Mapping Change

IN BUNCOMBE COUNTY

A PLACE-BASED CHANGE ANALYSIS



DEVELOPED BY

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TABLE OF CONTENTS

MAPPING CHANGE IN BUNCOMBE COUNTY OVERVIEW	4
EXECUTIVE SUMMARY	4
DATA REVIEW	4
KEY ISSUES FOR BUNCOMBE COUNTY	5
DEMOGRAPHICS	6
POPULATION	7
POPULATION CHANGE	7
POPULATION, RACE, and ETHNICITY	
POPULATION, INCOME, and POVERTY	9
HOUSING	
HOUSING TYPE	11
NUMBER OF UNITS	11
MOBILE HOMES	
RV'S, VANS, and BOATS	15
ADDRESSES	17
OCCUPIED/VACANT	
YEAR BUILT	
NEW STRUCTURES	
NEW RESIDENTIAL STRUCTURES	19
HOUSEHOLD TYPE	19
HOMEOWNERSHIP	
HOME RENTER	
PRICES	
HOUSING VALUES	
OWNER COSTS	
RENT	
EDUCATION	
SCHOOL ENROLLMENT	
EDUCATIONAL ATTAINMENT	25
LAND USE	
FOREST CHANGE	
DEVELOPED CHANGE	
STATS	
ENVIRONMENTAL QUALITY	

WATER QUALITY	
HEALTH AND WELLNESS	
FOOD SECURITY	
USDA FOOD ACCESS RESEARCH ATLAS	
SNAP PROGRAM	32
ECONOMICALLY DISADVANTAGED STUDENTS	
SOURCES	34
DEMOGRAPHICS	
HOUSING	34
EDUCATION	
LAND USE	
ENVIRONMENTAL QUALITY	
HEALTH AND WELLNESS	
FOOD SECURITY	
MAPS	39

MAPPING CHANGE IN BUNCOMBE COUNTY OVERVIEW

EXECUTIVE SUMMARY

This report, Mapping Change in Buncombe County – The 20-Year Update, was created by students in the Spring 2023 Advanced Geographic Information Systems class at Warren Wilson College. The first Mapping Change project, which was released in the Fall of 2003 by the Environmental Leadership Center at the College, was designed to give decision-makers and stakeholders the data necessary for examining change in Buncombe County over the two decades leading up to the turn of the century. Given the significant growth and change in the county over the past twenty years, the students in Advanced GIS have created this update of several aspects of social and environmental change within eight main categories:

- Demographics
- Housing
- Education
- Land Use
- Environmental Quality
- Health and Wellness
- Food Security

In each of these chapters, we first highlight relevant statistics and information about the category, then describe patterns found in the maps that are included in the back of the document. The maps are coded by category (e.g., maps focusing on Demographics are coded as **D-01**, **D-02**, etc.) beginning on page 39.

DATA REVIEW

Every effort was made to ensure data accuracy in this report. Data was gathered from several sources, including the U.S. Census Bureau (the 2020 Decennial Census, American Community Survey), the Centers for Disease Control (PLACES: Local Data for Better Health, Social Vulnerability Index), the U.S. Geological Survey (National Land Cover Database), and more.

For much of the data collected from the U.S. Census Bureau, we have chosen to use the Census tract as the spatial unit of analysis. Census tracts are designed to be relatively permanent subdivisions of a county (though those tracts in areas with significant population growth tend to be split over time). Census tracts contain an average of approximately 4000 individuals.

KEY ISSUES FOR BUNCOMBE COUNTY

Many of the maps and datasets used in this report reflect the same datasets used in the 2003 report. We also chose to study aspects of Buncombe County that were not covered in the previous report but which seemed relevant and important to understanding the area in 2023, including data on health and wellness and food security. Key issues and important takeaways from the data will be included in each chapter of the report.

DEMOGRAPHICS

In 2003, the demographics category was the second highest ranked out of the five key issues decided upon by a panel of expert decision makers in the area. As Buncombe County continues to develop, the subject of demographics becomes increasingly relevant. During the research phase of the initial Mapping Change project, the CEL received an influx of questions pertaining to demographics. They were forced to somewhat limit their response due to time and budgetary issues. Similarly, we've chosen to limit our update to some key aspects which best demonstrate the last two decade's effect on the region. Additionally, this section's analysis will mostly only include data from 2010 and 2020, due largely to time constraints.

In addition to providing a summary of the area's current demographic makeup, we aim to analyze data from the Decennial Census and ACS in order to better understand the socioeconomic dynamics that have emerged since this project's initial effort. Since 2000, Buncombe's population has increased by 27%. An increase of such magnitude is significant, and worthy of spatial analysis.

- This 27% population increase is especially noteworthy when compared against the population change in North Carolina and the entire United States.
- **Table I** shows that North Carolina is growing more rapidly than the whole US, but that neither the state or country reached an increase of over 10%.

	2010	2020	Percent Change
North Carolina	9,535,483	10,439,388	9.48%
United States	308,745,538	331,449,281	7.35%
Buncombe	238,743	263,477	10.36%

Table I: Population Change in North Carolina and the United States.

Source: US Decennial Census, 2010 & 2020.

In order to best understand and translate this data, we've chosen to focus on data that's available at the Census tract level. This decision is in keeping with common practice for this kind of analysis, and allows us to compare data across the tract's consistent outer boundary.

POPULATION

In 2020, the population of Buncombe County was 263,477. At the time of this document's writing (2023) the population is currently 278,791. The growth over the last three years represents a 5.8% increase. For a visual reference, see the **Total Population Map (D-01)**.

• Map D-01 indicates that the region's most densely populated Census tracts are mostly concentrated near Fairview, Shiloh, Arden, Leicester, and the Biltmore Lake residential area.

