

# MAPPING SOCIAL CHANGE IN U.S. COASTAL COUNTIES: A SOCIAL ATLAS OF COASTAL NORTH CAROLINA

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NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA)  
COASTAL SERVICES CENTER



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December 2008

This document represents a pilot effort to map social change in the coastal United States—a social atlas characterizing changing demographic, housing, and economic attributes. This pilot effort focuses on coastal North Carolina. The impetus for this project came from many discussions about the usefulness and need for a graphic representation of social change information for U.S. coastal regions.

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LINKING PEOPLE, INFORMATION, AND TECHNOLOGY

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and West Coast

## ABOUT THIS DOCUMENT

This document represents a pilot effort to map social change in the coastal United States—a social atlas characterizing changing population, demographic, housing, and economic attributes. This pilot effort focuses on coastal North Carolina. The impetus for this project came from numerous discussions about the usefulness and need for a graphic representation of social change information for U.S. coastal regions. Although the information presented here will be of interest to a broad segment of the coastal community and general public, the intended target audience is coastal natural resource management professionals, Sea Grant Extension staff, urban and regional land-use planners, environmental educators, and other allied constituents interested in the social aspects of how the nation's coasts are changing.

This document has three sections. The first section provides background information about the project. The second section features descriptions of social indicators and depictions of social indicator data for 1970, 1980, 1990, and 2000, and changes from 1970 to 2000 for all North Carolina coastal counties. The third section contains three case studies describing changes in select social attributes for subsets of counties.

## ACKNOWLEDGEMENTS

This project was a collaborative effort undertaken by the National Oceanic and Atmospheric Administration's (NOAA) Coastal Services Center and the North Carolina Sea Grant Extension Program, with thoughtful input from local, county, and state government officials from North Carolina's coast.

All data collected from U.S. Census of Population and Housing.

An electronic version of this document is available at:  
[csc.noaa.gov/publications/Mapping\\_Social\\_Change.pdf](http://csc.noaa.gov/publications/Mapping_Social_Change.pdf)

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## INTRODUCTION

Coastal areas across the United States are changing, both in terms of their biophysical landscape features and natural resources, and in terms of their social and cultural characteristics. Yet changes occurring along the coast are not homogeneous. The people who live and work in coastal communities are working to adapt and survive amidst such changes. At national, regional, state, and local levels, policy makers and natural resource management agencies are challenged with developing programs, regulations, and incentives to optimize the coast's human, economic, and environmental well-being. To accomplish these tasks, decision-makers need information about past and current conditions to assess implications of change on future conditions. This document examines social change in North Carolina coastal counties across time and space in an effort to characterize and graphically depict past and present conditions and changes that have occurred over the past 30 years.

In recent decades, many U.S. coastal counties have experienced population growth at rates up to three times the national average (Clark 1996) and population densities more than four times the national average (Hinrichsen 1998). Many other counties have experienced continuous outmigration and associated loss of labor and traditional resource-dependent industries, such as small-scale agriculture, forestry, and commercial fishing. Landscape change along the coast can also be attributed to migration within the coastal zone and increased conversion of open space in the absence of

high rates of population growth (for example, associated with recreation and tourism development). The complexion of change at the coast is varied, but often results in a loss of social capital and original community character, irreversible transformation of natural landscapes, and displacement of long-term residents, businesses, and other groups.

Changes in societal demands at the regional or national level are strong drivers of change to local economies, which, in turn, drive changes in smaller communities. For example, as a large segment of the national population moves toward retirement age, an increased demand exists for development of retirement and seasonal homes by nonresident landowners in choice settings around the country. In coastal areas, natural amenities, such as beaches, seascapes, and mild winter temperatures, attract nonresidents from many northern urban centers. Increased development of seasonal homes in historically small tourist or fishing communities and rural areas leads to changes in population distribution, composition, and density, housing availability and affordability, municipal expenditures, traffic, and demand for public participation in local decision-making. These changes present challenges for local governments, service providers, resource managers, and long-term residents (both permanent and seasonal).

## SOCIAL ATLAS

Recognition of change is often based on personal observations and anecdotal evidence; however, the change that occurs over time can be difficult to visualize

on a day to day basis. Much of what occurs around us every day is recorded in one fashion or another, yet comprehensive accounts of changing social conditions are often not conducted nor deemed warranted until prescribed by law (for example, National Environmental Policy Act) pursuant to federal or state management actions or public policy changes. Extensive quantitative evidence of social change is available in many forms, including the U.S. Census of Population and Housing, National Social Survey, and remotely sensed imagery depicting physical attributes on the ground. However, much of the information necessary to assess social change is spatially and temporally fragmentary and disparate in content and format; a thoughtful collection of attribute data, useful for depicting changes to the social environment and quality of life, is typically not readily available. Also, while much data is available in tabular form, few projects have assembled data to create graphic depictions of static present or past conditions. Fewer have compared conditions over time to represent changes and trends or identify unique patterns of change.

One useful method to help visualize the change occurring along our nation's coasts is to depict changes in various social attributes in a social atlas. This approach uses a geographic information system (GIS) to compile, analyze, and illustrate past and present social conditions and associated patterns of change. This format allows decision makers to visualize information for specific geographic areas (for example, counties, watersheds), identify specific community needs and issues, and uncover patterns of change across geographies to help

inform planning and program development to meet the needs of the changing social complexion. As more agencies operate under a system of ecosystem-based and ecoregional management, it is important that the social aspects of the human presence and use of coastal resources be represented.

Presentation of social change across coastal counties can confirm or dispel perceptions of change. Displaying data graphically enables decision makers to better discern changes in individual social indicators, visualize connections between multiple indicators, compare across time and space, and begin to establish communication networks for the exchange of information and expertise. This graphical component provides valuable information to inform management and planning decisions, outreach and education programming, and targeted delivery of technical assistance to meet constituents' needs.

## **SOCIAL INDICATORS**

This document uses social indicators to represent changes in key social attributes in coastal counties over time. Social indicators are typically statistics collected over time for a particular geographic area to help inform policy and management decision making. The social indicators included in this pilot effort are aligned with components of the Human Ecosystem Framework (Machlis, Force, and Dalton 1994; Machlis, Force, and Burch 1997). The human ecosystem framework represents a holistic ecosystem-based management framework in which people and resources (both biophysical and sociocultural) are contained within a

given spatial or temporal extent. The selected indicators used here represent examples of the “critical resources” included in the human ecosystem framework (Figure 1) to demonstrate how changes in the human ecosystem can be explained by monitoring key indicators over time.

*“Social indicators can be effective in presenting the ‘basic facts’ about the people of a region. Such basic facts are important to ecosystem management, and can be used in many ways: assessing the potential impact of government policies, developing effective resource management plans, increasing public involvement in the planning process, and so forth. Like measures of water quality, wildlife populations, or timber supply, social indicators provide managers and citizens with information needed to make sound decisions concerning public resources.”*  
(Machlis, Force, and McKendry 1995, page 2)

## METHODS

For this project, a GIS was created for the 20 North Carolina coastal counties that are under the jurisdiction of the North Carolina Coastal Area Management Act (CAMA) of 1974 (Figure 2). Data are presented for the 20 CAMA counties for each decadal census (1970, 1980, 1990, and 2000) as well as changes from 1970 to 2000. Three case studies illustrating changes in select social indicators are also included with subsets of counties comprising three virtual regions.

The GIS was constructed using Environmental Systems Research Institute’s (ESRI) ArcView and ArcGIS. Data for the GIS comprised data compiled chiefly from the U.S. Census of Population and Housing from 1970, 1980, 1990, and 2000. Additional data were compiled from the NOAA Coastal Change Analysis Program.

The majority of data in this document were depicted using choropleth maps with varying shade densities representing different value ranges (for example, low=light, high=dark), as indicated in the legends. Maps of static data for 1970, 1980, 1990, and 2000 have standardized legends containing the complete range of values across the 30 years. Legends for change maps show percent change from 1970 to 2000.



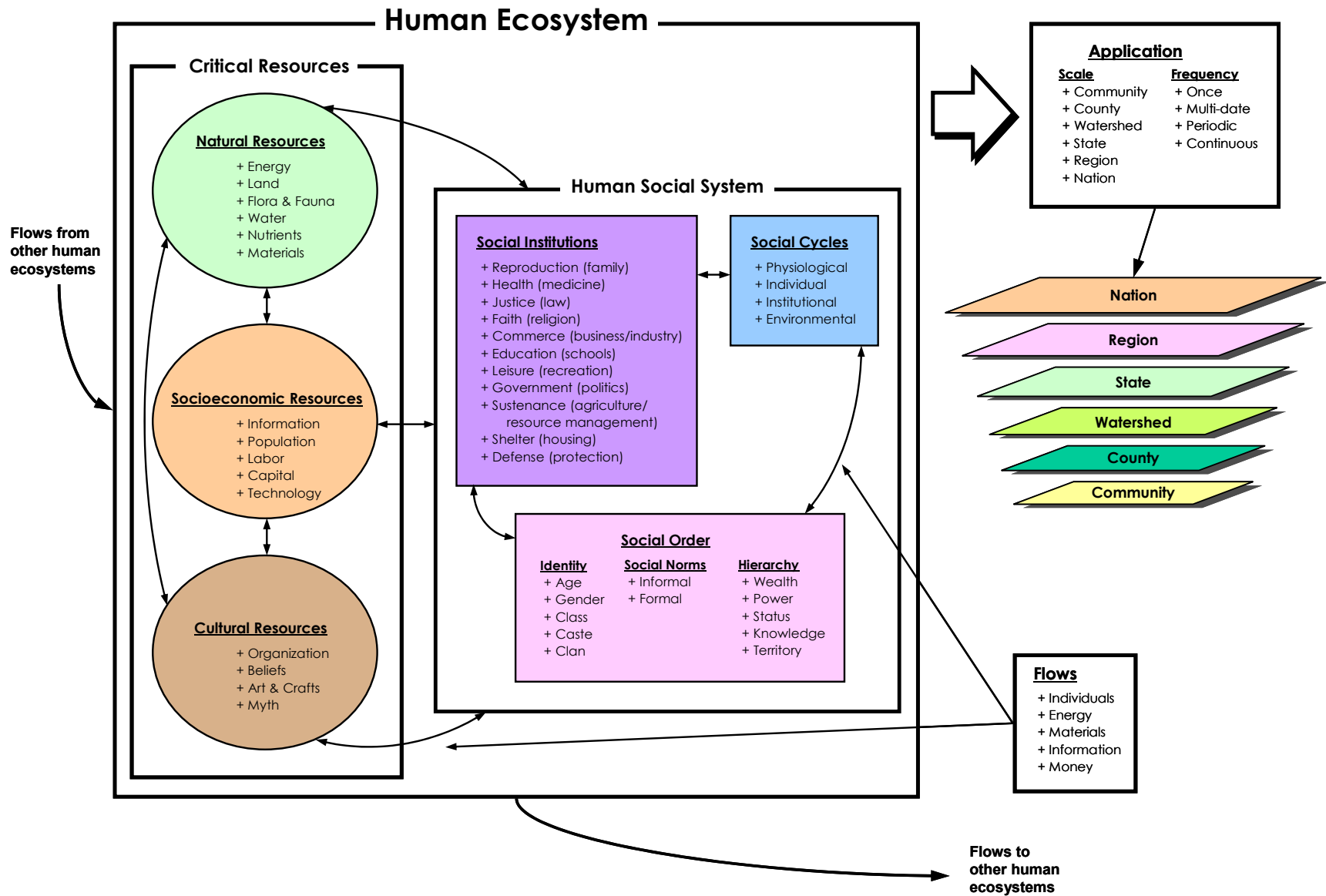


Figure 1. Human ecosystem framework (adapted from Machlis, Force, and Dalton 1994).

