demonstration using our local community of Chapel Hill, we used water usage, ozone warning days, mode of transportation, and the amount of green space to define Chapel Hill's sustainability in the realm of environment. Data for Chapel Hill in these categories was compared with other suggested values and averages and then analyzed through the AHP. Chapel Hill was more sustainable in some areas than others, but the overall result suggested that it was above average. This may be because the environment has become a priority for the town of Chapel Hill in recent years as the town council has adopted a comprehensive plan in 2000 to ensure its sustainability.

INTRODUCTION

Everyone has to breathe, and the quality of our air affects how well people are able to do just that. Ground level ozone is one of the main components of smog and can damage lung tissue. Ozone is formed through a complex chemical reaction involving hydrocarbons, nitrogen oxides (both of which are produced by cars, other industrial processes, and people using cleaning chemicals) and sunlight on calm summer days.



Air quality is often worse in summertime, which is particularly unfortunate since that is when more people are outside and exposed to pollutants. The amount of pollution present in the atmosphere is not entirely dependent on local conditions, since chemicals can travel with the wind, so the Air Quality Index is also indicative of the regional conditions.

MEASUREMENT

The US Environmental Protection Agency (EPA) created the Air Quality Index (AQI) to provide uniform and easily identifiable information about the daily levels of air pollution. There are many pollutants that affect air quality; the ones measured by the AQI are ozone, particulate matter smaller than 2.5 micrometers, particulate matter smaller than 10 micrometers, carbon dioxide, and sulfur dioxide. The AQI broadly groups health effects into 6 categories, with scores ranging from 0-500.

DATA

The US EPA provides daily data from 1997 to present¹. Data for Orange County, NC is available for a varying number of days per year. For the Raleigh-Durham-Chapel Hill region as a whole, data is available on a more or less daily basis since 1997.

AHP SCALE

The AQI makes comparisons within regions in the United States easy, as the entire county uses the same reporting scale. As such, the categories for the AHP follow the precedent set by the EPA. The categories are good (0-50), moderate (51-100), unhealthy (101-200), very unhealthy (201-300), and hazardous (301-500)².

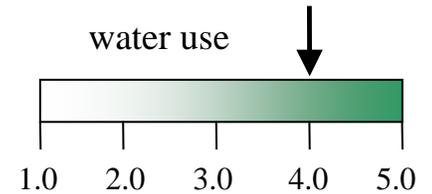
RANKING AND EVALUATION

Orange County scores a 5 on the AHP process, as the average AQI value from 2000-2007 was 37.375. Yearly variation is minimal and the main pollutant in Orange County's air was particulate matter smaller than 2.5 micrometers. However, if one were to look at the average AQI for the Raleigh-Durham-Chapel Hill area, the average score would be higher and there are more problems from ozone, indicating that the region has a larger problem with air pollution. The data suggest that Chapel Hill can continue its efforts to reduce air pollution, but perhaps more importantly, should attempt to get regional neighbors to reduce the amount of air pollution they create.

ENVIRONMENTAL HEALTH INDICATOR B: WATER CONSUMPTION

INTRODUCTION

Water is a finite resource that we all need. This resource is vital for public health, agricultural production, and economic growth. Water resources are most important in order to continue to provide a healthy environment along with sustainable growth in agriculture and industry. As the population grows so will the demand for water resources, therefore, it is very important that Orange County carefully manages the use of its water resources.³



MEASUREMENT

The United States Geological Survey (USGS) provides data for each state as well as each county in the U.S., collecting data on water usage every three years. Water usage data is broken down into its end-uses, e.g., public supply, industrial use, agricultural use, etc. The data for Orange County (OC) is provided in an Excel sheet, which includes data for all the counties in North Carolina (NC). For lack of a direct source with up-to-date data on water consumption, the data presented in this pilot study is from the year 2000. The data from USGS for all the counties in NC was used to determine the statistics for water consumption (gallons per person per day).⁴

DATA

This indicator measures the amount of water consumed, for all purposes, in gallons per person per day at the county level. The data were calculated by dividing the number of gallons of water used per day by the total population for each county to give gallons per person per day (gpd) as the result.

AHP SCALE

The scale used in our AHP was determined based on what we considered reasonable and attainable values. The scale was determined using Microsoft Excel's quartile function, which allowed us to identify key values and categorize the data into different ranges. These values included, e.g., minimum, first quartile, median, second quartile, and maximum. The scale was then determined using the inter-quartile ranges and ranked according to the most water used (with a rank of 1.0) to least water used (with a rank of 5.0). The table below shows the scale and rankings for this indicator, and also indicates where Orange County stands among the rankings.

For statistical data with ranges and scale with assigned rankings, see below.

Rank	1.0	2.0	3.0	4.0	5.0
Statistics	4 th quartile	3 rd quartile	2 nd quartile	1 st quartile	<min
Range/Scale (gallons/person/day)	>367	218-367	166-217	56-165	<55
Where we lie (based on 2001 data)			USA (166gpd)	Orange Co. (145gpd)	Netherlands (27gpd)

RANKING AND EVALUATION

Orange County received a rank of 4 out of 5 in the AHP process. Based on the sustainability scale, Orange County is doing well at 145 gpd, compared to the national average, i.e., 166 gpd. When comparing Orange County to the rest of the counties in North Carolina, Orange County ranks among one of the most sustainable places in NC with a 4 out of 5. However, Orange County is still not as sustainable as possible in water consumption. There are places in the world, such as the Netherlands, which is a developed nation with infrastructure similar to the US and North Carolina, where an average person only uses 27 gpd. To further illustrate this point, according to the Pacific Institute, an average person in the African nation of Gambia only uses 1.7 gpd⁵. Though this statistic is interesting to note, it is not a realistically attainable number in any developed and industrialized nation. Chapel Hill should aim to reach a sustainability ranking of 5, which corresponds to less than 55 gpd of water consumption. Though this will be a drastic change in the amount of water consumed, it is nevertheless attainable and feasible. If Orange County can strive to be as sustainable as possible, then it is possible to attain a value even less than 55 gpd.

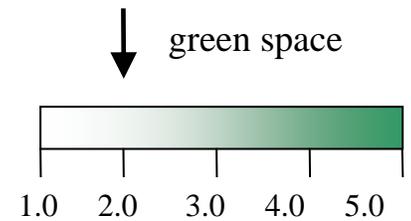
Since our indicator is being used for the first time here, it does not allow comparison about water usage over time. The data on per person demand reveal that the amount of water used per person increased from 124 gpd in 1985 to 145 gpd in 2000, a 17% increase. This increase would have been higher if Flint Fabrics, which used 1 million gpd, had not closed in 2000.¹ It is of relevance to note, however, that Orange Water and Sewage Authority (OWASA) indicated a decrease in the water consumption from 121 gpd (in 2004) to 108 gpd (in 2005)⁶.