POPULATION CHANGE

The total population in Buncombe County increased from 2010 to 2020 by 10.3601%. **Table II** shows the change in population across several categories. See the **Population Change Map (D-02)** for a visual reference.

- Within Buncombe County: Arden, Biltmore lake, Leicester, and Black Mountain saw the most population increase in the last ten years.
- The male and female populations in Buncombe increased at a fairly consistent rate, however the female population has remained larger by about 10,000 people.
- The US Census defines households as any (potentially unrelated) persons living within the same house, condominium, or apartment.
- The US Census defines families as two or more persons living together who are related by birth, marriage, or adoption.
- The number of households increased by nearly 5%, directly contrasting the slight decrease in number of families.

	2010	2020	Percent Change
Total Population	238,743	263,477	10.36%
Male	111,907	124,395	11.16%
Female	121,342	135,181	11.41%
# of Households	99,309	105,177	5.91%

Table II: Population Change Across Buncombe County Between 2010 & 2020.

# of Families 6	60,886	60,615	-0.45%
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Source: ACS, 2010 & 2020.

POPULATION, RACE, and ETHNICITY

For the most part, demographic trends relating to race and ethnicity remain consistent with findings from the 2003 Mapping Change. Each race/ethnic group recorded an increase in the population.

Refer to **Table III** for more information and to see a more detailed breakdown. For a visual reference, see the **African American Population Map (D-03)**, and the **Hispanic/Latinx Population Map (D-04)** for visual references.

- The Census' definition of the Black/African American racial category also includes everyone who self-identifies as from any African country.
- The "Some Other Race" category is an additional 6th option, referring to self-described ethnic identities that don't fit into the Census' umbrella definitions.
- White people still remain the dominating majority, Buncombe County was 83% white in 2020.

In addition to recording the region's current demographic situation, we also used this data to analyze the ways in which Buncombe's demographic makeup has changed over time. For a visual reference, see the **Change in African American Population Map 2010-2020 (D-05)**, and the **Change in Hispanic/Latinx Population Map 2010-2020 (D-06)** for visual references.

- According to the US Census, the Black/African American population displayed the least population growth, at 0.66%. In 2020, black people comprised only 5.8% of Buncombe county's population. Black population growth is concentrated in and around West Asheville, and there was either very little change or a decrease in black population in Census tracts closest to Asheville's city center.
- In contrast, the "Two or More Races" group represented the highest population growth, at a staggering 280% increase between 2010 and 2020. This increase is due in part to changes to the US Census questionnaire, which allows for informants to more accurately describe themselves.
- The percentage of the county's population that identifies as white has gone down by 5% since 2000. White people still represent Buncombe's largest majority. Additionally of note, the hispanic/latinx population saw a significant increase of nearly 54%. This population growth was seen largely in areas in and around West Asheville

	2010	2020	Percent Change
Total Population	238,743	263,477	10.36%
Black/African American	15,211	15,311	0.66%
Asian	2,417	3,322	37.44%
Native American/Alaska Native	948	1,253	31.12%
Native Hawaiian/Pacific Islander	289	496	71.63%
Hispanic/Latinx	14,254	21,922	53.81%
Some Other Race	6,266	11,249	79.52%
Two or More Races	4,995	18,964	280%
White	208,192	218,867	5.13%

Table III: Change in Buncombe County's Population Across Race and Ethnicity in 2010 &2020.

Source: Decennial Census Race Dataset, 2010 & 2020.

Source: Decennial Census Hispanic/Latino or Not, 2010 & 2020.

POPULATION, INCOME, and POVERTY

Statistics for Buncombe County's average income can be found in **Table IV.** In order to standardize the data and make it comparable across the years, we chose to convert all US Dollar amounts to their current 2023 value. To this effect, the cumulative rate of inflation is 38.4% between 2010 and 2023 and 16.6% between 2020 and 2023. This analysis comes from data recorded by the American Community Survey in 2010 and 2020. This section also includes both mean and median income at the household and family level. For a visual reference, see the **Median Income by Tract Map (D-07)**, and the **Percent Below Poverty Map (D-08)**.

- The median income is defined as the cut-off where half the households make more and half make less.
- Mean income refers to the average income in the County.

The US Census Bureau sets dollar amount poverty levels that vary based on the size of family and the age of the members. This threshold changes every year, and is adjusted for inflation.

In order to best understand the socioeconomic position of this county, this section also includes an analysis of the change in income statistics across the last decade. For a visual reference, please see the **Change in Percent Below Poverty 2012-2020 (D-09)**. To note, relevant data on this issue was not available for 2010, 2012 was the closest alternative.

	2010	2020	Percent Change
Median (Households)	61,168	64,180	4.92%
Mean (Households)	82,589	92,065	11.47%
Median (Families)	76,105	85,979	13%
Mean (Families)	99,205	112,577	13.58%

Table IV: Income Statistics for Buncombe County in 2010 & 2020, Adjusted to 2023 dollars.

Source: ACS, 2010 & 2020.

HOUSING

In 2003, the original Mapping Change in Buncombe County document was developed as a community planning resource documenting demographic changes in Buncombe County. Housing was identified as the 5th most critical issue facing the county, and as Buncombe County builds more housing and infrastructure, the factors of affordability and availability, combined with the lasting effects of covid-19, this issue is becoming more imperative.

The **Buncombe County Community Survey Findings Report (January 2022),** conducted a survey of Buncombe County residents to better understand the evolving needs of the Buncombe County community. Of the priorities that respondents thought leaders should address over the next five years, *providing equitable access to housing* was identified by 45.4% of the 753 random household respondents. *(Findings Report: Buncombe County Community Survey (2021).*

The Housing section utilized information from the United States Census Bureau to compare changes from 2000 to 2020 and to visualize the current housing situation, with emphasis on topics related to equitable housing.