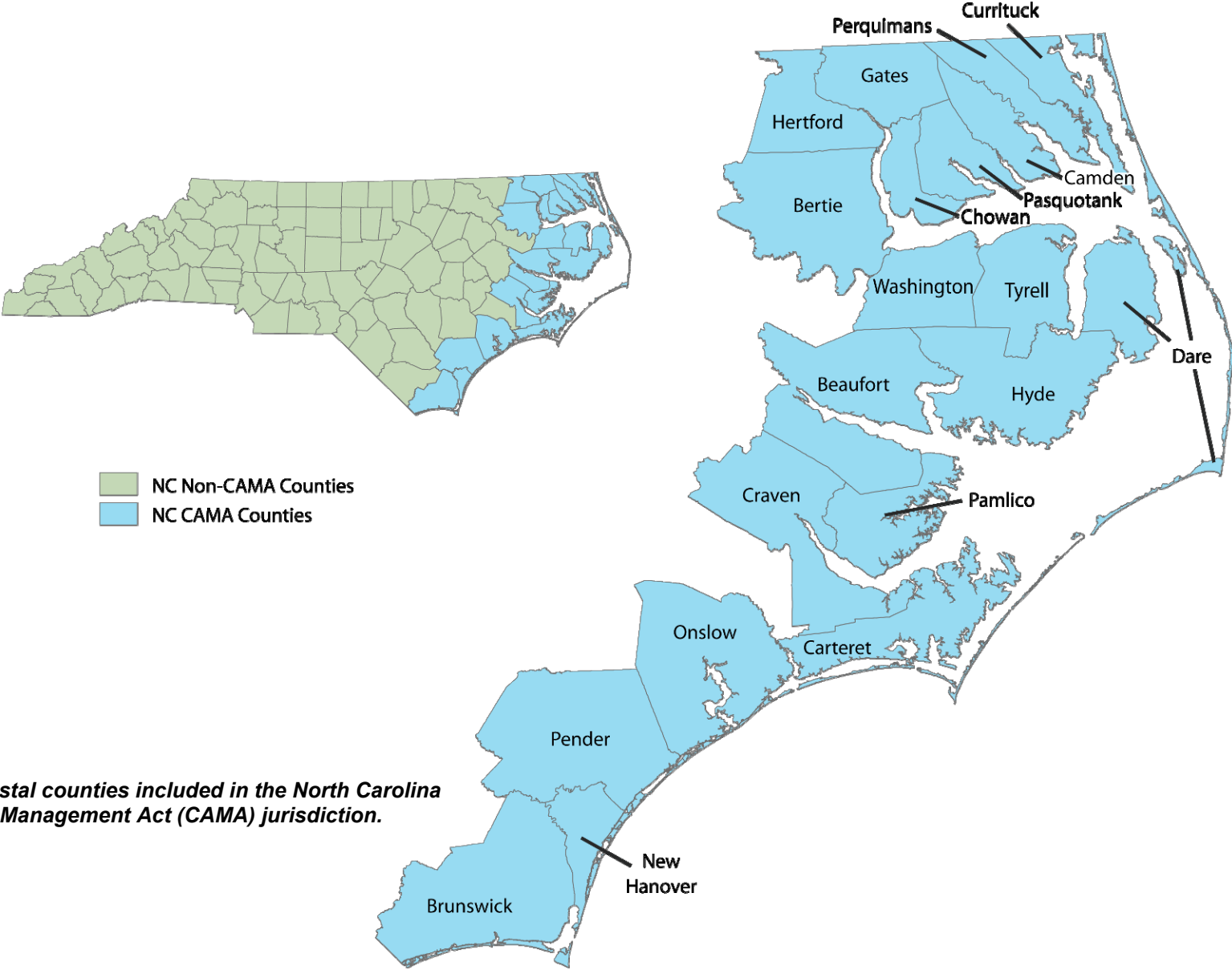


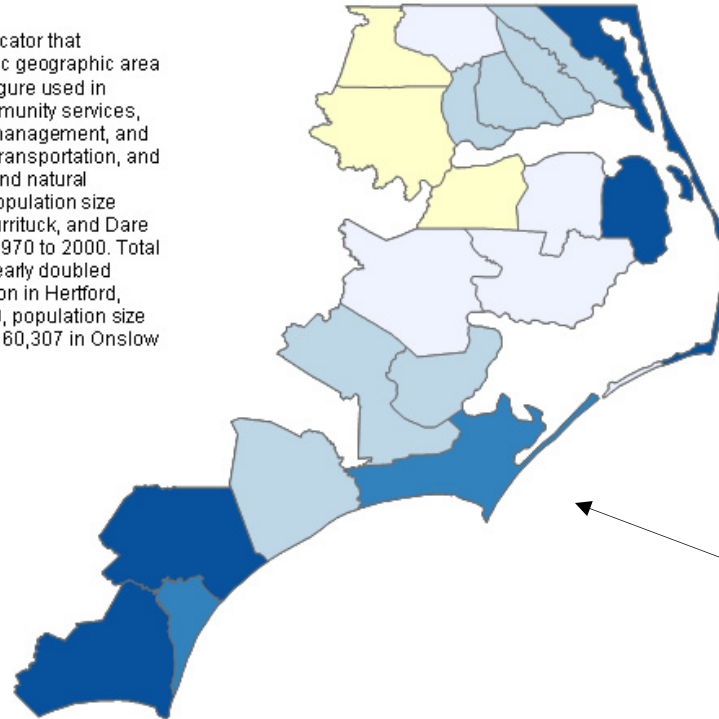
Figure 2. Coastal counties included in the North Carolina Coastal Area Management Act (CAMA) jurisdiction.

SOCIAL INDICATORS

NOAA Coastal Services Center

**Total Population**

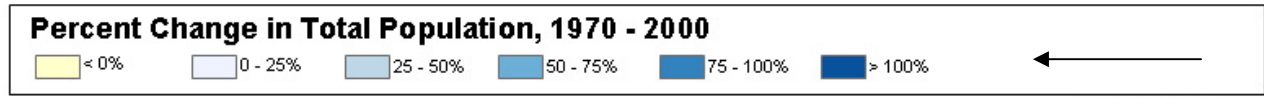
Total population is an important and widely used indicator that represents the total number of individuals in a specific geographic area (for example, county). Total population is the basic figure used in assessments of population density, planning for community services, such as schools, law enforcement, and emergency management, and public infrastructure for electricity, sewer and water, transportation, and communications. Demands for goods and services and natural resources (for example, land) increase as resident population size increases. Total population in Brunswick, Pender, Currituck, and Dare Counties increased by more than 120 percent from 1970 to 2000. Total population in Carteret and New Hanover Counties nearly doubled during the same time period. However, total population in Hertford, Bertie, and Washington Counties decreased. In 2000, population size ranged from 4,149 in Tyrrell County to 150,355 and 160,307 in Onslow and New Hanover Counties, respectively.



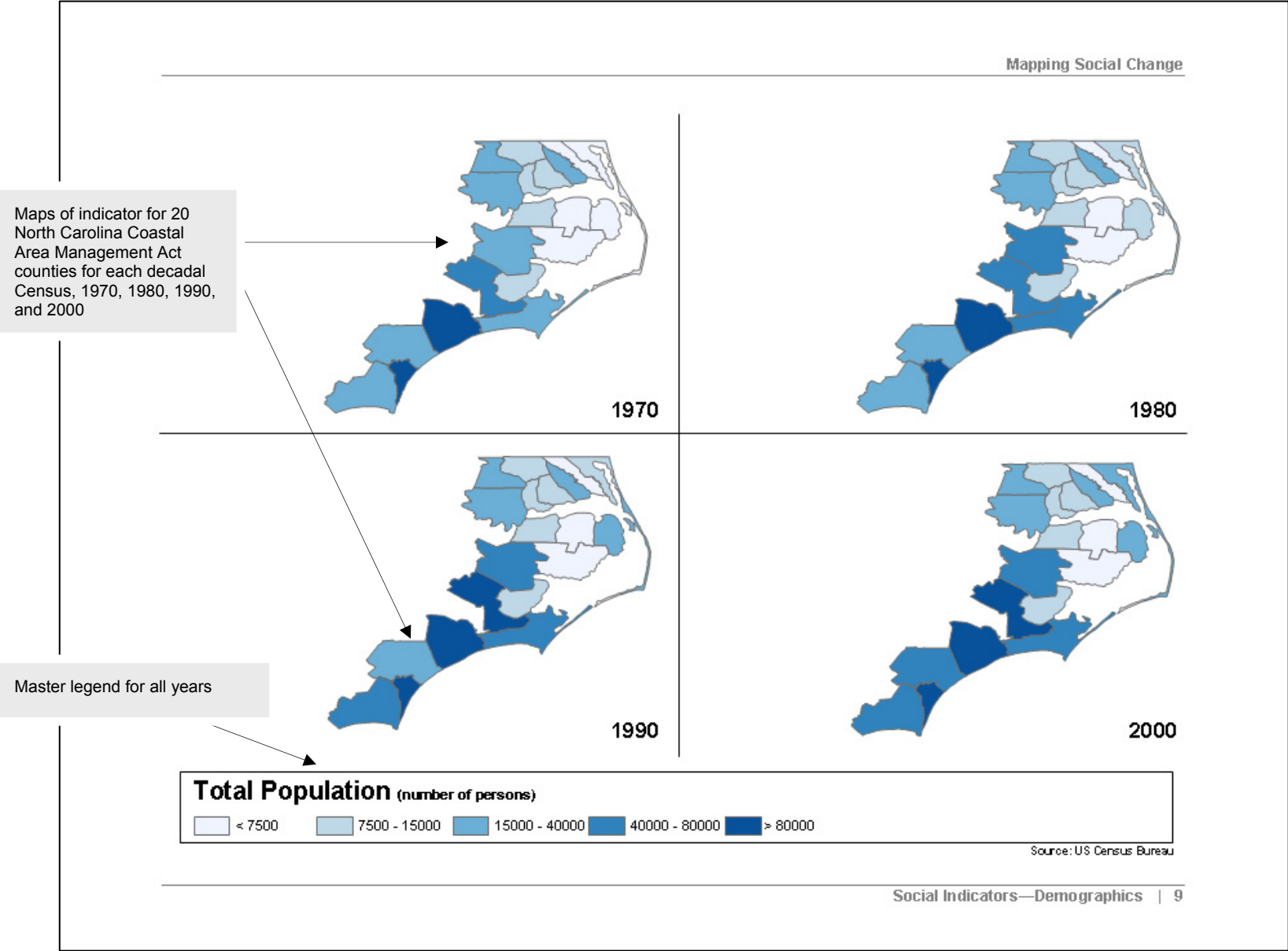
Social indicator description

Legend for changes 1970 to 2000

Map of indicator for 20 North Carolina Coastal Area Management Act counties for change from 1970 to 2000

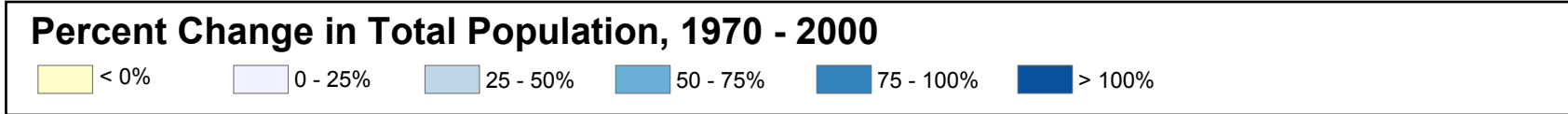
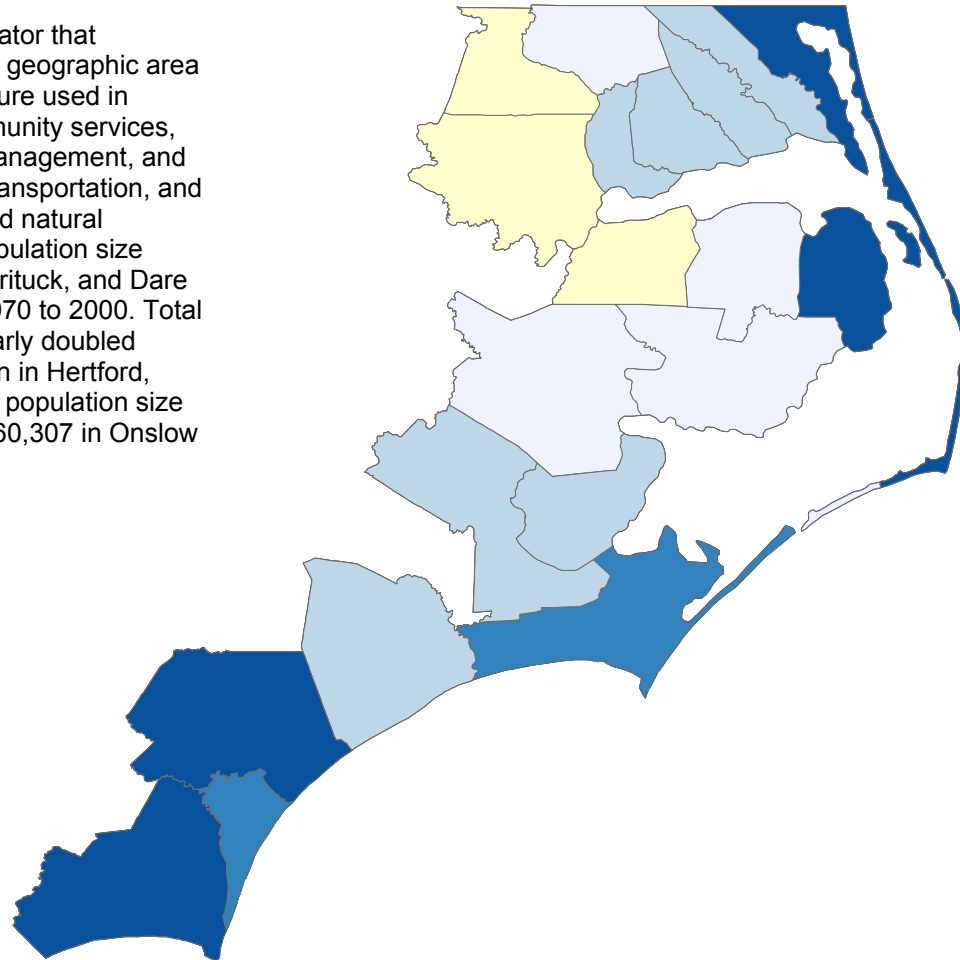