ENVIRONMENTAL HEALTH INDICATOR C: GREENSPACE

INTRODUCTION

Green space relates to how much biodiversity is present within a community in terms of trees and undeveloped areas. It also gives us an idea of the rate of development within that area and how important environment is to that community⁷. The environmental benefits of preserving regional natural systems include maintaining biodiversity, improving water quality, moderating air temperature, improving air quality, and reducing soil erosion.

Green space preservation also enhances the economic vitality of communities by providing higher property tax revenues (from higher property values), enticing businesses to establish themselves in the area, and providing a natural filtering system that reduces the need for man-made infrastructure (culverts, gutters, etc.). The aesthetic qualities of preserved green space, though largely subjective, are closely linked to the environmental and economic benefits⁸.



MEASUREMENT

The metric we chose to measure green space within a developed community was acres of parkland per 1000 people. The metric of 'total acres of parkland per community' was not used as it was not the most relevant measure of this indicator; this metric neglects to consider the size of the city and population density. Also another possible metric that was considered was the rate of development, but this also failed to measure our indicator as well as acres of parkland.

DATA

The data used to assess the green space was provided by the town of Chapel Hill in the Chapel Hill Comprehensive Plan adopted by the city council in May of 2000. 'Greenways and open space' is listed in the table of indicators at the beginning of the report and then discussed further in detail later on in the report. On page S-15, the total area of parks and open space is provided in terms of acres per 1000 residents as well as total acreage. Along with that, they also provide a list of greenways and trail around the town and their respective lengths. They attempt to interpret the data by comparing the data to that in the year 2000⁹.

AHP SCALE

The scale used in the AHP was determined by looking at national averages of green space of towns and cities similar to Chapel Hill². The national average was not utilized since it failed to capture the geographic and demographic variation of communities nationwide. The desirable score of 5 would be achieved if Chapel Hill had over 70 acres of green space per resident, and its level of green space would be considered unsustainable if it had less than 10 acres per 1000 residents¹⁰. A limitation of this scale is that it is descriptive of current conditions in towns around the country rather than normative, which would reflect the ideal condition.

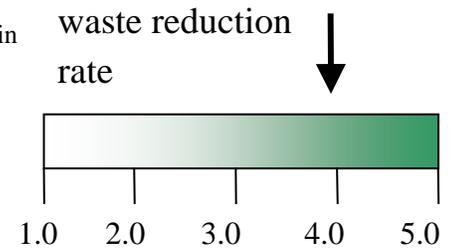
RANKING AND EVALUATION

The Chapel Hill community scored a 2 on the AHP scale, falling just below the average by 9 acres per resident. However, the community has been showing signs of improvement. In the year 2000, there were only 10.4 acres per 1000 residents; this improved to 21 acres per 1000 residents in the year 2004¹. The report from which these data were gathered emphasizes the links between green space preservation and the environment and the economy of the town and the overall betterment for the community.

ENVIRONMENTAL HEALTH INDICATOR D: WASTE REDUCTION RATE

INTRODUCTION

The waste reduction rate of a community is indicative of the quality of the recycling programs in place, the ease of participation for community members, and community attitudes and norms. Waste reduction - the combination of waste prevention and recycling - has numerous benefits. It diverts material from landfills, boosts recycling and composting rates, and often results in savings for the community. For recycling to be successful, everyone has to participate in each phase of the loop; from government and Industry and the university to people at home - every effort to recycle makes a difference. With a growing economy and population leading to more products and materials being generated from increased consumption, the goal of source reduction becomes increasingly important. Orange County should take necessary steps to recycle in order to lessen the burden on landfills and to become a more sustainable community.



MEASUREMENT

The waste reduction rate takes the per capita amount of garbage produced in the base year (1991) and compares it to the current per capita waste production. This waste reduction rate includes all solid waste land-filled in Orange County and waste which comes from Orange County but land-filled at private landfills elsewhere.¹¹ Waste managed at the Orange County landfill comprises mostly municipal solid waste and construction and demolition waste. Recycled materials include paper materials, glass, metal, plastics, food waste and animal bedding, and corrugated cardboard.¹² Measurements from Orange County for these statistics are given in tonnage.

DATA

The per capita amount of garbage produced in the base year, 1991, was 1.36 tons. This is the first year that measurements were taken regarding per capita waste disposal. By 2005-2006, the per capita disposal rate had dropped to 0.75 tons. The waste reduction rate is then calculated by dividing 0.75 by 1.36, and subtracting this number from 1 to show the change in the numbers.^{13 14}

AHP SCALE

The EPA claims that the country currently recycles 32.5% of its waste.¹⁵ According to the breakdown of net waste disposal from the EPA, approximately 90% of our waste can be recycled with the current programs.¹⁶ Orange County has set a goal of 61% waste reduction.¹¹ Based on this information and statistics from other cities who have achieved high values of waste reduction, it was reasonable to set a scale in increments of 15%, where a waste reduction rate over 60% would result in the “most sustainable” score of a 5.¹⁷

1: 0-14% **2:** 15-29% **3:** 30-44% **4:** 45-59% **5:** 60% or greater

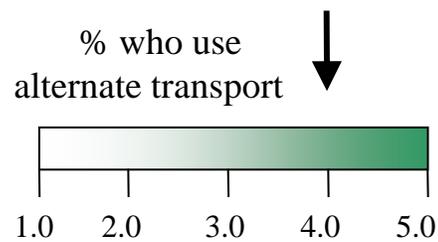
RANKING AND EVALUATION

With a value of 45%, Orange County received a 4 on our AHP scale, showing an impressive reduction from 1991. This is the highest waste reduction any county has accomplished in North Carolina. Progress resulted from improvements in the recycling programs such as banning wood, metal, and cardboard from the landfill, and improving the extensive curbside and drop-off programs throughout the County. Orange County has come a long way since 1991, as their effort has kept over a half of ton of waste per person from being landfilled each year. There is still a significant amount of recyclables being thrown away each year, particularly paper products and food waste.¹⁸ In order to bring the reduction rate to 61%, and set goals of raising that number thereafter, Orange County should make amends to their current program that focus on keeping paper and food waste out of the landfill.