HOUSING TYPE

NUMBER OF UNITS

A *housing unit* is any single-family structure (like a house or a manufactured home) or any distinct unit in any building where four criteria are met. Refer to **Table I** and **Chart I** for a visual representation of this analysis. The Census's criteria for a housing unit can be assessed in a four-part test:

- A housing unit is a unit that is currently lived in or otherwise available or intended for living quarters
- Provides living space that is separate and private for the occupants
- Has access to the outside, directly or through common halls, without having to pass through others' private residential space

• Conditions of occupancy are independent of any service provision or institutional affiliation (housing not restricted to an institution's population). All four criteria must be satisfied.

	2000	2010	2020
1 - Unit Detached	58,706	71,887	79,282
1 - 4 Units	8,076	10,661	10,446
5 - 9 Units	4,404	5,798	6,994
10 - 19 Units	1,501	2,329	4,852
20+ Units	3,147	5,991	6,968

Table I : Number of Units 2000 - 2020

Source:US Decennial Census, 2000, 2010 & 2020.







Source: US Decennial Census, 2000, 2010 & 2020.

MOBILE HOMES

One of the housing alternatives offered in Buncombe County are mobile homes. *The Buncombe County Housing Needs Assessment,* was an analysis used to assess the market characteristics of, and to determine the housing needs for, Buncombe County. To accomplish this task, Bowen National Research evaluated various socio-economic characteristics, inventoried and analyzed the housing supply (rental and owner/for-sale product), conducted stakeholder interviews, evaluated special needs populations and provided housing gap estimates to help identify the housing needs of the county.

As part of this analysis, participants were asked to give recommendations on what the local government could do to aid in mobile home park living, Bowen National Research received a variety of responses. Responses included that the city of Asheville does not allow mobile home parks within the city limits, creating a negative stigma of parks. Respondents stated that mobile home living is some of the most affordable to area residents and that more should be done to promote this type of housing.

Between 2000 and 2020 there isn't an appreciable increase or decrease in the number of available mobile homes in Buncombe County, as you can see in **Table II** and **Charts II.A** and **II.B**.

	2000	2010	2020
Mobile Homes	18,054	16,770	17,076

 Table II : Number of Mobile Homes 2000 - 2020

Source: US Decennial Census, 2000, 2010 & 2020.

Chart II.A: Mobile Homes in 2000, 2010 and 2020



Mobile Homes

Source: US Decennial Census, 2000, 2010 & 2020.





Source: US Decennial Census, 2000, 2010 & 2020.

RV'S, VANS, and BOATS

Housing when occupants do not have usual residence. There is a very small number of housing units that show up in decennial Census counts, but that local governments do not normally consider as housing units. For a visual reference, see **Table III** and **Chart III.A** and **III.B** for a visual reference. For Census purposes, these situations only count when the occupants do not have any other usual residence:

- People paying for housing in week-to-week or month-to-month motel/hotel rooms: In this situation, motel/hotel rooms count as housing units for Census purposes and are categorized as multi-family housing in Census's American Community Survey. However, local governments will consider motels/hotels to be commercial establishments.
- People living in boats in marinas, tents in campgrounds, or RV parks: These "transitory situations" count as housing units for Census purposes and are categorized as "other" building types in Census's American Community Survey. However, local governments typically do not consider these situations as housing.

Table III : Number	of RV's, Vans	and Boats 2000 - 2	2020
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	2000	2010	2020
RV's, Vans and Boats	85	83	254

Source: US Decennial Census, 2000, 2010 & 2020.





RV's, Vans and Boats

Source: US Decennial Census, 2000, 2010 & 2020.





Source: US Decennial Census, 2000, 2010 & 2020.

ADDRESSES

Generally, one- and two-person owner-occupied households represented a combined two-thirds of the owner-occupied household base within the county in 2015. At the same time, of the county's owner-occupied households, approximately 16% will be three-persons, over 11% will be four-persons, and over 6% will be five-person or larger. (*The Buncombe County Housing Needs Assessment*) Those shares of owner occupancy rates did not change significantly through 2020. (.04% increase) Total vacancies increased by almost 40%. See Table IV and Chart IV for a visual reference.

OCCUPIED/VACANT

	2010	2020
Occupied	101,164	105,177
Vacant	12,355	20,695

Table IV : Number of Occupied and Vacant Housing in 2010 and 2020

Source: US Decennial Census, 2010 & 2020.



Occupied and Vacant Housing



Source: US Decennial Census, 2010 & 2020.

YEAR BUILT

NEW STRUCTURES

In 1990-1999, the largest regions of new construction were in the western and southern portions of the county- predominantly in Sandy Mush, Leicester, Avery Creek, south Asheville and Fairview Townships. visual reference, see the **Structures Built in Buncombe County Map 1990-1999 (H-01)**.

In 2000-2009, the largest regions of new construction were in the areas surrounding Asheville Township- predominantly directly north, east and south of Asheville Township. visual reference, see the **Structures Built in Buncombe County Map 2000-2009 (H-02)**.

In 2010-2013, the largest regions of new construction, again, was in the adjacent areas surrounding Asheville Township- predominantly directly north, east and south of Asheville Township. visual reference, see the **Structures Built in Buncombe County Map 2014-2020 (H-03)**.

In 2014-2020, the largest regions of new construction as a continued trend, again, was in the adjacent areas surrounding Asheville Township - predominantly directly north, east and south of Asheville Township. visual reference, see the **Structures Built in Buncombe County Map 2014-2020 (H-04)**.