Source: US Census Bureau

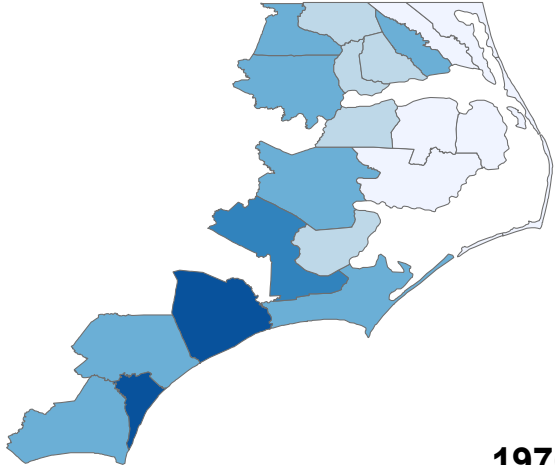


## Total Population

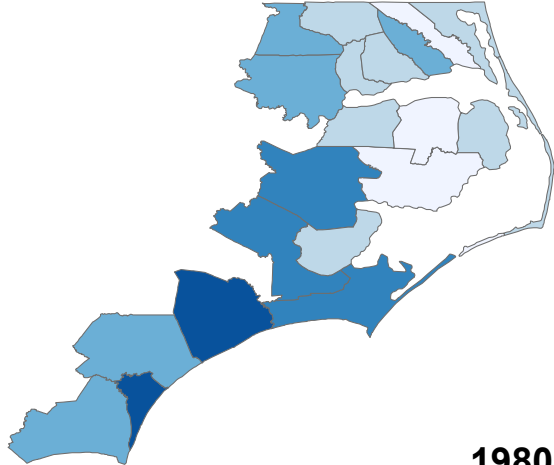
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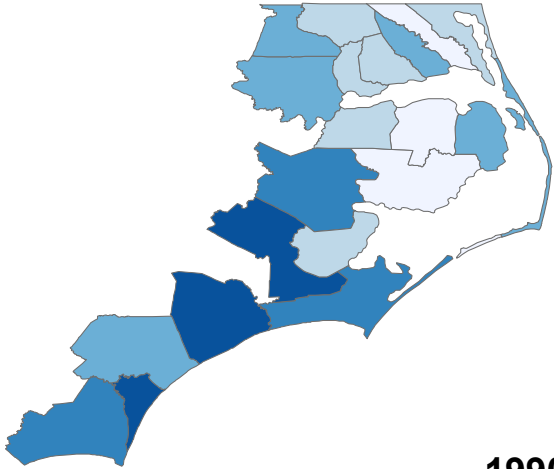
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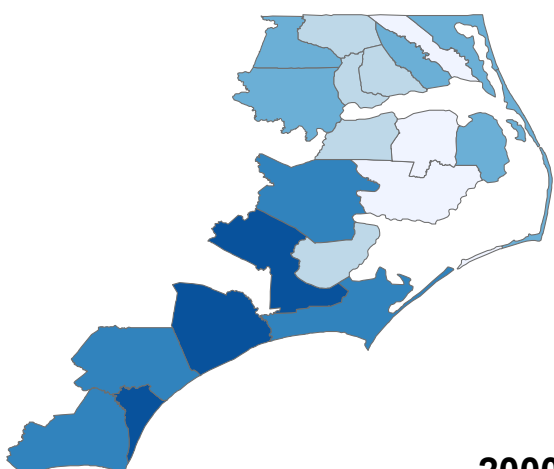
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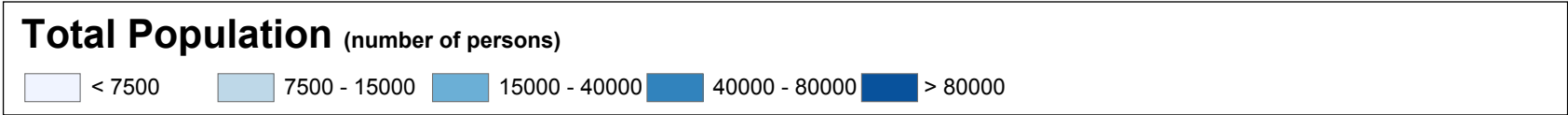
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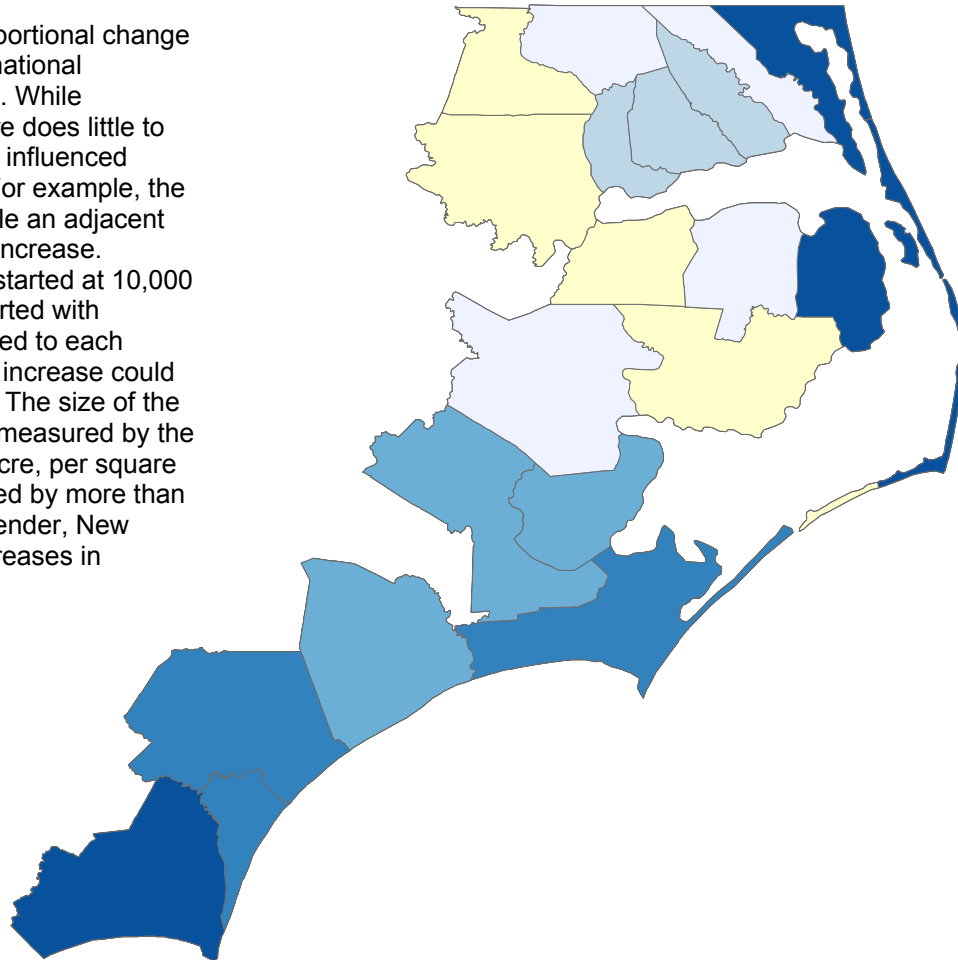
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Source: US Census Bureau

## Population Density

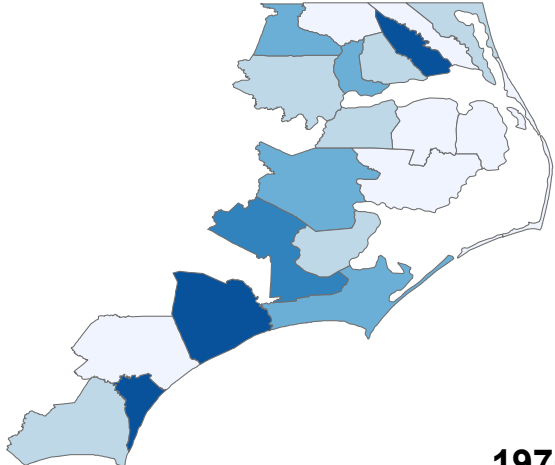
Population change measured over time can show proportional change to total population for a given area. For example, the national population growth rate for the 1990s was 13.4 percent. While informative of overall total population growth, this figure does little to explain how this increase in individuals has potentially influenced specific geographic areas, such as coastal counties. For example, the population of one county has doubled in ten years while an adjacent county has experienced only a 10 percent population increase. However, if the population of the county that doubled started at 10,000 individuals and the county that grew by 10 percent started with 100,000 individuals, the net number of individuals added to each county roll is the same. However the effect of such an increase could be quite different depending on the size of the county. The size of the county affects both the real and perceived change as measured by the density of individuals per unit area (for example, per acre, per square mile). The population density for Dare County increased by more than 300 percent from 1970 to 2000. Currituck, Carteret, Pender, New Hanover, and Brunswick Counties all experienced increases in population density between 46 and 200 percent over the same time period. Hertford, Bertie, Washington, and Hyde Counties experienced declines in population density. In 2000, population density was highest in New Hanover County, the most populous coastal county.



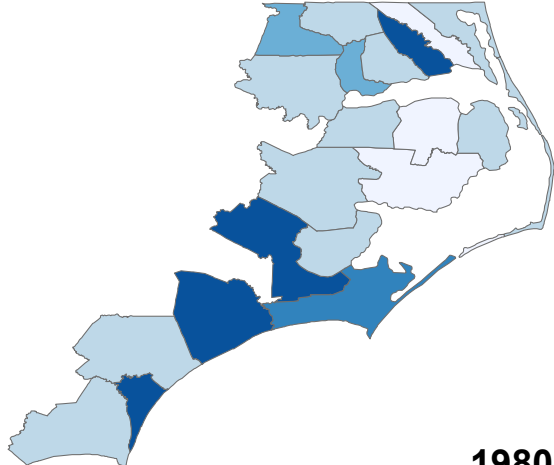
### Percent Change in the Population Density, 1970 - 2000