ENVIRONMENTAL HEALTH INDICATOR E: TRANSPORTATION MODE BREAKDOWN

INTRODUCTION

A transportation mode breakdown, known as a modal split, represents the shares of the different modes of transportation used for travel.¹⁹ A sustainable multi-modal transportation system will have higher levels of walking, bicycling, carpooling, and public transit use, while an unsustainable transportation system will be heavily car dependent. Vehicle emissions account for the largest source of air pollution in urban areas, emitting more than two-thirds of the atmospheric carbon dioxide, a third of the nitrogen oxides, and a fourth of the hydrocarbons.²⁰



Decreasing reliance on single occupancy vehicles (SOV) will not only reduce pollution, but will also reduce congestion, fuel consumption, and other problems associated with the car based society of today.²¹ Having a lower dependence on single occupancy vehicles is a good indicator that a community has good quality walking and bicycling conditions and an adequate public transportation system.²² It would be ideal to include all trips since work commute is only a portion of daily transportation; however this indicator only focuses on work-related travel. Work commute was used because the data is available nationally and is familiar to planners since work commute is a frequent, routine behavior that is relatively easy to measure and analyze.

MEASUREMENT

The indicator measures the percent of the population that uses each mode of transportation. Alternatives to SOV include walking, bicycling, moped, transit, and shared travel such as carpooling and vanpooling, and have better environmental, economic, social, and health benefits than SOVs. The higher the percentage of alternative (non-SOV) transportation, the more sustainable the modal split.

DATA

The data set used to measure the modal split indicator is from the 2005 Chapel Hill Data Book: Section 7 Transportation.²³ The data available is the modal breakdown for the UNC-CH students' and employees' journey from home to work or school. The current data is sufficient for an approximation of the transportation mode breakdown for both students and employees, although it is several years old and it does not include any other people in Chapel Hill.

AHP SCALE

The scale for transportation mode breakdown was developed using the national average in SOV use for the journey to work found in the Census 2000 Brief²⁴. The national average for non-SOV in the 2000 Census showed that only 24.3% of people used non-SOV modes of travel for the majority of their journey to work trips. This number was used as the midpoint score of 2 because while it is the national average for non-SOV, it is not sustainable. The trend for mode transportation use was shown to be increasing for SOV use since 1980 when this indicator was first measured. Because non-SOV use is continually increasing, the current national average should be considered lower on the ranking scale than an acceptable average of sustainability. While the national average is not sustainable it was given a score of 2 instead of 1 because there are many places with a much higher use of SOVs. A more sustainable outlook on transportation mode breakdown was calculated using the goals of the Community Carbon Reduction Programme (CRed).²⁵ CRed proposes that carbon emissions need to be cut by 60% by 2025 and this same goal was applied to reducing use of SOV. A 60% reduction in SOV use would set a goal of 65% non-SOV use. This number was used as the midpoint for a score of 4. The 60% reduction was not used for a score of 5 because a 60% reduction in SOV use does not mean a 60% reduction in carbon emissions. A change from SOV use carpooling or transit use reduces the carbon emission rate per person but it does not reduce it as much if they were to use a non-polluting transportation method such as walking or biking. Therefore a more ideal sustainable goal should be higher than the 60% reduction in SOV use in order to reach a 60% reduction in carbon emissions. The overall scale ranges used in the AHP

process were as follows: <15% for a score of 1, 15-35% for a score of 2, 35-55% for a score of 3, 55-75% for a score of 4, >75% for a score of 5.

RANKING AND EVALUATION

Chapel Hill received a score of 4, indicating that the town is above the middle range for transportation mode breakdown. The approximate usage of alternative modes of transport for UNC-CH students and employees traveling to and from UNC-CH is 56%, leaving 41% that consists of people driving alone or being dropped off. While Chapel Hill is doing well with the modal breakdown and is considered a leader in transportation demand management, the fact that it is on the lower end of the 4 score suggests that Chapel Hill needs to continue to improve their reliance on alternative transportation options as opposed to SOV use.

ENVIRONMENTAL HEALTH SUSTAINABILITY: CONCLUSION

When talking about sustainability, it is clear that the environment is what keeps us alive and is a primary concern for future generations. The natural systems around us provide space, food, air, water, and everything else that would be exceedingly expensive to replace with man-made systems. With this knowledge, environmental indicators were chosen that illuminate the sustainability of how Chapel Hill deals with its environment.

Water use was weighted most heavily, at 0.3, for water is a resource that is critical for life and is of limited supply. Waste reduction and travel mode breakdown were each weighted equally at 0.25 because they deal with how society moves itself and eliminates its waste. Ozone warning days received 0.15 because air quality is a regional, not a specifically local, problem, and so one community can only make so much of a difference. Green space was assigned 0.05 not due to the lack of importance of open space but primarily because the other indicators were considered to be more indicative of sustainability.

The overall score for Chapel Hill for the Environment section was 4.1, suggesting that the community is doing above average in the environmental category of sustainability. The area most in need of improvement is acres of green space per person. While this indicator suggested Chapel Hill performed poorly, the area did well in water use, air quality, and use of alternative transportation.

SUSTAINABILITY DIMENSION TWO: ECONOMIC VITALITY

Economic vitality refers to the means by which one can assure the continued development and accrue of capital. For a community, it might be represented by maintaining a steady tax base, minimizing inflation, or by investing in the future by helping to provide individuals with work, housing, and education. It has often been the case historically that economic prosperity has been the gateway for considering social and environmental matters. After all, it was the growth of the middle class in this country that brought about the modern environmental movement. It is also true that even the most beneficial plan can fail without the proper funding to implement it.

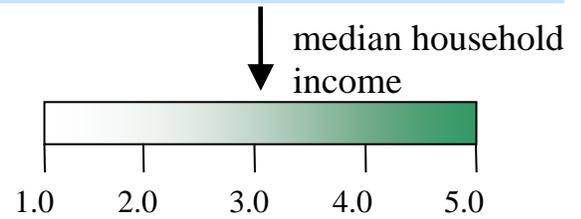
We realize today though that to address economic performance in isolation from other factors is to ensure its eventual failure. Though it may give an individual the luxury of pondering things beyond providing food for her table, the only way a community can be sustainable is to consider the connections that exist between society, environment, and economy and make decisions in each that aid in the improvement of all.

In our view of the economic dimension, we chose community wealth, affordable housing, and unemployment as indicators of a successful community. The reasons, development, and use of each are presented below.