NEW RESIDENTIAL STRUCTURES

In 2000-2020, the largest region of new residential construction was in western Asheville Township- visual reference, see the **Heatmap of Residential Structures Built Between 2000-2010 (H-05)**.

In 1990-2000, the largest region of new residential construction was directly north of Asheville Township- visual reference, see the **Heatmap of Residential Structures Built Between 1990-2000 (H-06)**.

In 2000-2010, the largest region of new residential construction was in western Asheville Township- visual reference, see the **Heatmap of Residential Structures Built Between 2000-2010 (H-07)**.

In 2010-2020, the largest regions of new residential construction was again concentrated in Asheville Township- visual reference, see the **Heatmap of Residential Structures Built Between 2010-2020 (H-08)**.

HOUSEHOLD TYPE

HOMEOWNERSHIP

Homeownership among 15-34 years declined approximately 30% between 2000 and 2020. In the age bracket 35-64 years, there was an increase in home ownership of 13% between 2000 and 2010, but then it dropped to approximately the same level in 2020 as it had been 20 years prior. In the age bracket 65+ years, there was a steady increase in homeownership between 2000 and 2020, with an overall increase of 33% from 2000 to 2020.See **Table V** and **Chart V** for a visual representation of this analysis.

	2000	2010	2020
15 - 34 years	7,636	6,444	5,256
35 - 64 years	35,999	41,143	36,582
65+ years	16,642	18,899	24,793

Table V : Age of Homeowners 2000 - 2020

Source: US Decennial Census, 2000, 2010 & 2020.

Chart V: Age of Homeowners in 2000, 2010 and 2020



Source: US Decennial Census, 2000, 2010 & 2020.

HOME RENTER

Home renters among 15-34 years increased approximately 26% between 2000 and 2020. In the age bracket 35-64 years, there was an increase in home rentership of 33% between 2000 and 2010, but then remained at the same level in 2020. In the age bracket 65+ years, there was a steady increase in home rentership between 2000 and 2020, with an overall increase of 52% from 2000 to 2020. See **Table VI** and **Chart VI** for a visual representation of this analysis.

	2000	2010	2020
15 - 34 years	9,920	12,641	13,496
35 - 64 years	11,788	17,613	17,140
65+ years	3,793	4,424	7,910

Table VI : Age of Home Renters 2000 - 2020

Source: US Decennial Census, 2000, 2010 & 2020.





Source: US Decennial Census, 2000, 2010 & 2020.

PRICES

HOUSING VALUES

In 2020, the regions of lowest median home values are in the extreme east and west regions of Buncombe County. Highest home values are located in the central and southern portions of the county. visual reference, see the **Median Housing Value in Buncombe County 2020 (H-09)**.

OWNER COSTS

Monthly owner costs with mortgage increased 33% between 2000 and 2020, and increased 38% for individuals without a mortgage.

	2000	2010	2020
With a mortgage	948	1,271	1,421
Without a mortgage	260	361	399

Table VII : Monthly Owner Costs with and without a Mortgage 2000 - 2020

Source: US Decennial Census, 2000, 2010 & 2020.





Monthly Owner Costs with and without a Mortgage

Source: US Decennial Census, 2000, 2010 & 2020.

RENT

In 2020, the lowest median rents are in the eastern portion of the county, and outside Asheville township. The highest median rents are in the central and eastern regions of Buncombe County-visual reference, see the Median Rent in Buncombe County 2020 (H-10).

EDUCATION

Buncombe county has 75 schools, and 23 public school districts, with roughly 55,548 students from nursery school to high school, and another 17,674 students in college (undergraduate and graduate). Of the 75 schools, 50 are public schools (9 owned by the city of Asheville, and 41 owned by the county), 18 are private (with 11 being religious schools), and 5 are charter schools. For a visual reference, see the **School and School District Map (E-01)**.

SCHOOL ENROLLMENT

Look at **Tables I** and **II** for a state of the county in terms of school enrollment. 2010 data on this was difficult to acquire, so we were ultimately unable to analyze changes from 2010 to 2020.

	Nursery or kindergarten	Elementary	High-school	College (Undergrad- uate or graduate)
Total	7,243	32,046	16,259	17,674
Men	3,640	16,491	8,191	7,577
Women	3,603	15,554	8,068	10,097

Table I: Population Enrolled in School.

Source: School Enrollment, American Community Survey, 2021.

Table II: Population Not Enrolled in School.

	Total Population	Not Enrolled in school	High-School Graduate	Not high school graduate or in school
Total	313,928	240,706	212,261	28,445
Men	153,256	117,357	102,727	14,630
Women	160,671	123,348	109,534	13,814

Source: School Enrollment, American Community Survey, 2021.

EDUCATIONAL ATTAINMENT

For the total population of Buncombe county(313,928), there are 226,669 people over the age of 25 whose level of education is a high school diploma or higher. Of the tracts in Buncombe county, the minimum number of people with this level of educational attainment is 727, while the maximum is 7,365, and average for a tract in this county is 3,063. We made one map in this section (E-03) to represent these numbers in percentages of people in the tract that are 25 or older and have a highschool diploma or higher, and one which demonstrates where each tract falls on a quartile range in terms of population (E-04). In the former, it is clear that the highest percentages of people fitting this description are closer to the center and central southern end of the county, while the quartile map does not seem to have a distinct pattern. We also made one map which visualizes the change in the percentage of people over the age of 25 who do not have a highschool diploma (E-02), and in this map there is large increases (16.6-26.6%) in a number of more rural tracts northwest and to the east of Asheville, and there was no decrease in any of the studied tracts.