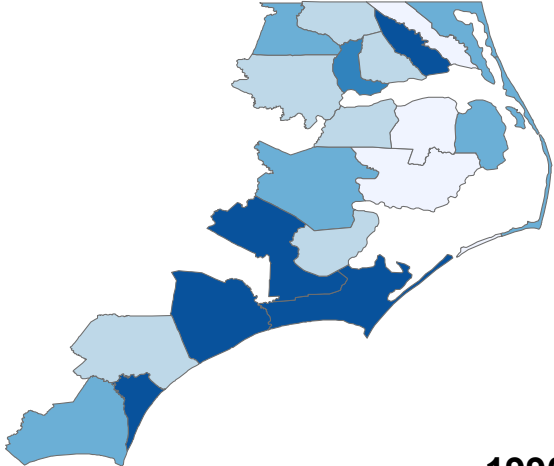
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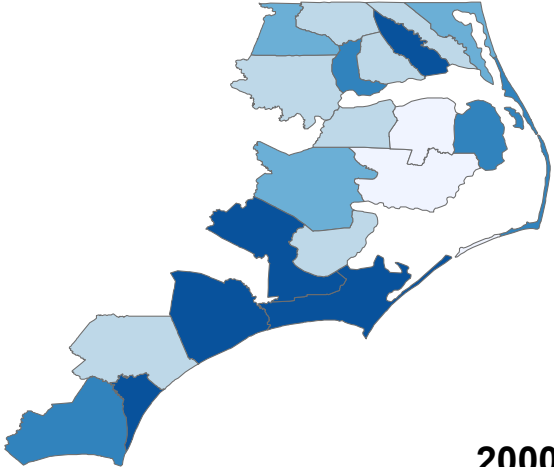
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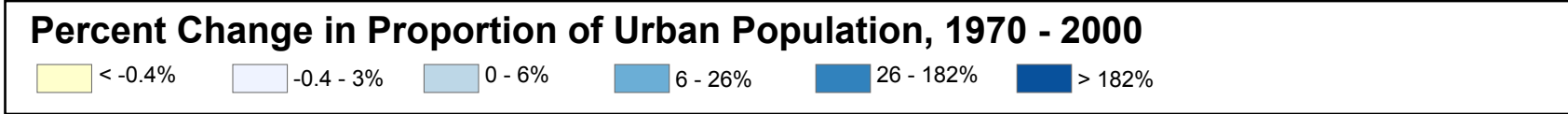
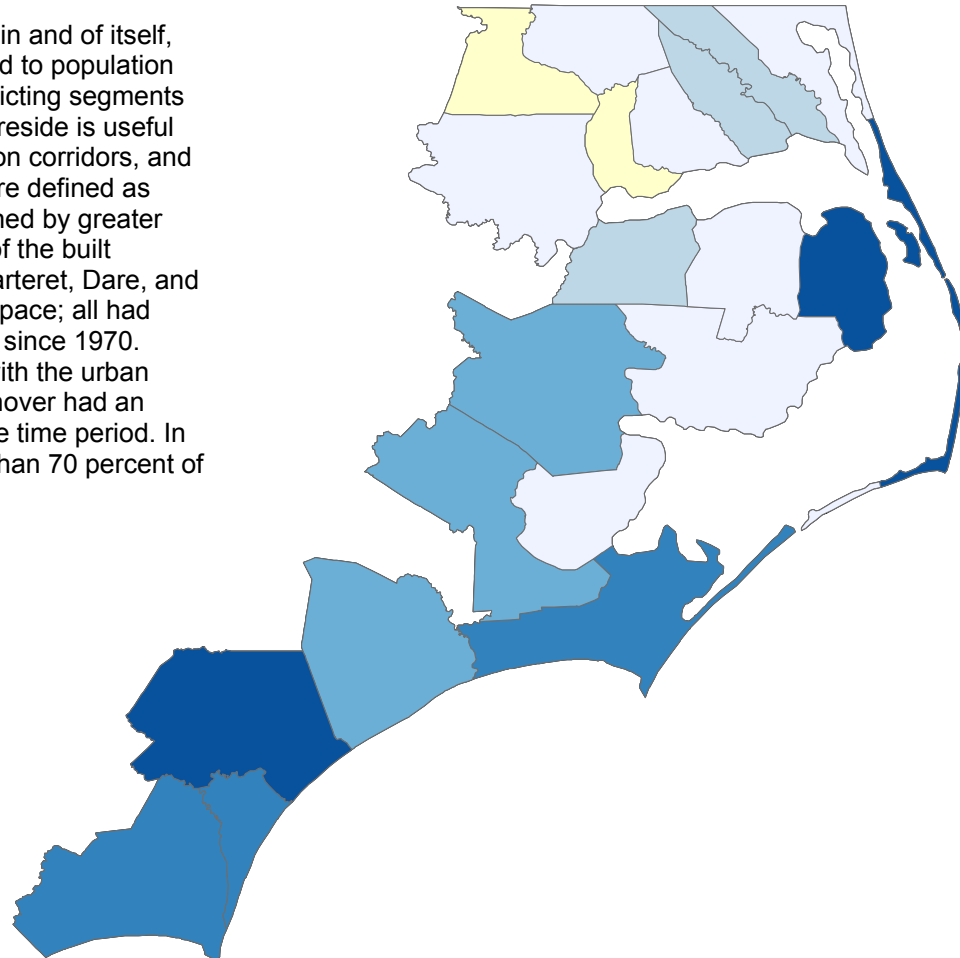


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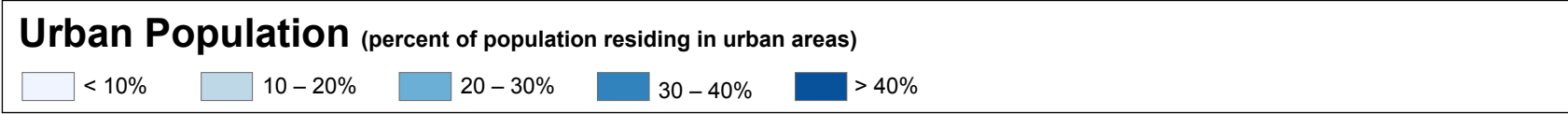
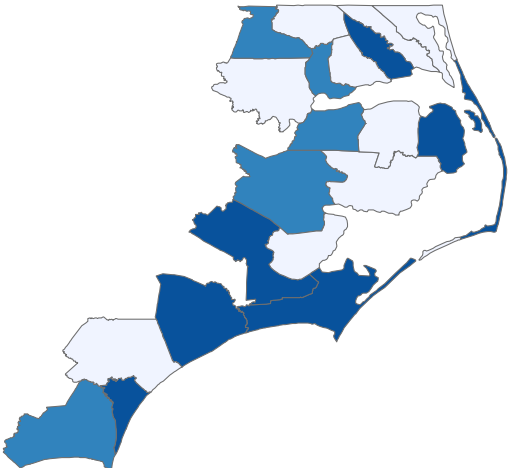
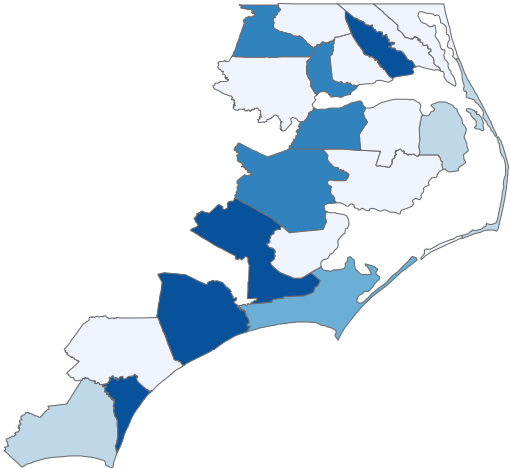
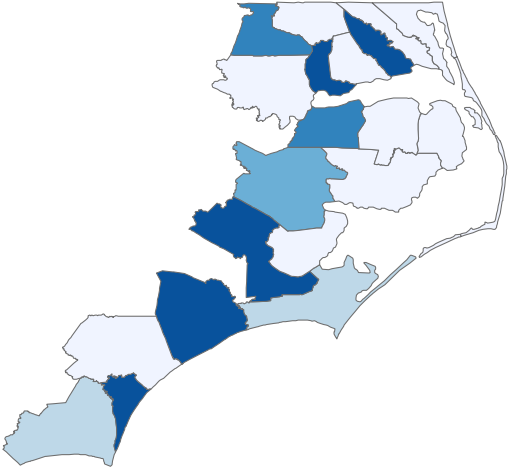
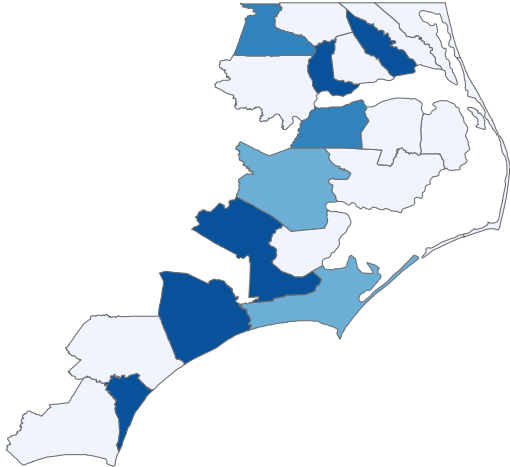


## Urban Population

While total population can be an informative measure in and of itself, measuring the distribution of the population with regard to population density and landscape features is also important. Depicting segments of the population by the types of places in which they reside is useful for understanding potential future growth, transportation corridors, and commuting distances and times. Rural communities are defined as having fewer than 2,500 people; urban areas are defined by greater population densities and having a greater proportion of the built environment. In coastal North Carolina, Brunswick, Carteret, Dare, and Pender Counties had the highest increases in urban space; all had over a hundred percent increases in urban population since 1970. Pender County observed the most dramatic change with the urban proportion changing 11,591 percent. Nearby New Hanover had an increase in urban space of 38 percent during the same time period. In 2000, New Hanover and Onslow Counties had more than 70 percent of their total population living in urban areas.



Source: US Census Bureau

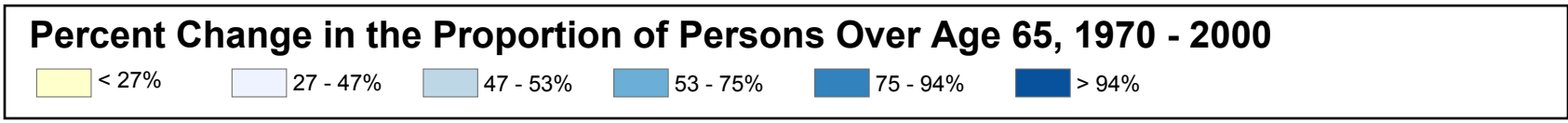
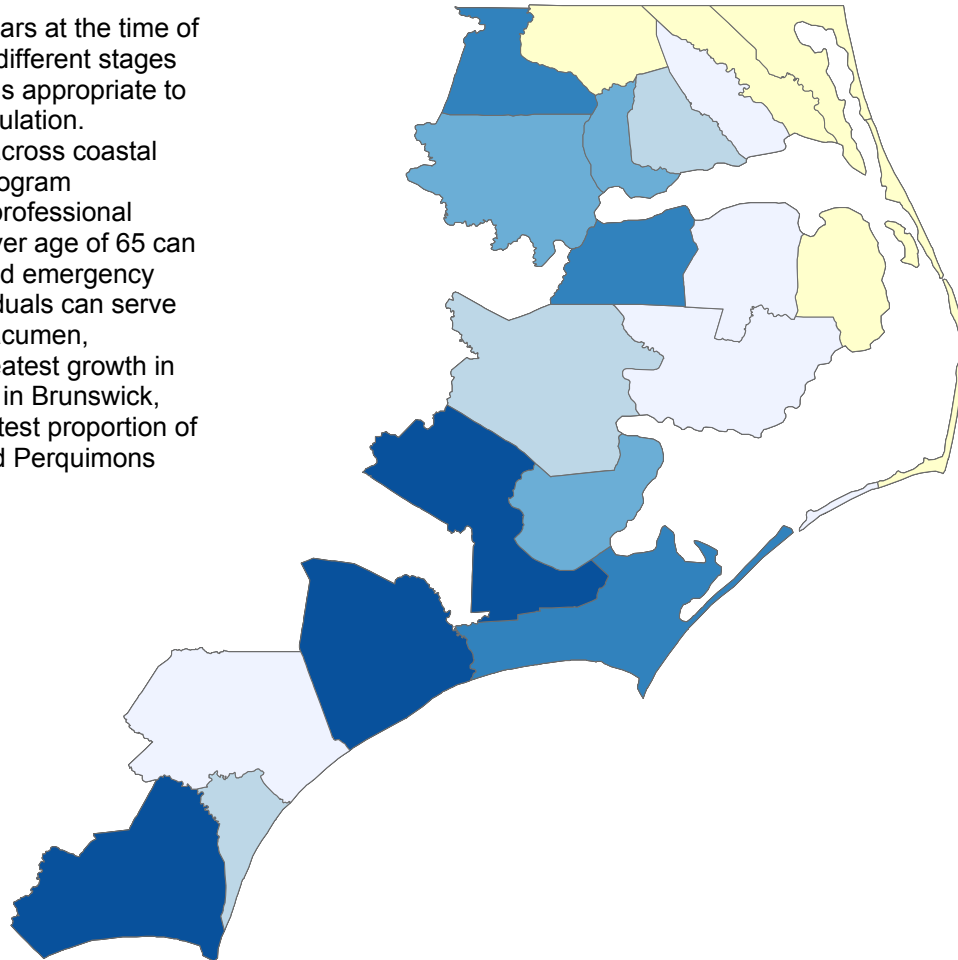


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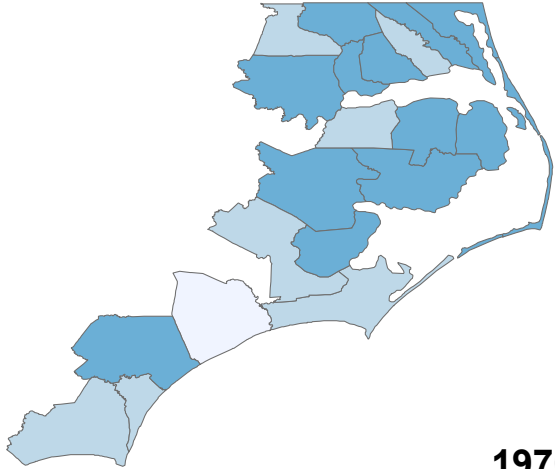
## Age

Age data reflect the ages of individuals in complete years at the time of inquiry. Measuring the proportion of the population at different stages in life can inform development of policies and programs appropriate to the needs and actions of specific segments of the population.