ECONOMIC VITALITY INDICATOR A: COMMUNITY WEALTH

INTRODUCTION

Community wealth provides the economic resources that individuals, and by extension the city, have at hand to draw upon. A population that is comfortable in its economic status is more willing and able to put money towards protecting and aiding others and solving problems that affect the livelihood of the community but seem very distant when a family cannot provide for itself.



Furthermore, capital provides the means for addressing community problems such as lack of green space, public health issues, poor quality of life, etc., that would be beyond the capabilities of a struggling municipality. Community wealth therefore demonstrates the gateway nature of economic vitality.

MEASUREMENT

Median household income was chosen as the metric for this indicator. While an average value can be skewed by a few extreme outliers, a median value is more resistant to extremes and can be more representative of the general wealth of the community.

DATA

The United States Census Bureau compiles frequent demographic profiles of cities across America, addressing general, social, economic, and housing characteristics. Median household income, as compared to the United States average, is one statistic for which they collect data. Information from the year 2000 study was most readily available and was used for the primary measurement.²⁶ Estimates for the year 2005 were also employed in a secondary measurement, which will be explained along with the former in the next section.²⁷

AHP SCALE

To compare different values of median household income, a scale was created. This five point scale used the national median as its value for average achievement. The extremes on the low and high ends came from the median household incomes of Muncie, Indiana and Yorba Linda, California,²⁸ respectively. Both are well known for being at their respective ends of the range of economic status and are relatively similar in population to Chapel Hill.²⁹ Two intermediate values, represented by scores of 2 and 4, were then chosen based on the averages between Muncie and the national average and Yorba Linda and the national average, respectively. Finally, a range for each value was assigned by finding the averages between the dollar amounts behind each number on the scale.

As an additional provision to check accuracy, a further measurement was done using median household incomes for each city in North Carolina with more than 6,000 people. The number values of the scale represented the minimum, 25% marker, median, 75% marker, and maximum, with ranges about each decided in the same manner as the above technique. As the data for this technique did not come directly from the US Census Bureau, and so is of questionable parentage, this measurement was used for confirmation of findings rather than independent analysis and was not included in the AHP.

RANKING AND EVALUATION

Chapel Hill, with a median household income of \$39,140, scored a 3 on the AHP scale, ending up in the lower end of that range. This value equates to an average level of community wealth under our guidelines, though it was noticeably below the national average. In the additional technique using just state data, Chapel Hill also scored a 3, though it was far closer to the state median than it was to the national.

ECONOMIC VITALITY INDICATOR B: UNEMPLOYMENT

INTRODUCTION

According to the International Labour Organization (ILO), an unemployed person is one who is a member of the labor force currently available for and seeking work but without work.³⁰

The unemployment rate is a widely accepted indicator of the state of the economy and is reported by the United States Census Bureau by geographical region, race, gender, sector, age, and income level.³¹ The distribution of unemployment among different groups directly affects a community's level of sustainability by influencing crime rates, the ability to afford housing and health insurance, and the need for government assistance programs. Unemployment is often a symptom of structural problems or inefficiencies in the economy and thus can be used to evaluate its overall health.



MEASUREMENT

In an attempt to quantify the distribution of unemployment in the Chapel Hill community, this indicator measures the ratio of the unemployment rate between the two largest racial groups. The method used was adapted from the London Sustainable Development Commission's report comparing the ratio of the unemployment rate for black and minority ethnic (BME) groups to white majority groups³². Since current Orange County data was not available for all minority groups, the ratio we used compares unemployment among black or African American citizens to white or Caucasian citizens, representing approximately 88% of Orange County's population. While this indicator represents the need for an even distribution of unemployment in a sustainable community, it would not take into account high overall unemployment rates.

DATA

The data set used in this study is from the US Census Bureau's 2006 American Community Survey Data for Orange County, North Carolina.³³ The current data set has categories but not data for unemployment of many other racial groups. When this data is available in the future, the London method can be used to represent a larger percentage of the population.

AHP SCALE

The scale used in our AHP was determined by breaking down ratio ranges into five categories based on national and state values as well as what we feel is attainable. A "most sustainable" score of 5 is only achieved when the ratio = 1.00 ± 0.10 . For example, if the unemployment rate among whites is 4.6%, an AHP score of 1 would be achieved if the unemployment rate among blacks is in the range 4.1%-5.1% (90% of 4.6% to 110% of 4.6%). A ratio close to one was chosen as the most sustainable score to represent the goal of having low unemployment evenly distributed among all racial groups in the community. The ranges for scores of 1-4 are based on national and state averages, and could be adjusted in the future as the average values move closer to the desired distribution.

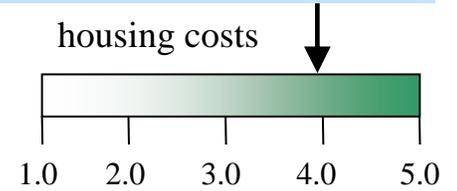
RANKING AND EVALUATION

Orange County scored a 2 in our AHP process, representing a worse than average distribution of unemployment across racial groups. For 2006, the overall unemployment rate in Chapel Hill was estimated at 5.5%, with an average of 12.3% among blacks or African Americans and 4.6% among whites or Caucasians (ratio of 2.67). This distribution is worse than the distributions of the US (2.45) or NC (2.38).

ECONOMIC VITALITY INDICATOR C: HOUSING AFFORDABILITY

INTRODUCTION

Affordable housing is a large determinant of the economic vitality of any community due to its direct ties to the quality of life and disposable income of a community. Lack of affordable housing causes serious stresses on a community, as well as contributing to sprawl and associated consequences—for example increased commuter times and the associated pollution and environmental degradation.



MEASUREMENT

This indicator measures the percentage of the population that spends more than 35% of their income to pay for housing costs. The more people who are spending a significant portion of their income on housing (more than 35%, which is slightly above the 30% cut-off that lenders use to determine to whom they will grant loans), the lower the discretionary income that is available to spend in the community,³⁴ negatively affecting the economic vitality of Chapel Hill. The indicator also provides information about income levels and the percentage required to meet a very basic need.

DATA

The US Census Bureau provides data for the percentage of income that is devoted to paying for housing costs. The figure that is the most indicative of sustainability is the percentage of the population who spends more than 35% of their income on housing costs. This data was broken out by homeowners and renters and utilized after being multiplied by the percentage of the population who owns and rents, respectively to get an average percentage of income that fairly represents the two groups. In Orange County, the average is 26%, compared to a national average of 29%.