Given that the data used in the quartile map was not normalized via percentages, it is a less reliable data analysis tool. This lack of normalization likely explains why the tracts with higher numbers seem to mirror tracts with higher populations. For a visual reference, see the following maps: Change in No High School Diploma (E-02), Percent of People with High School Diploma or Higher in Buncombe County (E-03), Census Tracts in Buncombe County with their Quartile Range (E-04).

LAND USE

This section uses National Land Cover Data (NLCD) to highlight how land in Buncombe county is used in addition to how it has changed. The NLCD uses 30 by 30 meter pixels to classify land, and calculates each pixel by the largest percent or mixture of percents to assign each classification. For example, a Mixed Forest classification means that pixel contains roughly equal proportions of evergreen and deciduous forest. **L-01** is Buncombe County classified according to the NLCD.

The NLCD has classifications for many different years. The two that were closest to the years of interest were chosen to do this change analysis. Additionally only two land categories, forest and developed, were of particular interest for a change analysis. These maps highlight the connection between the amount of developed land and the amount of forested land. **The Percent Forest Change Map (L-03)** was calculated by summing the percent of all three forest classifications for 2001 and 2019 and then subtracting the percent for 2019 from the percent from 2001. The Percent Developed Change map was calculated using the same methodology as for forest change but for different classifications.

FOREST CHANGE

L-02 is Buncombe county parsed by the 2020 Census tract and displays the percent forest change from 2001 and to 2019. The green represents Census tracts that gained a small percent of forest and the red represents areas that have lost forest.

DEVELOPED CHANGE

L-03 is the change in developed land of all intensities from 2001 to 2019. The red represents areas that have increased the percentage of developed land, and the one white parcel in the center has lost a very small percentage of developed land.



Chart I: Buncombe Land Classifications by Percent

Source: NLCD • Created with Datawrapper

Source: Data | Multi-Resolution Land Characteristics (MRLC) Consortium, 2001 and 2019

ENVIRONMENTAL QUALITY

In 2003, a *Mapping Change* panel of expert decision makers identified water quality as a top issue, ranked fourth out of five total. Their three main areas of concern were:

- Quality and quantity of ground and surface waters
- Sources of any quality issues
- The extent of water and sewer systems within the county

They analyzed changes in water quality using water chemistry data collected by UNCA's Volunteer Water Information Network (VWIN), which they compared to changes in land use and impervious surface.

The VWIN began in 1990 and the number of sampling sites has fluctuated considerably over the duration of the program. Influential factors such as when sampling occurs in relation to storms are not considered in this data set, so even in 2003 the assessments were coarse at best. Since 2003, many of the sites have dropped out of service, and sampling appears to have decreased at those sites which are still part of the VWIN program. Because of these issues with VWIN data, the current 2023 analysis uses the North Carolina Department of Environmental Quality's integrated report on overall water quality, instead of data from the VWIN.

Therefore, the 2023 water quality assessment is not directly comparable to the water quality assessments done in 2003. In addition, the only years available for the NCDEQ overall quality reports were 2014 and 2018, so the amount of change shown in this analysis is more than likely not reflective of the actual rate or amount of change occurring in these areas. Due to difficulties obtaining data, the current analysis does not include information about the extent of water and sewer systems in Buncombe County. For a visual reference, please see the 2014 Water Quality & Forest Cover by 12-Digit HUC Subwatershed Map (WQ-01), and the 2018 Water Quality & Forest Cover by 12-Digit HUC Subwatershed Map (WQ-02).

WATER QUALITY

The current analysis combines the water quality data from the NCDEQ with changes in percent forest cover, sourced from the National Land Cover Database (NLCD). Percent forest cover was calculated for each 12-digit HUC subwatershed (also sourced from the NCDEQ), and overlaid with a map of streams assessed by the NCDEQ integrated report, colored by overall quality category. There are 5 total overall quality categories, with lower numbers equating to better water quality. Only categories 4 and 5 are considered to be of immediate concern.

No significant change in forest cover occurred in any of the 12-digit HUC subwatersheds between 2014 and 2018. Water quality on the other hand did experience some changes between 2014 - 2018. For a visual reference, see **Change in Water Quality by 12-Digit HUC Subwatersheds 2014-2018 (WQ-03)**. Some notable areas of change include: the Lower Swannaoa and a long stretch of the French Broad in central Buncombe being reclassified from a category 2 to a category 3, as were several streams in Lower Hominy Creek watershed in the southwest part of the county. Lower Cane Creek in the south was reclassified from a category 2 to a category 4, however, the section of the French Broad that feeds into it showed improvement, from a category 5 to a category 3. In addition, a number of sections of waterway were reclassified from a category 2 in 2014 to a category 1 in 2018. These sections showing improvement are primarily in the northwestern (and incidentally, more heavily forested) portions of the county.

HEALTH AND WELLNESS

This section uses Social Vulnerability Index data (SVI) and PLACES data (both from the Centers for Disease Control) to highlight how social determinants of health affect Buncombe county citizens at the Census tract level. Social Vulnerability is defined as the potential negative effects on communities caused by external stresses on human health (CDC).

The Social Vulnerability Index uses 16 different social variables (ranging from poverty to lack of a vehicle or crowded housing) and breaks them into 4 categories: Socioeconomic Status, Household Characteristics, Racial and Ethnic Minority Status, and Housing Type/Transportation. The resulting index from these variables ranges from 0 to 1, the closer to 1 the more vulnerable that Census tract is. You can see how social vulnerability has changed in Buncombe county since 2000 in the maps Social Vulnerability by Census Tract 2020(HE-01), Social Vulnerability by Census Tract 2010 (HE-02), and Social Vulnerability by Census Tract 2000 (HE-03).

Uninsured by Census Tract 2020 (HE-04) visualizes which Census tracts have the highest amounts of uninsured residents, which is a large determinant of health as people who are uninsured are likely to wait until it is too late seek medical aid, and preventative healthcare is not an option at all.