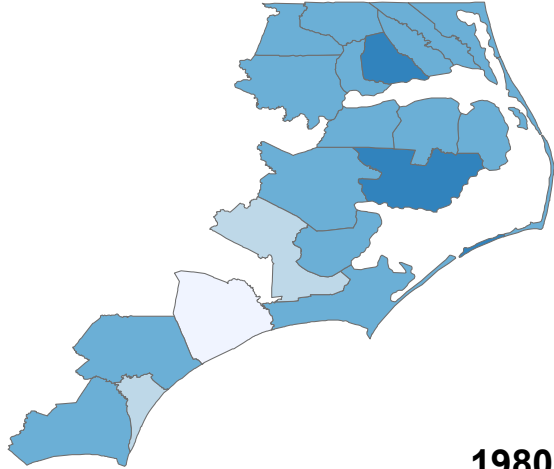
Awareness of the distribution of different age groups across coastal counties can aid decision making about community program development, allocation of resources, and sharing of professional expertise. Looking at the segment of the population over age of 65 can be useful for aspects of health care, transportation, and emergency services planning. Additionally, retirement aged individuals can serve as resources for the community in terms of business acumen, advocacy, and volunteering. In North Carolina, the greatest growth in the proportion of retirement-aged individuals occurred in Brunswick, Craven, and Onslow Counties. Counties with the greatest proportion of total population over age 65 in 2000 were Pamlico and Perquimons Counties.



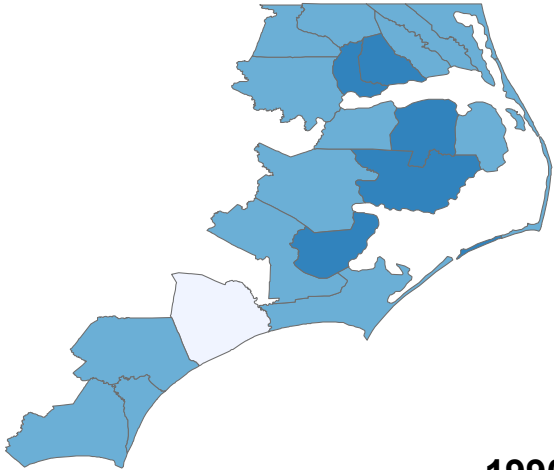
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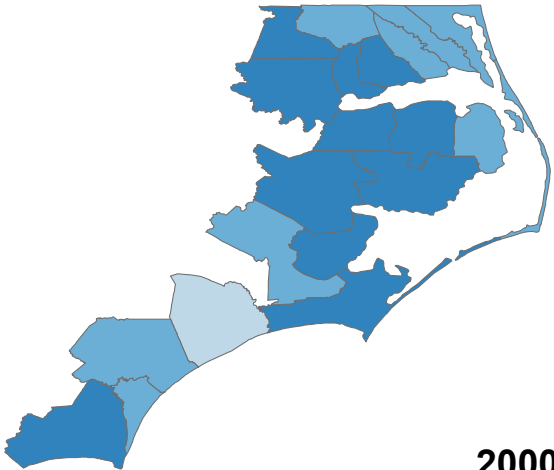
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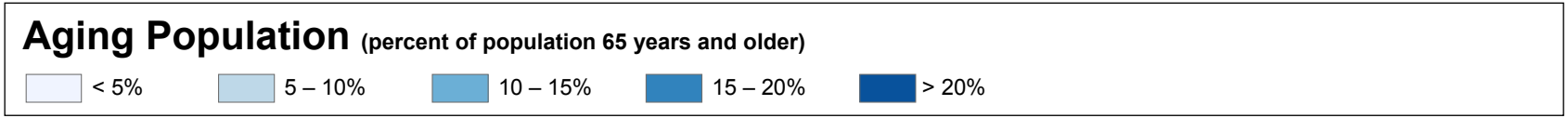
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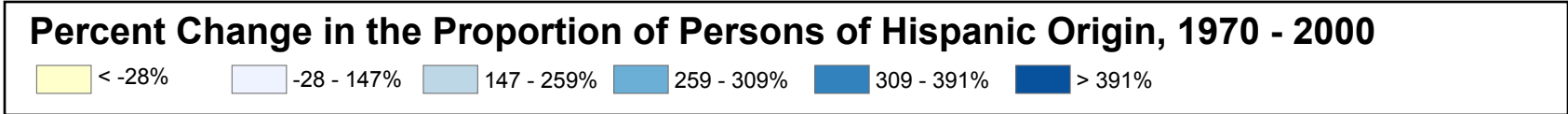
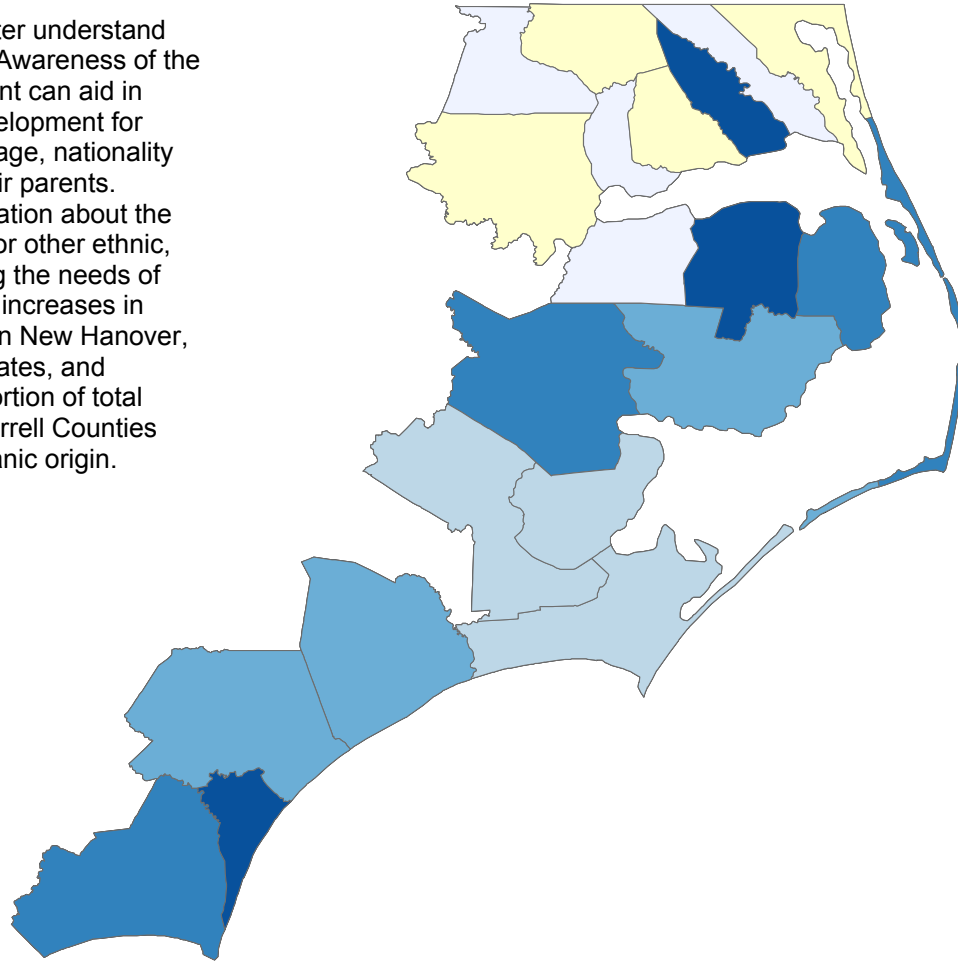
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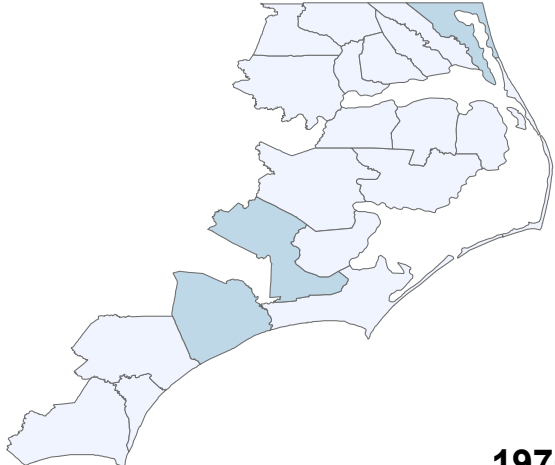
Source: US Census Bureau

## Ethnic Diversity (Hispanic Population)

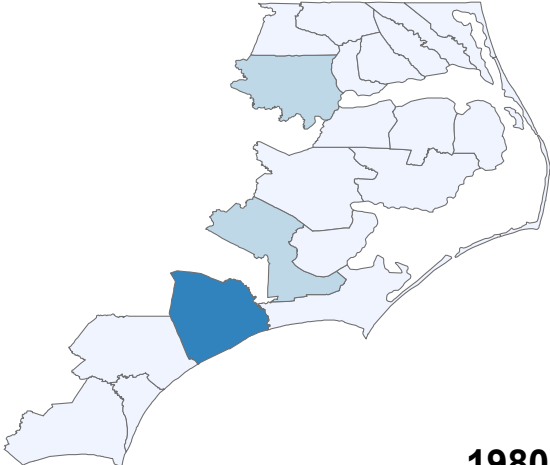
Measuring ethnic diversity is important in order to better understand perspectives of different segments of the population. Awareness of the breadth of diverse values, customs, and beliefs present can aid in decision making processes and specific program development for ethnic minorities. Hispanic origin data reflect the heritage, nationality group, lineage, or country of birth of individuals or their parents. Persons of Hispanic origin can be of any race. Information about the proportion and distribution of individuals of Hispanic, or other ethnic, origin can aid in the development of services targeting the needs of specific groups. In coastal North Carolina, the largest increases in proportion of total population of Hispanic origin were in New Hanover, Pasquotank, and Tyrell Counties. Bertie, Currituck, Gates, and Perquiman Counties showed no increase in the proportion of total population of Hispanic origin. In 2000, Onslow and Tyrrell Counties had the highest proportion of their population of Hispanic origin.