AHP SCALE

The scale was based on the national mean as a center point and then an appropriate spread was estimated using averages around the country in conjunction with the standard deviation. The data was clumped pretty closely, resulting in narrow ranges. This is likely because county data averages out the discrepancies between municipalities. Based on Orange County data, Chapel Hill received a 4 for this indicator. A score of 5 was assigned if the percentage was less than 25.7%, between 25.7% and 27.4% was a score of 4, between 27.5% and 30.8% was a 3, between 30.9% and 32.6% was a 2, and above 32.6% was a score of 1.³⁵

ECONOMIC VITALITY SUSTAINABILITY: CONCLUSION

In assigning values for the economic sustainability section of the AHP, it was decided that the indicators were of relatively equal importance, as each reflected a different aspect of the economy. Community wealth was given a slightly larger share of value because it is more stable, making any large shift in it the result of a major event that should demand attention.

Overall, this section scored a 3 on the AHP scale, indicating an average level of economic vitality and sustainability. Ground needs to be gained in a few areas, namely in the discrepancy between unemployment of whites and non-whites, but Chapel Hill seems to at least have a firm footing for the future.

SUSTAINABILITY DIMENSION THREE: SOCIAL EQUITY

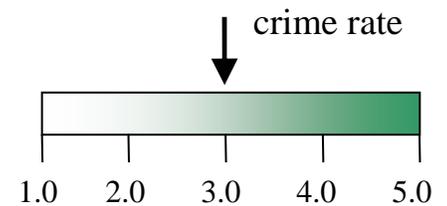
Social equity is a key component of our sustainability analysis. Traditional measures of success often ignore our human needs, desires, and potential. Social equity indicators can often overlap, or be included in other groupings, but all measure the justice, fairness, or happiness of a community. The types of data that could be included in this dimension come from a vast range of topics, including education, health, crime, safety, perception, and many other topics. Having higher levels of social equity will result in increased sustainability, or at the minimum prevent damaging, unsustainable practices that may disadvantage one group unfairly.

Important factors to consider when selecting or designing social equity indicators as recommended by the University of Oregon were as follows: indicators are quantities that reveal qualities, narrow indicators are more effective, causes should be looked at over symptoms, and organizations should have control over the indicators.³⁶ Our group endorses this method, and feels the indicators selected below reflect these criteria. Ideally, a fully developed program would have more indicators indicative of social equity, covering a broad range of issues important to the community. These below reflect what we found was most telling, available, and appropriate given our time frame.

SOCIAL EQUITY INDICATOR A: CRIME RATE

INTRODUCTION

Crime can deeply affect a community. High crime rates have obvious effects upon both victims and perpetrators and can influence the community as a whole by affecting the housing market, government expenditures, and peoples' perceptions of others in their community. Perhaps more important than actual crime itself is the community's perception of crime and how fear and anxiety are undesirable in a community. Resources devoted to preventing and dealing with crime are important crime reducing measures that can be provided by government or private sources.



MEASUREMENT

This indicator measures the rate of index crimes per 100,000 people at the county level. Index crimes are the combination of violent and property crimes. Violent crimes include murder, rape, robbery, and assault. Property crimes include arson, motor vehicle theft, larceny, and burglary. These rates are reported in the Federal Bureau of Investigation's Uniform Crime Reports, which are monthly aggregate collections of crimes reported to the agency.

DATA

The North Carolina State Bureau of Investigation (NC SBI) provides statistics and summary reports of reported crime rates.³⁷ The data for Orange County, NC and other counties are collected and organized on a yearly basis. Over the past 10 years, the Orange County crime rates have ranged from around 3,900 to 5,800 index crimes per 100,000 people.

AHP SCALE

The scale used in our AHP was determined by breaking down rates into what we considered reasonable and attainable ranges. Comparing crime rates is a difficult process and is cautioned strongly against by the FBI.³⁸ By looking at what other NC counties scored, we chose values that we thought were appropriate.

RANKING AND EVALUATION

Orange County scored a three out of five in our AHP process, representing an average rate of crime that influences the community at normal levels. Orange County would score similarly or slightly worse for most of the previous 10 years. It is also important to note that crime rates rose from 2005 to 2006.

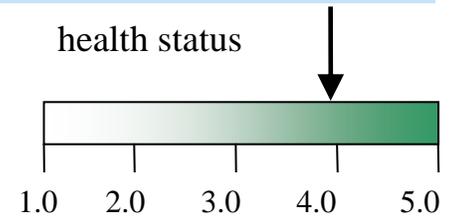
Orange County's current crime rate is acceptable but could be improved by both public and private efforts. Preventative measures such as volunteer campaigns against index crimes or policy changes might be cost-effective ways to lower crime without spending money on security measures. Improvement of economic and environmental conditions might also indirectly reduce crime.

Our pilot AHP uses static scaling based on ranges derived from the crime rates of other NC counties to assess the community's crime status. Trend data could also be used in the future to compare Orange County's current crime rate to that of previous years in a similar AHP community self-assessment. This would reduce comparability to other locations, but might provide more information about how Orange County is improving its ability to deal with crime.

SOCIAL EQUITY INDICATOR B: HEALTH STATUS

INTRODUCTION

We chose health status as a measure of sustainability because health is an integral determinant of a community's human capital. Healthier individuals are more able and willing to contribute to the community in positive ways.



MEASUREMENT

The health status of community members was measured through the following question posed on a survey administered by the North Carolina State Center for Health Statistics: "During the past 30 days, for about how many days did poor physical or mental health keep you from doing your usual activities, such as self-care, work, or recreation?"

DATA

We based our scoring for this indicator on the percentage of surveyed individuals who answered "none" to the aforementioned question. An ideal score of 5 is achieved if 90% or more gave this response, 4 if 80-89%, 3 if 70-79%, 2 if 55-69%, and 1 if less than 54%. In the 2006 survey, 80.4% of Orange County residents experienced no days of poor physical or mental health that interfered with their usual activities in the previous 30 days.³⁹ This score places our community at the lower end of the range to receive a 4 out of 5 for health status.

In order to take into account the racial equity of health status, our scoring is also based on the ratio of non-white: white percentages of individuals who answered "none." An ideal score of 5 is achieved if this ratio is 0.90-1.00, 4 if 0.80-.89, 3 if 0.70-0.79, 2 if 0.55-0.69, and 1 if less than 0.54. Since 72.1% of minority groups answered "none," while 82.9% of whites answered "none," the ratio for this statistic is 0.87, which earns our community a score of 4 out of 5.

AHP SCALE

We averaged these two scores to give the final score of 4 out of 5 for social equity sustainability in health status for Orange County.