PLACES uses 2019 and 2020 Behavioral Risk Factor Surveillance System (BRFSS) in tandem with 2010 Census data, tracts and population, and 2015-2019 American Community Survey (ACS) and produces 29 health measures at the Census tract level. We will focus on the health measures of cancer and asthma.

Crude Prevalence of Adults with Asthma Aged 18 Years and Older, 2020 (HE-05) visualizes the percentage of the population, by Census tract, that have been diagnosed with asthma by a medical professional and still have asthma. Asthma can lead to greater chances of adverse outcomes, such as hospitalization or death, and can affect people/groups disproportionately; nationwide, asthma has been increasing in prevalence since 2010.

Crude Prevalence of Adults with Cancer Aged 18 Years and Older, 2020 (HE-06) visualizes the percentage of the population, by Census tract, that have been diagnosed with cancer (excluding skin cancer) by a medical professional. Another project that uses this data is Healthy People 2030, in which it lists multiple health goals to achieve nationwide. The goal for cancer is to reduce the death rates of various types of cancer and increase the accessibility of treatment.

FOOD SECURITY

While Food Security was not a section in the 2003 Mapping Change project, we decided to add it to our updated edition to make use of some of the large, detailed datasets that have been produced in the last 20 years to evaluate and quantify food security. These include the USDA Food Access Research Atlas (also referred to as 'the Atlas'), Supplemental Nutrition Assistance Program (SNAP) data from the U.S. Census, and school Free and Reduced Lunch (FRL) or Economically Disadvantaged Students (EDS) data from the North Carolina Department of Public Instruction.

For each map created in this section, we also attempted to provide an appropriate statistical analysis for change in the averages of certain variables in the county as a whole. The use of these analyses is limited, given that they only pertain to whether or not an average has changed for the entire county, and that we have found no significant change in the last 10 years. However, this is a useful point of reference, especially for Census tracts that seem to have experienced more change than others, because it could lead to research into whether concentrations of a variable have shifted between tracts.

USDA FOOD ACCESS RESEARCH ATLAS

The USDA Food Access Research Atlas (the Atlas) is a valuable resource for evaluating food deserts. The Atlas contains variables quantifying how an area might be limited in terms of healthy food access. It does this primarily with measures of supermarkets, grocery stores, and other sources of healthy and affordable food in a given area, and including economic factors that may limit access like income and vehicle/public transport availability. For a visual reference, see the **Change in Distance (½ mile) From a Grocery Store Map (F-01),** and the ½ **Mile to the Grocery Store in 2019 Map (F-02).**

We chose specifically to map one variable from this dataset, which combines both the percentage of people who live more than $\frac{1}{2}$ mile from a supermarket, and percentage of people who are low income in the tract. There is one map for how these numbers have changed from 2010 to 2019 **(F-01)**, and one for how this variable is distributed across the county in 2019 (F-02). Note that

data for these maps comes 2019, not 2020, because 2019 is the most recent available iteration of the Atlas.

Most of the tracts highlighted for higher numbers of low income/low access households in the 2019 map are rural, rather than urban, except for some tracts in what would be West Asheville, River Arts District, Woodfin, and Candler areas. This makes sense simply considering the difference between rural and urban areas, and in fact the Atlas uses a different measure for rural areas (>10 miles from a grocery store) to constitute low access. We would have mapped this as well, but the data is flagged as a binary 'yes' or 'no', rather than percentages and therefore would not be comparable to our other analyses.

The urban areas highlighted in 2019 are not the ones highlighted for greatest change in the change map. Those highlighted for having the greatest positive growth (increased number of people with low income and limited access to a supermarket) (7.5-27.6 %) tend to be south of Asheville, except for the tract in the east near Black Mountain..

We then ran a two tailed t-test and found that the average percentage of people living in low income tracts more than a half mile from a grocery store did not change significantly between 2010 and 2020 (p = 0.6836). This is likely because a significant change in these numbers would require a significant change (ie increase) in infrastructure like housing and supermarkets across the whole county.

SNAP PROGRAM

SNAP data for this analysis was acquired from the US Census American Community Survey. For this section tracts are mapped by the percent of households in each tract that are on SNAP, and how these percentages changed from 2010 to 2020. Looking at just the maps, the tracts with higher percentages of households on SNAP seem to be in the central and eastern parts of the county, around west Asheville, Sandymush, and Shiloh areas (**F-03**, **F-04**). Using R to further analyze the data, we found it to be normally distributed, and averages for each year were 9.88% in 2010 and 8.03% in 2020. However, after running a two tailed t-test, we found that the change in the county overall was not statistically significant (p = 0.1375, $\alpha = 0.05$).

It is possible that concentrations of households on SNAP could shift between tracts, and this shift would not be reflected in our t-test analysis. However, based on the data we have, the average percentage of households on SNAP in the county have not increased or decreased in the last decade. The change map (F-05) reflects this fairly clearly, though the colors may lead one to think the differences between tracts are greater than they actually are. For a visual reference, see

the following maps: Percentage of Households on SNAP 2010 (F-03), Percentage of Households on SNAP in 2020 (F-04), and the Change in Percentage of Households on SNAP 2010-2020 (F-05).

ECONOMICALLY DISADVANTAGED STUDENTS

A two tailed t-test demonstrated that the average percentage of Economically Disadvantaged Students (EDS) in a school has not changed significantly (p = 0.3393) in the county as a whole in the last decade. However, some schools did see as much as a 30% decrease in students considered 'needy' or 'disadvantaged' while others saw as much as a 15% increase. The scope of our study was not wide enough to investigate all the factors may have caused or correlated to this decrease, including whether or not free and reduced lunch eligibility requirements might have changed over the decade. It is critical to note that five schools had to be excluded from change analysis as the 2010 dataset did not include those schools.