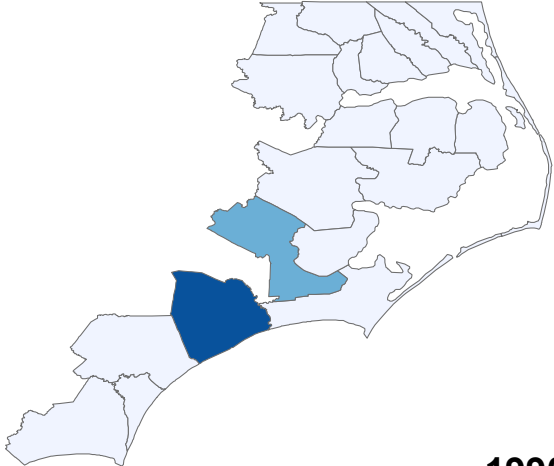
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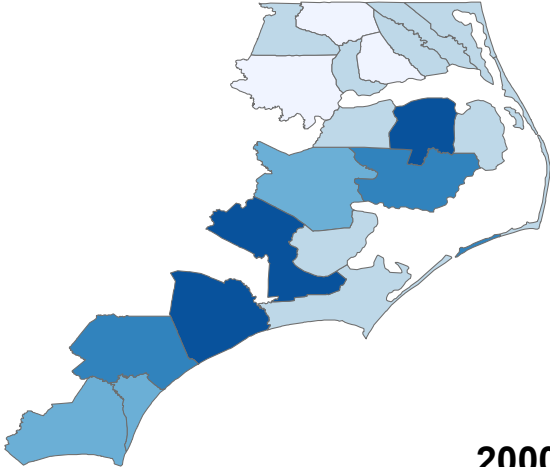
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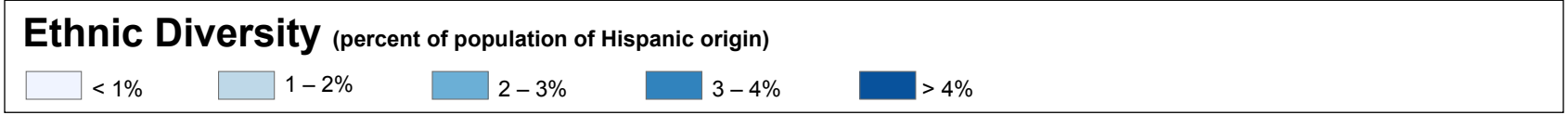
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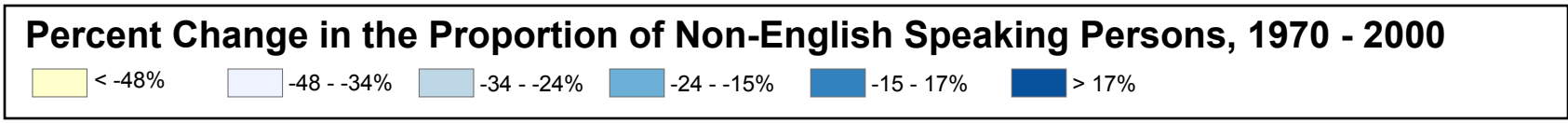
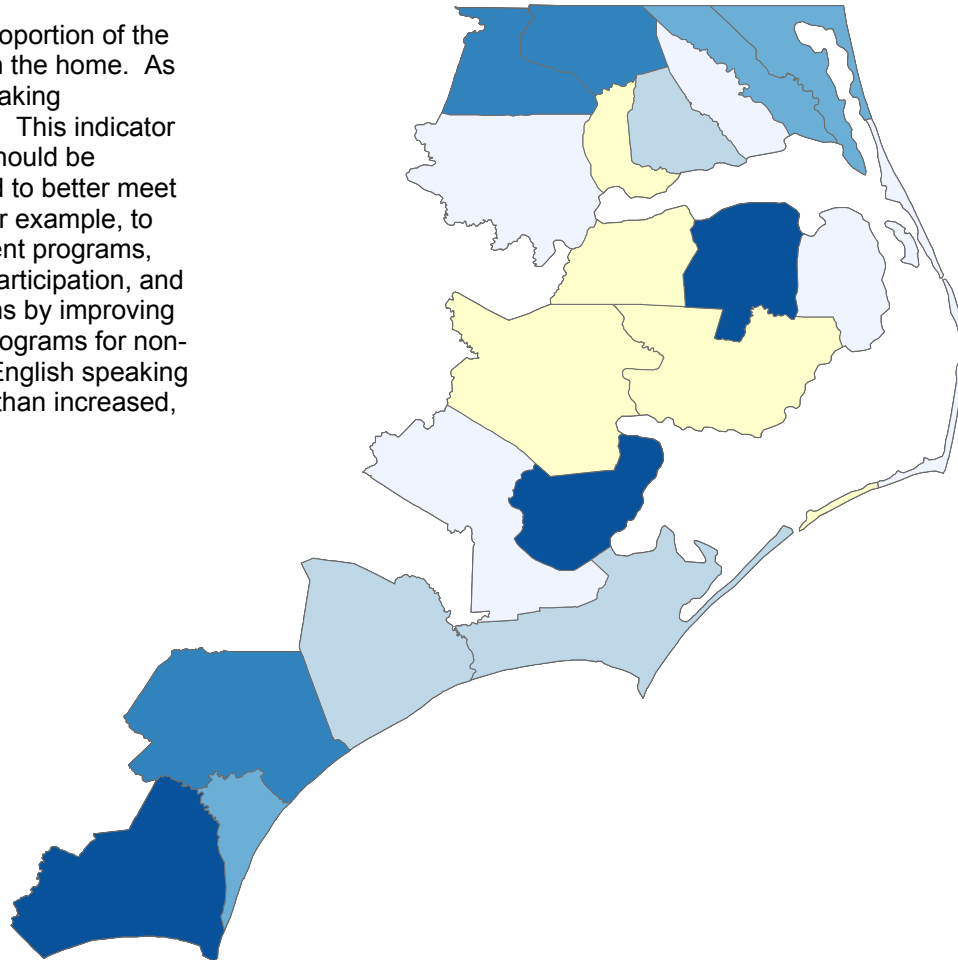
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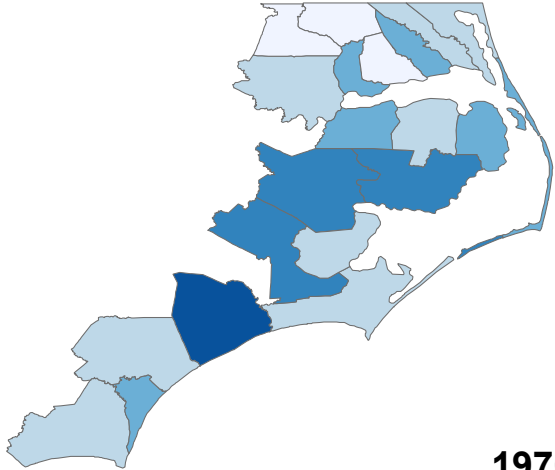
Source: US Census Bureau

## Language

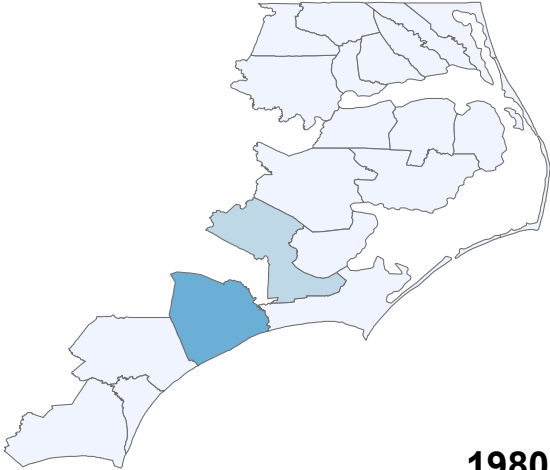
Language spoken in the home is an indicator of the proportion of the total population that does or does not speak English in the home. As presented here, it depicts changes in non-English speaking households as a proportion of households in a county. This indicator can serve to identify areas where existing programs should be modified or where new programs should be developed to better meet the needs of the non-English speaking community. For example, to improve compliance with specific resource management programs, efforts could be directed to improve communication, participation, and involvement related to resource management decisions by improving the level of communication and providing additional programs for non-English speakers. In coastal North Carolina, the non-English speaking proportion of the total population has declined, rather than increased, in 14 out of 20 counties.



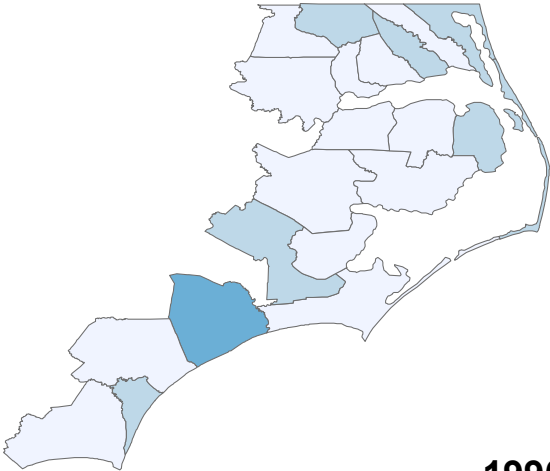
Source: US Census Bureau



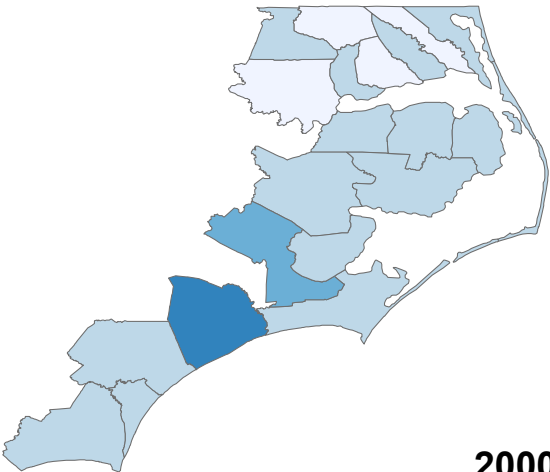
1970



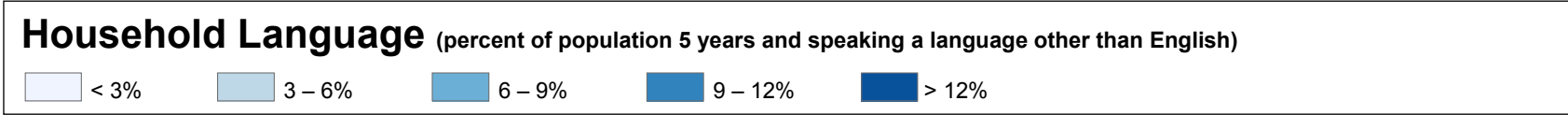
1980



1990



2000

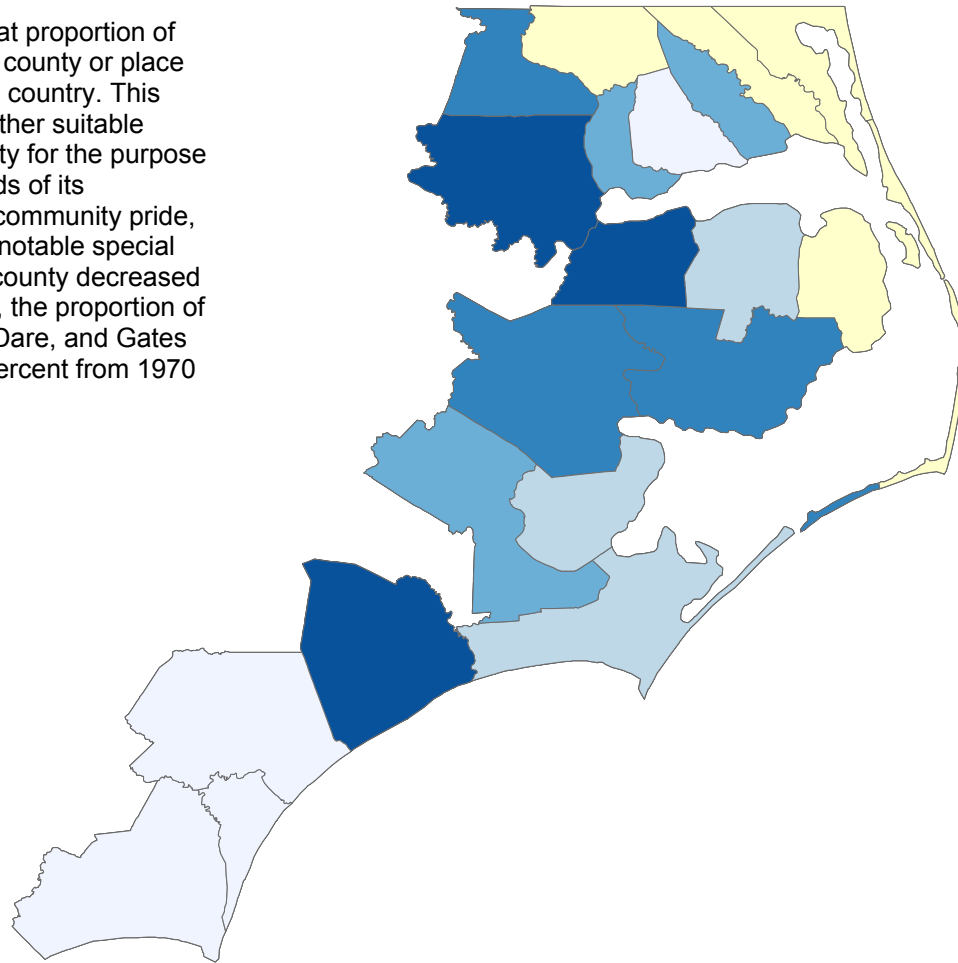


Source: US Census Bureau



## Place of Birth

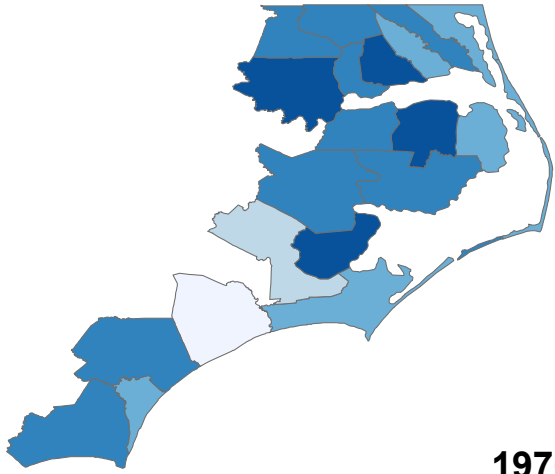
Reporting of place of birth is useful in determining what proportion of the total population was born in the state or sub-state county or place level, or if they were born out of the state or out of the country. This information, combined with language questions and other suitable variables, can help characterize a county or community for the purpose of program or policy development directed at the needs of its constituents/citizens. It can also become a source of community pride, a draw for additional new residents, tourism, or other notable special events. The proportion of current residents born in a county decreased in all of the coastal North Carolina counties. However, the proportion of residents born in the counties of Camden, Currituck, Dare, and Gates and New Brunswick Counties decreased over thirty percent from 1970 to 2000.