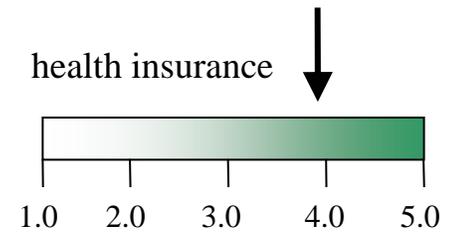
RANKING AND EVALUATION

Orange County, having earned a score of 4 out of 5, appears to be doing well in terms of the health status of its community members. For the sake of this pilot, we have assumed that Chapel Hill achieves comparable levels to the rest of the county in terms of social equity in health status. Thus, in order to improve, Chapel Hill could promote health in any number of ways. Since this indicator encompasses all sources of poor health, it serves the purposes of this pilot well but does not provide much insight into the specific illnesses Chapel Hill should work to prevent. General wellness can be promoted, however, by measures such as providing more walkways throughout the town and promoting the sale of healthy foods. The fact that smoking is legal in few public places throughout the community, and the fact that parking is limited and thus walking is promoted, among other factors, are aspects of the community that work in Chapel Hill's favor in terms of community health status.

SOCIAL EQUITY INDICATOR C: HEALTH INSURANCE

INTRODUCTION

The ability to afford medical care affects not only a person's quality of life by allowing her to maintain good health, but also by affecting her financial well being. If a person becomes seriously ill or injured, the cost of that person's medical treatment can be very high without health insurance or government assistance programs. According to a 2005 Harvard study, the number one cause of bankruptcy in America is unaffordable health care bills and illness.⁴⁰ The lack of health insurance or government assistance programs can also influence a person's willingness to seek medical help when he is sick and to receive preventative medical treatments such as vaccinations.



MEASUREMENT

We obtained data on the percentage of residents of Orange County who have health insurance from the North Carolina Center for Health Statistics⁴¹. For this indicator, data for Orange County is being used since Chapel Hill Data was not available.

AHP SCALE

In 2006, 84.5% of all Orange County residents had health insurance or received government assistance from Medicare or Medicaid. We awarded a score of 1 to 5 based on the percentage of residents who have some kind of health insurance or receive government assistance. A score of 5 was assigned if the percent of residence with health insurance was between 90% and 100%. Between 80% and 89% was a score of 4, between 70% and 79% was a 3, 55% and 69% was a 2, and below 54% was a score of 1.

RANKING AND EVALUATION

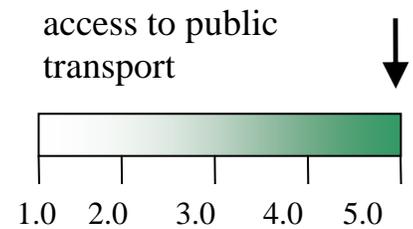
According to the scale, Chapel Hill receives a score of 4 out of 5. The overall statistic for health insurance in Chapel Hill is impressive; however, there is a significant discrepancy between health insurance coverage for white residents and coverage for non-white residents. The North Carolina Center for Health Statistics reports that 94.3% of white residents have some form of health insurance while 49.4% of non-white residents have health insurance. Because there are more white residents in Orange County than there are non-white residents,⁴² the overall percentage of people covered by health insurance in the area is high. Increasing the number of people who have health insurance may be a difficult task for Orange County to address. However, promoting educational and training opportunities might be a way for local governments to increase the number of people who are eligible for more competitive jobs that include benefits.

SOCIAL EQUITY INDICATOR D: ACCESS TO PUBLIC TRANSPORTATION

INTRODUCTION

Public transportation can contribute to the sustainability of a community in many ways. It can help reduce the energy consumption of and pollution generated by a community. It can also provide citizens who do not have the resources to purchase and maintain their own vehicles or prefer not to drive an affordable way to get to school, work, or around the community in general. Busses, metros, and other modes of transportation can decrease traffic congestion and make transportation faster and more efficient for users and non-users.⁴³

However, in order for public transportation to maximally improve a community environmentally, economically, and socially, it must be accessible to a very large share of the population. Increased accessibility of public transportation encourages use of services by a larger number of people, helping lead to the positive effects described.



MEASUREMENT

In Chapel Hill and Orange County, busses provide the predominant form of public transportation; thus, accessibility to busses is what our group aimed to measure. This indicator measures the percent of the population that lives within $\frac{1}{4}$ of a mile of a bus stop. Research indicates that individuals located farther than a fourth of a mile from a public transport stop are unlikely to use public transportation if other options are available, sometimes even finding it prohibitively inconvenient; city planners have also started using $\frac{1}{4}$ of a mile as a standard measurement for public transport.⁴⁴ Thus, communities that hope to maximize the use of their public transportation systems should strive to provide bus stops within $\frac{1}{4}$ of a mile of almost all residences, perhaps excepting those remote from densely populated areas.

DATA

Unfortunately, the town of Chapel Hill currently does not have the data necessary to determine the percent of the town's population living within $\frac{1}{4}$ of a mile of a bus stop. Based on the importance of accessibility to the effectiveness of public transportation, we strongly recommend that Chapel Hill determine this statistic.

AHP SCALE

Ideally, nearly everyone in a community should be able to access public transportation; in a moderately urban environment such as Chapel Hill, this may also be quite possible. Our AHP scale reflects our judgment that it would be reasonably feasible for Chapel Hill to provide bus stops within a fourth of a mile of all homes by categorizing a '5' as 90-100%. We also decided that any coverage less than 30% deserves the lowest rating, and assigned the remaining AHP scale values accordingly.

RANKING AND EVALUATION

For the sake of this exercise, we will use Chapel Hill planner David Bonk's estimate that a little more than 90% of the town's people are within a fourth of a mile of a bus stop.⁴⁵ Chapel Hill, therefore, receives a 5 for this indicator.

However, this does not mean there is nothing to be improved upon. While the bus stops themselves may be accessible, it is also important that busses visit these stops frequently enough to serve most of the public's work and recreational travel needs.

SOCIAL EQUITY SUSTAINABILITY: CONCLUSION

Since health-related issues are of special relevance in understanding the happiness of individuals or a community, health insurance and health status are given greater weights in determining the final social equity score. Crime rate, which we see as more of an effect of social inequality than a cause of it, is given a correspondingly lower weight, and access to public transportation a medium weight.

Overall, Chapel Hill scored a 4.0 on the AHP scale, indicating an above-average level of social equity. Of course, there is still much that can be improved on, and we hope that the Town of Chapel Hill continues to aim to improve the distribution of critical services and resources and the safety of the community.