However, we did overlay the change in EDS points with a map visualizing change in poverty in each Census tract in the county (**F-06**). Based purely on the visuals it would appear that some of the schools seeing the greatest decrease in EDS students are also in tracts seeing the greatest decreases in percentages of poverty. It is difficult to tell whether this trend is consistent across all schools and tracts without further analysis. For a visual reference, see the **Change in Percent EDS in Each School Over Percent Change in Poverty (F-06)**.

SOURCES

DEMOGRAPHICS

US Census Bureau Decennial Census, 2010 & 2020, P1: Race, Accessed at: https://data.census.gov/table?q=P1&g=050XX00US37021\$1400000&tid=DECENNIALPL2020. P1

US Census Bureau Decennial Census, 2010 & 2020, P2: Hispanic or Latino, and Not Hispanic or Latino by Race, Accessed at:

https://data.census.gov/table?q=P2&g=050XX00US37021\$1400000&tid=DECENNIALPL2020. P2

US Census Bureau American Community Survey, 2010 & 2020, S1901: Income in the Past 12 Months, Accessed at:

https://data.census.gov/table?q=S1901&g=050XX00US37021\$1400000&tid=ACSST5Y2021.S1 901

US Census Bureau American Community Survey, 2012 & 2020, S1701: Poverty Status in the Past 12 Months, Accessed at:

https://data.census.gov/table?q=S1701&g=050XX00US37021\$1400000&tid=ACSST5Y2021.S1 701

US Census Bureau American Community Survey, 2010 & 2020, S1101: Households and Families, Accessed at:

https://data.census.gov/table?q=S1101&g=050XX00US37021\$1400000&tid=ACSST5Y2021.S1 101

HOUSING

US Census Bureau Decennial Census, 2000, H021: Tenure by Age of Householder by Occupants per Room, Accessed at:

https://data.census.gov/table?q=Occupancy+Characteristics+age&g=050XX00US37021&y=200 0

US Census Bureau American Community Survey, 2010, B25015: Tenure by Age of Householder by Occupants per Room, Accessed at:

https://data.census.gov/table?q=Occupancy+Characteristics+age&g=050XX00US37021&y=201 0&tid=ACSDT5Y2010.B25015

US Census Bureau American Community Survey, 2020, B25015: Tenure by Age of Householder by Occupants per Room, Accessed at:

https://data.census.gov/table?q=Occupancy+Characteristics+age&g=050XX00US37021&y=202 0&tid=ACSDT5Y2020.B25015

US Census Bureau Decennial Census, 2000, DP4: Profile of Selected Housing Characteristics: 2000, Accessed at:

https://data.census.gov/table?q=Selected+housing+characteristics&g=050XX00US37021&y=20 00

US Census Bureau American Community Survey, 2010, DP04: Selected Housing Characteristics, Accessed at:

https://data.census.gov/table?q=Selected+housing+characteristics&g=050XX00US37021&y=20 10&tid=ACSDP1Y2010.DP04

US Census Bureau American Community Survey, 2020, DP04: Selected Housing Characteristics, Accessed at: <u>https://data.census.gov/table?q=Selected+housing+characteristics&g=050XX00US37021&y=20</u> 20&tid=ACSDP5Y2020.DP04

EDUCATION

Buncombe County School District Boundaries, Buncombe County. September 24, 2019. https://data.buncombecounty.org/datasets/buncombe-county-school-district-boundaries/explore?l ocation=35.617194%2C-82.532900%2C10.78. (Accessed April 1, 2023)

Buncombe County Schools, Buncombe County. September 24, 2019. https://data.buncombecounty.org/datasets/buncombe-county-schools/explore?location=35.61854 4%2C-82.525400%2C11.25. (Accessed April 1, 2023)

CDC/ATSDR Social Vulnerability Index, CDC. November 16, 2022. https://www.atsdr.cdc.gov/placeandhealth/svi/index.html. (Accessed April 1, 2023)

Educational Attainment, Census. July 4, 2022. https://www.census.gov/topics/education/educational-attainment.html. (Accessed April 1, 2023) *School Enrollment*, American Community Survey, 2021. https://data.census.gov/table?q=United+States+education+environment&g=010XX00US. (Accessed April, 1, 2023)

LAND USE

Data | *multi-resolution land characteristics* (*Mrlc*) *consortium*. 2001. https://www.mrlc.gov/data?f%5B0%5D=category%3ALand%20Cover (Accessed, Feb 20, 2023)

Data | *multi-resolution land characteristics* (*Mrlc*) *consortium*. 2019. https://www.mrlc.gov/data?f%5B0%5D=category%3ALand%20Cover (Accessed, Feb 20, 2023)

ENVIRONMENTAL QUALITY

12-Digit HUC Subwatersheds, NC Dept. of Environmental Quality Online GIS. February 11, 2022.

https://data-ncdenr.opendata.arcgis.com/datasets/ncdenr::12-digit-huc-subwatersheds/explore (Accessed March 16, 2023)

2014 IR Overall Cat., NC Dept. of Environmental Quality Online GIS. October 26, 2021. https://data-ncdenr.opendata.arcgis.com/datasets/ncdenr::2014-ir-overall-cat-/explore (Accessed April 18, 2023)

2018 Integrated Report Overall Category, NC Dept. of Environmental Quality Online GIS. October 14, 2022. https://data-ncdenr.opendata.arcgis.com/datasets/ncdenr::2018-integrated-report-overall-category /explore?location=35.148852%2C-79.899903%2C7.87&showTable=true (Accessed April 18, 2023)