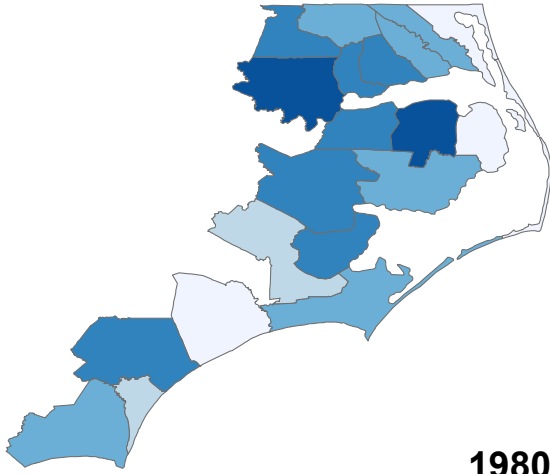
**Percent Change in the Proportion of Persons Born in North Carolina, 1970 - 2000**

< -35%    
  -35 - -24%    
  -24 - -19%    
  -19 - -14%    
  -14 - -9%    
  > -9%

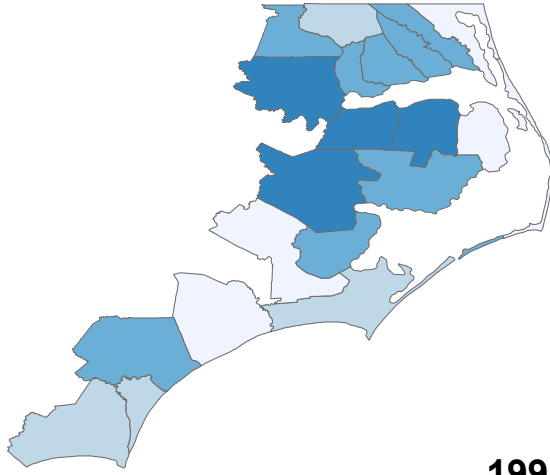
Source: US Census Bureau



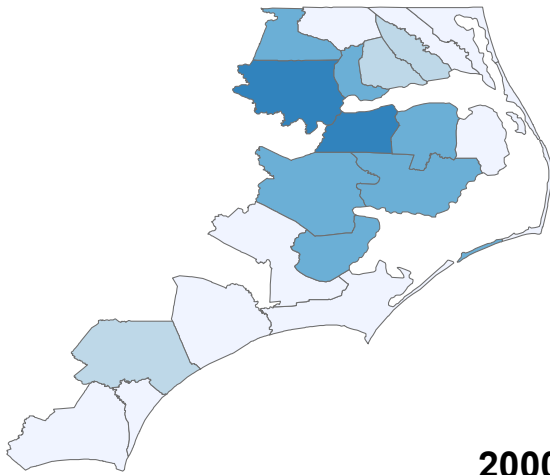
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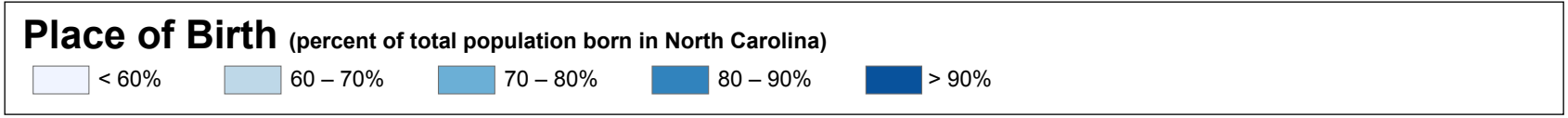
1980



1990



2000

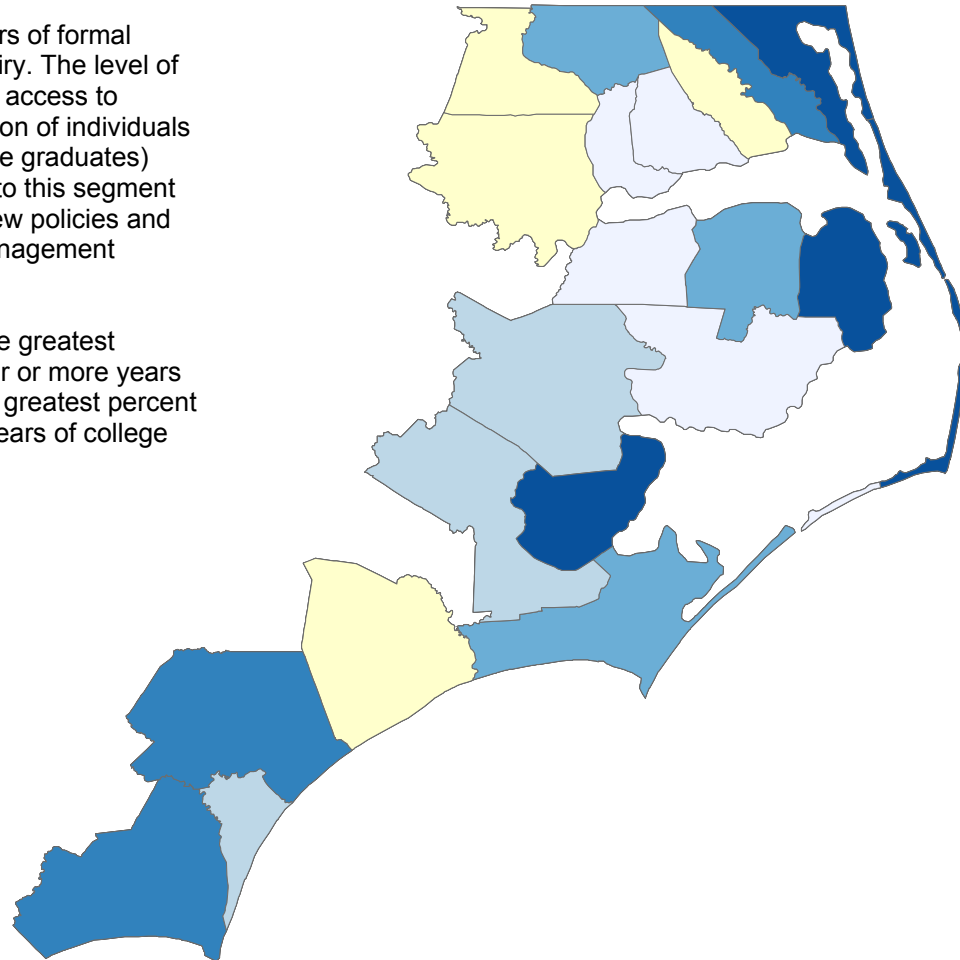


Source: US Census Bureau

## Educational Attainment

Educational attainment data reflect the number of years of formal education completed by individuals at the time of inquiry. The level of educational attainment is helpful in depicting trends in access to knowledge. Awareness of the proportion and distribution of individuals with four or more years of college (for example, college graduates) enables informed targeting of programs and services to this segment of the public, and can influence the development of new policies and the level of public participation related to resource management decision making.

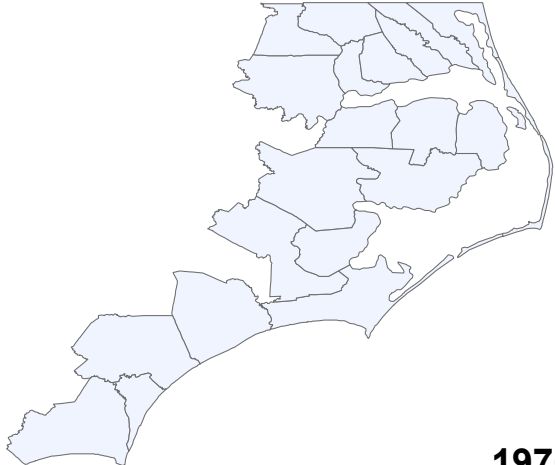
In 2000, Currituck, Dare and Pamlico Counties had the greatest proportion of coastal North Carolina residents with four or more years of college. These three counties also experienced the greatest percent increase in numbers of individuals with four or more years of college from 1970 to 2000.



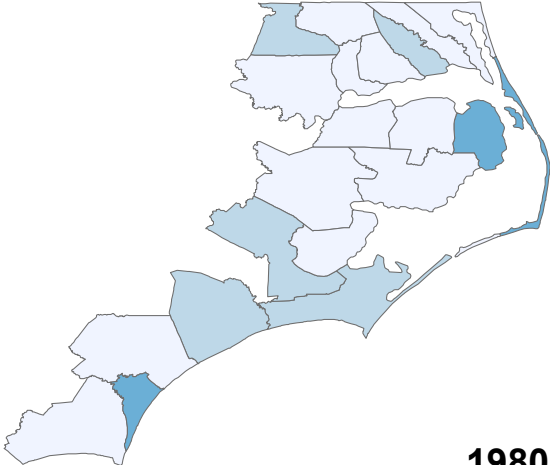
**Percent Change in the Proportion of Persons Completing College, 1970 - 2000**