EVALUATING THE SUSTAINABILITY OF CHAPEL HILL: CONCLUSION

OVERALL SCORE AND IMPLICATIONS

In our Analytical Hierarchy Process (AHP), Chapel Hill received an overall score of 3.8 representing a somewhat better-than-average or “B-” score for sustainability. The division of the twelve indicators into three categories represents the town’s stated goal of “balance[ing] social, economic and environmental concerns in decision making.”⁴⁶ The indicators were categorized under one of these three primary headings to ensure that all three of these areas are addressed in our analysis, but each indicator was chosen because it crosses these boundaries and has implications that influence multiple dimensions of sustainability. Dimensions were weighted proportionally in the AHP analysis based on the number of indicators assigned to them, allowing us to better assess each indicator’s contribution to sustainability as a whole rather than to one single dimension of sustainability.

TOWN PRIORITIES AND CURRENT ACTIONS

The vision for a sustainable Chapel Hill held by community leaders, citizens, and planners is enumerated in three documents: the Resolution Establishing the Town Sustainability Committee (2007-2015), the Town of Chapel Hill website, and the Comprehensive Plan created by a task force of Chapel Hill citizens and planning board members appointed by the Town Council.

The town of Chapel Hill strives to “create healthy living environments, [...] protect, restore and maintain ecological integrity, [...] and conserve energy and natural resources and use them efficiently.”⁴⁷ The community received a score of 5 with respect to ozone warning days. The ozone score for the greater region, however, is lower, and given the regional nature of air quality it is important that Chapel Hill work with neighboring communities to improve air quality to benefit the health and wellbeing of its environment and citizens. Chapel Hill has listed “water conservation at the household level”⁴⁸ as a sustainability goal, and this is reflected in the fact that the gallons of water consumed per person per day is lower in Chapel Hill than the national average, yielding an AHP score of 4. Water conservation in households, industry and agriculture is essential to the community’s long term viability as clean water becomes an increasingly scarce resource globally and sustained periods of drought threaten local availability. Countries such as the Netherlands have shown that reducing daily water use per person to less than 20% of its current Chapel Hill level is possible in a developed nation, so despite its good score, Chapel Hill can continue to take significant steps toward reducing water consumption. Measuring the number of acres of green space per 1,000 residents addresses the stated goals of “conserv[ing] and protect[ing] the natural setting of Chapel Hill”⁴⁹ and providing “green space, public trails, and public space.”⁵⁰ The AHP score of 2 shows that the community is below average with respect to availability of green space when compared to similar communities nationally and should take steps toward increasing greenways, parks and other natural spaces to meet its stated goals.

In our Analytical Hierarchy Process (AHP), Chapel Hill received an overall score of 3.8 representing a somewhat better-than-average or “B-” score for sustainability.

“Public transportation effectiveness”⁵¹ is a sustainability priority on the Town’s website while “work[ing] toward a balanced transportation system” and “complet[ing] the bike, greenway and sidewalks systems”⁵² are listed as goals by citizens and city planners in the Comprehensive Plan. These goals are addressed by both the environmental health indicator transportation mode breakdown and the social equity indicator percent of people who live within ¼ mile of a bus stop. Due to Chapel Hill’s size, public transportation within the community is mainly by bus, and the free UNC area bus system and scheduled service by Triangle Transit Authority have largely resulted in the AHP score of 4 for transportation mode breakdown. Just over half of trips made by community members are made by non-single occupancy vehicles, so further steps can be taken to increase the quality and availability of service provided by Chapel Hill busses as well as community knowledge regarding the importance of using public transportation whenever possible. The 90% of the Chapel Hill community estimated by Chapel Hill planner David Bonk to live within ¼ mile of a bus stop yielded an AHP score of 5 with respect to the social equity indicator of access to public transportation. However, by measuring only transit stop access and not frequency of service, this indicator goes only so far in reflecting how Chapel Hill’s strong transit system may impact overall sustainability by reducing auto ownership and use.

“Creat[ing] and preserving affordable housing opportunities”⁵³ is a Chapel Hill Comprehensive Plan goal. Approximately one-quarter of community members spend more than 35% of their income on housing, yielding an above-average AHP score of 4. Families who spend more than 35% of their income on housing have very little discretionary income available to meet basic needs such as health insurance. The town currently requires residential developments of five or more units to “provide 15% of their units at prices

affordable to low and moderate income households, contribute in-lieu-fees, or propose alternative measures so that the equivalent percent of their units will be available and affordable.”⁵⁴

Social equity indicators reflect the Town’s goal to “promote equity, dignity and social justice.”⁵⁵ While 80.4% of community members said that they had experienced no days of poor physical or mental health that interfered with their usual activities in the previous 30 days, minorities were approximately 10% less likely to have answered no than whites. The AHP score of 4.0 indicates that the community perceives itself to be healthier overall than the average community. Chapel Hill index crime rates are on par with crime rates in other parts of North Carolina, yielding an average AHP score of 3.

RECOMMENDATIONS

The overall feasibility of many of the environmental and social initiatives proposed in this report and listed in the Town’s sustainability goals is highly dependent on the community’s economic vitality for funding. Community wealth received an average score of 3, suggesting that steps could be taken to increase the availability of jobs in the area that provide livable wages. The distribution of unemployment in the community received an AHP score of 2 due to the fact that African Americans are 2.67 times more likely than whites to be unemployed in Chapel Hill. While overall unemployment in Chapel Hill is close to the national average, the wide racial unemployment disparity needs to be addressed in order for the social harmony and economic sustainability of Chapel Hill to be maintained. The University of North Carolina and area community colleges are great resources for training the labor force for higher skilled jobs as well as generating sustainable businesses that can provide jobs in the local community.

While 84.5% of community members have health insurance or receive government assistance from Medicare or Medicaid, yielding an AHP score of 2, whites are nearly twice as likely to have some form of health insurance as minorities. The inability to afford health care bills is the number one cause of bankruptcy in the United States, and in order to avoid the high future economic and social costs to these individuals and the community, we recommend that the Town make availability of health insurance to minorities a sustainability priority.

CONCLUSIONS: THE IMPORTANCE OF QUANTITATIVE SUSTAINABILITY RANKING

Evaluating the overall sustainability of Chapel Hill is a complex task, and the success of any such attempt is limited by the availability of data and quality of indicators selected. The AHP is valuable as a flexible tool that can respond to both changing conditions and community values. While the scales we chose reflect current standards or knowledge and available data, values for scale scores may change as conditions change, new knowledge emerges, or new technology appears. Where common practices were not available, we had to make reasoned and justified yet ultimately subjective choices to both describe current conditions and drive progress toward higher standards of sustainability.