NLCD Land Cover (CONUS) All Years, National Land Cover Database. 2019. https://www.mrlc.gov/data?f%5B0%5D=year%3A2019 (Accessed March 2023)
HEALTH AND WELLNESS

Centers for Disease Control and Prevention/ Agency for Toxic Substances and Disease Registry/ Geospatial Research, Analysis, and Services Program. CDC/ATSDR Social Vulnerability Index 2000 Database North Carolina.

https://www.atsdr.cdc.gov/placeandhealth/svi/data_documentation_download.html. (Accessed on April 21, 2023)

Centers for Disease Control and Prevention/ Agency for Toxic Substances and Disease Registry/ Geospatial Research, Analysis, and Services Program. CDC/ATSDR Social Vulnerability Index 2010 Database North Carolina.

https://www.atsdr.cdc.gov/placeandhealth/svi/data_documentation_download.html. (Accessed on April 21, 2023)

Centers for Disease Control and Prevention/ Agency for Toxic Substances and Disease Registry/ Geospatial Research, Analysis, and Services Program. CDC/ATSDR Social Vulnerability Index 2020 Database North Carolina.

https://www.atsdr.cdc.gov/placeandhealth/svi/data_documentation_download.html. (Accessed on April 21, 2023)

PLACES. Centers for Disease Control and Prevention. https://www.cdc.gov/places. (Accessed on April 21, 2023)

FOOD SECURITY

Food Access Research Atlas, USDA. December 15, 2022. https://www.ers.usda.gov/data-products/food-access-research-atlas/. (Accessed April 1, 2023)

Supplemental Nutrition Assistance Program (SNAP) Eligibility & Access, Census. January 17, 2023. https://www.census.gov/library/visualizations/interactive/snap-eligibility-access.html. (Accessed April 1, 2023)

Buncombe County Schools, Buncombe County. September 24, 2019. https://data.buncombecounty.org/datasets/buncombe-county-schools/explore?location=35.61854 4%2C-82.525400%2C11.25. (Accessed April 1, 2023)

CDC/ATSDR Social Vulnerability Index, CDC. November 16, 2022. https://www.atsdr.cdc.gov/placeandhealth/svi/index.html. (Accessed April 1, 2023) 2019-2020 Economically Disadvantaged Student Data, North Carolina Department of Public Instruction.

https://www.dpi.nc.gov/districts-schools/district-operations/school-nutrition/sn-data-reports#Eco nomicallyDisadvantagedStudentDataEDS-3178. (Accessed April 1, 2023)

2010-11 Free-Reduced 09-20, North Carolina Department of Public Instruction. https://www.dpi.nc.gov/districts-schools/district-operations/school-nutrition/sn-data-reports#Eco nomicallyDisadvantagedStudentDataEDS-3178. (Accessed April 1, 2023)

MAPS

DEMOGRAPHICS

D-01 Total Population Map
D-02 Population Change Map, 2010 & 2020
D-03 African American Population Map
D-04 Hispanic/Latinx Population Map
D-05 Change in African American Population Map, 2010 & 2020
D-06 Change in Hispanic/Latinx Population Map, 2010 & 2020
D-07 Median Income by Tract Map
D-08 Percent Below Poverty Map
D-09 Change in Percent Below Poverty Map, 2012 & 2020

HOUSING

H-01 Structures Built, 1990-1999
H-02 Structures Built, 2000-2009
H-03 Structures Built, 2010-2013
H-04 Structures Built, 2014-2020
H-05 Heatmap of Residential Structures Built, 2000-2020
H-06 Heatmap of Residential Structures Built, 1990-2000
H-07 Heatmap of Residential Structures Built, 2000-2010
H-08 Heatmap of Residential Structures Built, 2010-2020
H-09 Median Housing Value, 2020
H-10 Median Rent, 2020

EDUCATION

E-01 Buncombe County Schools and DistrictsE-02 Percent Change without High School Diploma, 2010-2020E-03 Percent with High School Diploma, 2020E-04 Census Tracts with their Quartile Range, 2020

LAND USE

L-01 National Land Cover Classification, 2019 L-02 Percent Forest Change, 2001-2019 L-03 Percent Developed Land Use Change, 2001-2019

ENVIRONMENTAL QUALITY

WQ-01 Water Quality and Percent Forest Cover by 12-Digit HUC Subwatershed, 2014 WQ-02 Water Quality and Percent Forest Cover by 12-Digit HUC Subwatershed, 2018 WQ-03 Change in Water Quality by 12-Digit HUC Subwatershed, 2014-2018

HEALTH AND WELLNESS

HE-01 Social Vulnerability by Census Tract, 2020
HE-02 Social Vulnerability by Census Tract, 2010
HE-03 Social Vulnerability by Census Tract, 2000
HE-04 Uninsured by Census Tract, 2020
HE-05 Crude Prevalence of Asthma Among Adults 18 Years and Older, 2020
HE-06 Crude Prevalence of Cancer Among Adults 18 Years and Older, 2020

FOOD SECURITY

F-01 Change in Distance (Half-mile) from Grocery Store
F-02 Low-income Population at ¹/₂ Mile or More from Grocery Store, 2019
F-03 Percentage of Households on SNAP, 2010
F-04 Percentage of Households on SNAP, 2020
F-05 Percentage Change in Households on SNAP, 2010-2020

F-06 Change in Poverty and Change in Free and Reduced Lunch, 2010-2020









Percentage of Hispanic Population











Percent of Population Below Poverty Line D-08



Change in Percent Below Poverty 2012-2020 D-09















































Social Vulnerability by Census Tract 2010

HE-02



Social Vulnerability by Census Tract 2000 **HE-03**


Uninsured by Census Tract 2020











Percentage of Household on SNAP in 2010

F-03