This report is intended to serve as a pilot project to demonstrate the potential for using AHP analysis to better understand a community’s sustainability.

This assessment represents the convergence of “ideal” indicators (see Appendix A) and indicators for which data is currently available for the community. Chapel Hill data was used where available, but in most cases Orange County data had to be substituted. In the case of water usage statistics we were limited to North Carolina data, and access to public transportation percentages represent the best estimate available from the Chapel Hill planning department. The twelve indicators in this report represent both the vision of sustainability laid out by the community as well as our committee’s recommendations based on extensive research into similar initiatives in other communities.

This report is intended to serve as a pilot project to demonstrate the potential for using AHP analysis to better understand the strengths and weaknesses of the community and is not meant to serve as a third party stamp of approval regarding Chapel Hill’s sustainability. We encourage the Town to undertake a full scale project that would allow it to comprehensively evaluate the success of its current initiatives at fulfilling its stated goals as well to identify areas that need to be addressed to allow the community to improve its environmental health, economic vitality and social equity today without sacrificing the ability to do so in the future. We think a team of 3 to 5 people could further develop this project through collaboration with the town of Chapel Hill to refine metrics and scales, capture trends in the analysis, track progress over time, and develop additional visualization tools for the indicators.

APPENDIX: COMPREHENSIVE LIST OF INDICATORS

INTRODUCTION

A goal of the 2007 Fall Capstone group was to create a comprehensive list of indicators that could be applied to any community and its priorities. The following list of indicators are divided into separate dimensions of sustainability and then broken down further into indicators within sub-categories. We have developed this list as a tool that will be useful to any community in North Carolina that wants to use it in a self-assessment of sustainability. After reviewing many other lists of sustainability indicators, including the indicator set currently available in the Virtual North Carolina (VNC) database, we chose these indicators, metrics, and scales based on our best judgment, but these indicators can be customized by users. It is important to note that the indicators listed below may or may not have current or available data and a community may have to initiate data collection if it decides that a specific indicator is an essential measure of its sustainability.

ENVIRONMENTAL HEALTH DIMENSION: SUB-CATEGORIES AND CORRESPONDING INDICATORS

- I. Air Quality
 - A. CO₂, NO_x, SO_x in air
 - B. Number of days under adverse ozone warnings

- II. Water Quality and Consumption
 - A. Heavy Metals in Water (Pb and As)
 - B. Nitrates in Water
 - C. pH of rain
 - D. % stream miles meeting state water quality standards
 - E. Water use per capita
 - F. Water consumption versus total annual precipitation
 - G. Water quality in lakes and rivers (how is it measured-- nutrient load/dissolved oxygen)

- III. Waste Management
 - A. % of solid waste recycled per capita
 - B. Solid waste generation per capita
 - C. Space used as landfill
 - D. Highway litter bags collected per mile
 - E. Number of people involved in recycling initiative
 - F. Tons of recycled material
 - G. Percentage of goods purchased made of recycled materials (municipal, household)
 - H. % of recycled products actually recycled

- IV. Energy Use
 - A. Gallons of fuel use per capita (gasoline, heating, lights, and everything else)
 - B. Energy use/square foot of building space
 - C. Renewable energy use per capita
 - D. Total energy use
 - E. Total energy use per capita
 - F. Average miles per gallon attained

- V. Natural Resources Usage
 - A. Acres of parks and or open space per person
 - B. Erosion of cropland
 - C. % of surfaces that are impervious
 - D. Percent of land in the region devoted to people habitat, car habitat, wildlife habitat, and agriculture
 - E. Proximity to schools and grocery stores
 - F. Travel time index (ratio of travel time to travel under free-flow conditions)
 - G. % Mass transit use (ridership, mode of transport)
 - H. Number of trees/acres of forests lost to development (annually)

ECONOMIC VITALITY DIMENSION: SUB-CATEGORIES AND CORRESPONDING INDICATORS

- I. Income
 - A. Economic growth rate
 - B. Number of patents per year
 - C. Distribution of purchasing power
 - D. Income distribution
 - E. Inflation
 - F. Interest income per capita
 - G. Personal debt v. personal savings per capita

- II. Investment
 - A. Wages invested in local community
 - B. Average number of worker hours needed for basic needs
 - C. Community reinvestment act

- III. Debt
 - A. County/city government debt
 - B. Average business debt to asset ratio

- IV. Employment
 - A. Percent of jobs providing livable wage
 - B. Labor force distribution (by professional classification)

- V. Housing Costs (Public and Private)
 - A. Proportion of people who spend more than 30% of their income on housing
 - B. Average price of housing compared to median income
 - C. Percentage of income spent on housing
 - D. Amount of rent lost per vacancy per year
 - E. Public income assistance to housing

- VI. Unemployment
 - A. Unemployment rates

SOCIAL EQUITY DIMENSION: SUB-CATEGORIES AND CORRESPONDING INDICATORS

I. Demographics

- A. Life expectancy
- B. Voter turnout

II. Safety

- A. Vehicle accidents per capita/year
- B. Juvenile apprehensions
- C. Crime rates
- D. Satisfaction with safety/security
- E. Sense of safety

III. Social Services

- A. % of transit service miles (percent of roads covered by public transportation; weekend/weekdays)
- B. Percentage of income spent on transportation
- C. Number of minutes between buses on scheduled routes (headways)
- D. % of streets (by mileage) with bike paths
- E. Child abuse rates
- F. Domestic abuse rate
- G. Volunteer hours per capita (environment and health)
- H. Percentage of citizens that volunteer
- I. Residential lots within $\frac{1}{4}$ mile of services (ex. bus stops)

IV. Wellbeing

- A. Automobile occupancy rate
- B. Auto-ownership per family (based on income/socioeconomic group)
- C. Usage of athletic facilities
- D. Asthma prevalence in population
- E. % of population who smokes
- F. Childhood obesity rate
- G. Prevalence and Incidence of cancer
- H. Rate of degenerative diseases

V. Social Services related to Healthcare

- A. Health insurance claims
- B. Number of recipients of Medicare and Medicaid
- C. Doctor to patient ratio
- D. % of population with health insurance
- E. % of ER visits not true emergencies
- F. Average rescue call response time

VI. Arts

- A. People per community center
- B. People served by museums and arts
- C. % of population in local workforce

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