< 92%    92 - 132%    132 - 221%    221 - 256%    256 - 302%    > 302%

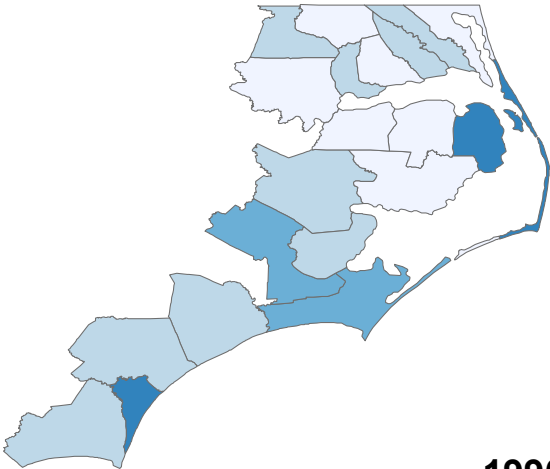
Source: US Census Bureau



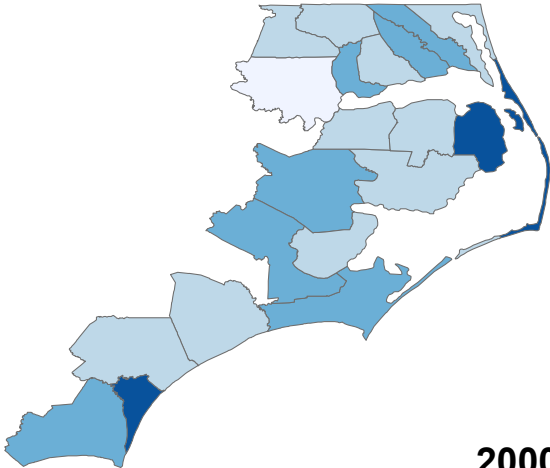
1970



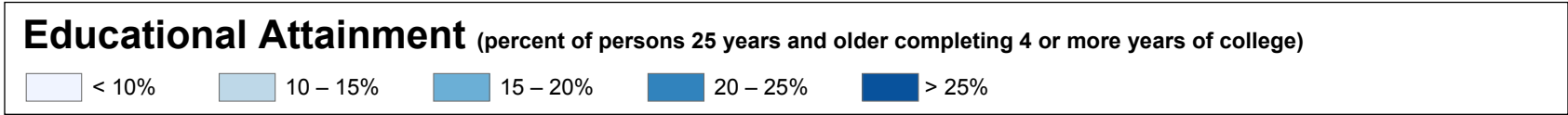
1980



1990



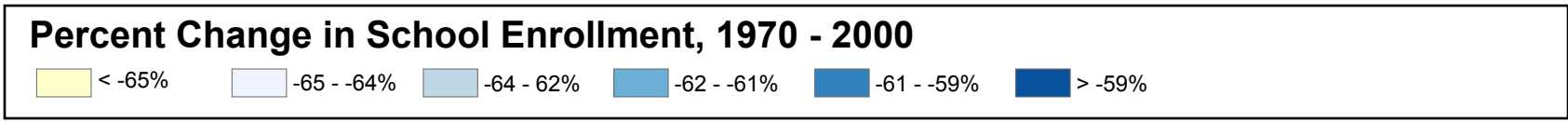
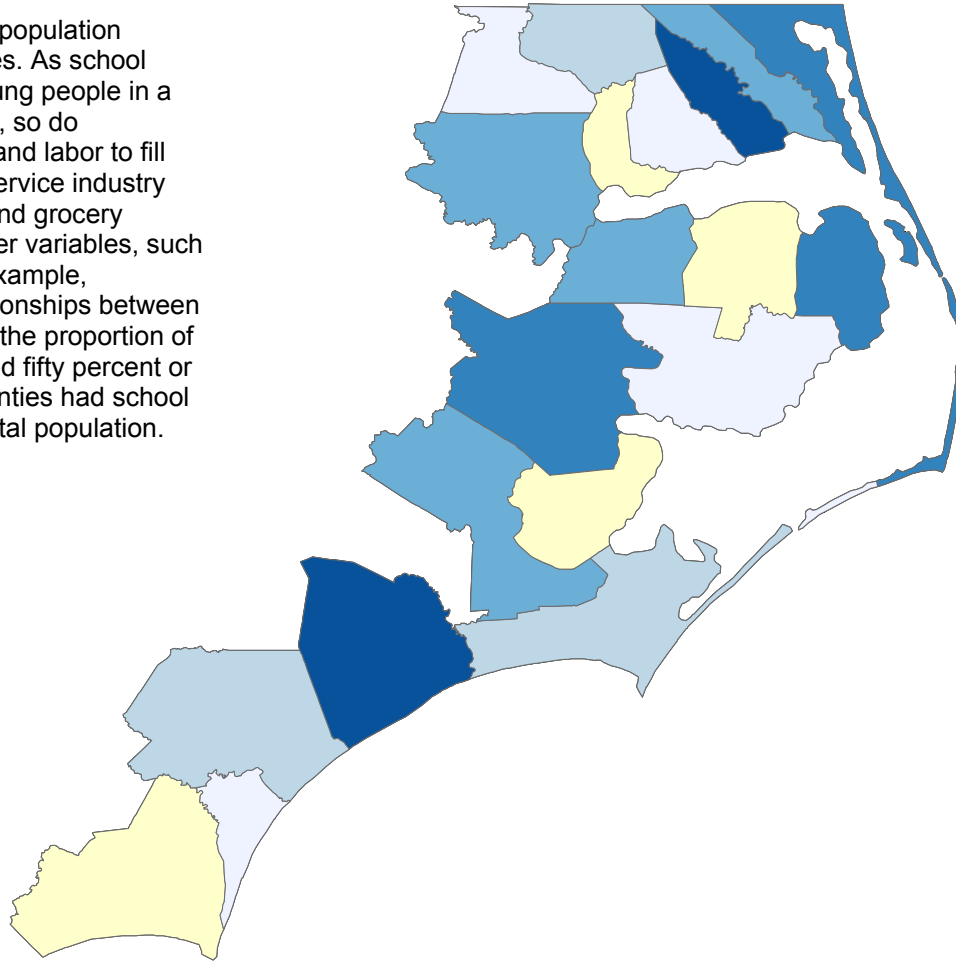
2000



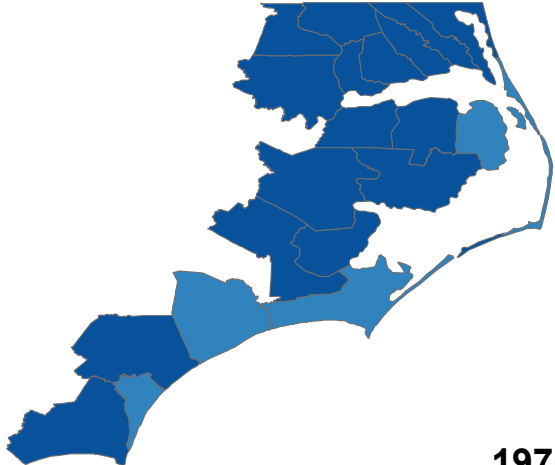
Source: US Census Bureau

## School Enrollment

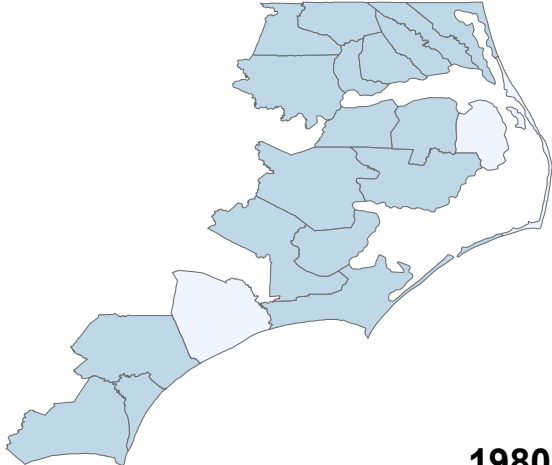
School enrollment reflects the percentage of the total population actively enrolled in public or private schools or colleges. As school enrollment declines, there is a proportional loss of young people in a given community. As the number of students declines, so do opportunities for employers to hire young local talent and labor to fill part-time, seasonal, and full-time positions in staple service industry establishments (for example, restaurants, hardware and grocery stores, recreation facilities). When compared with other variables, such as changing age structure within the population (for example, increasing numbers of retirement-age residents) relationships between the different variables become apparent. Since 1970, the proportion of the population currently enrolled in school has declined fifty percent or more in all of the coastal counties. In 2000, many counties had school enrollment at levels below eighteen percent of their total population.



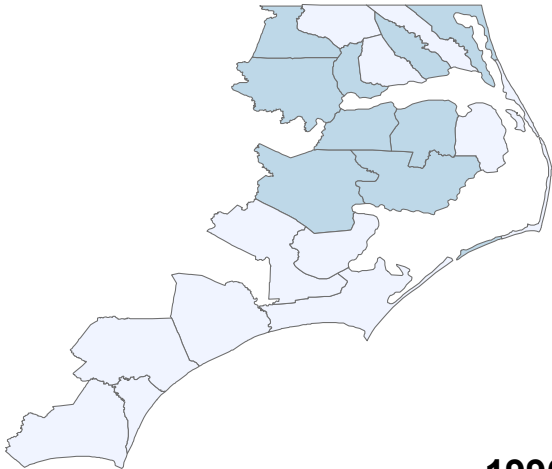
Source: US Census Bureau



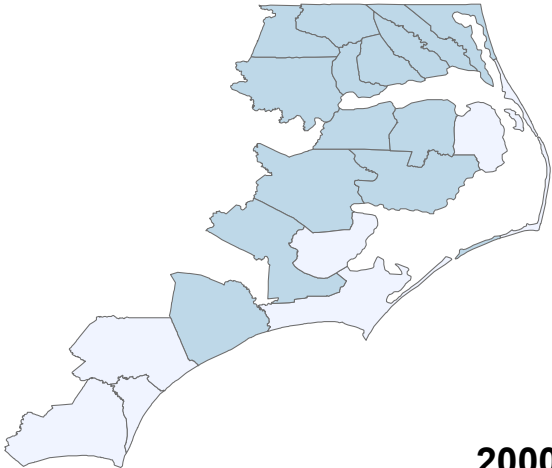
1970



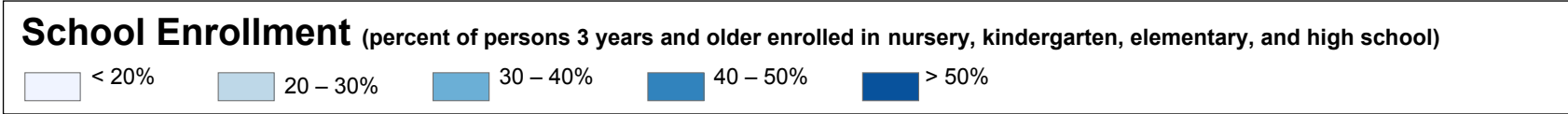
1980



1990



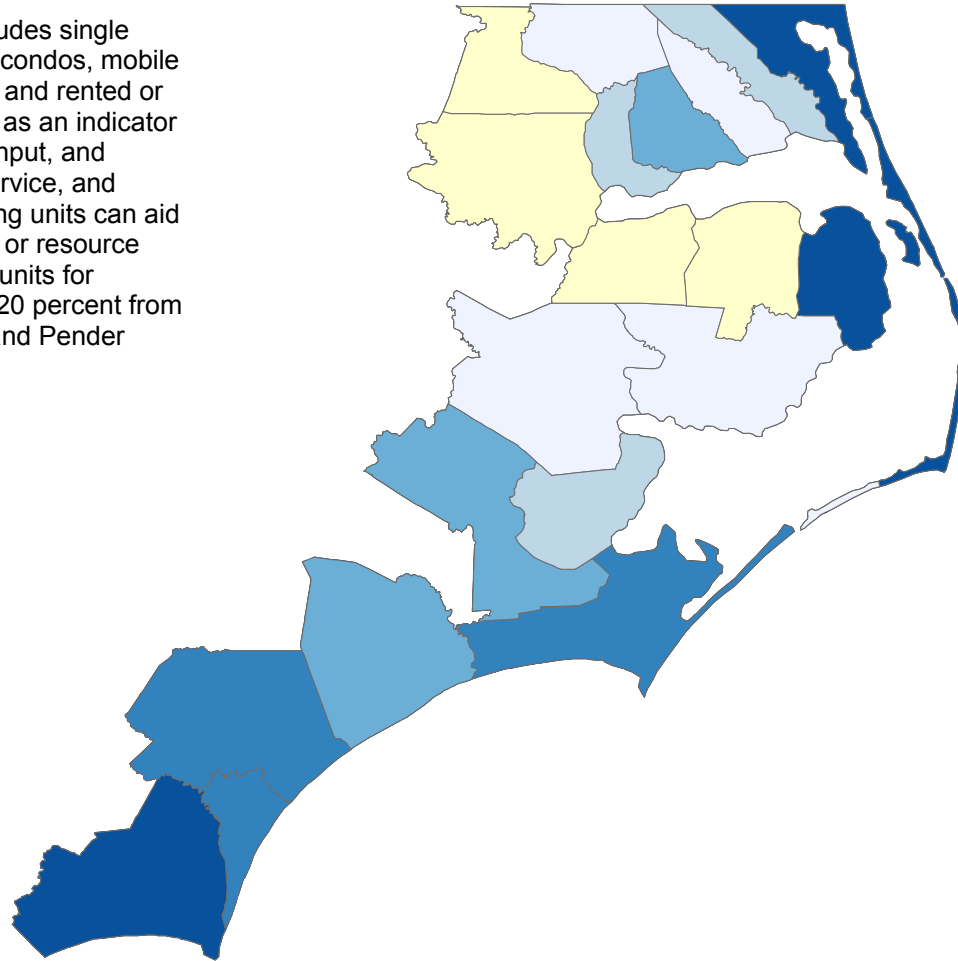
2000



Source: US Census Bureau

## Total Housing Units

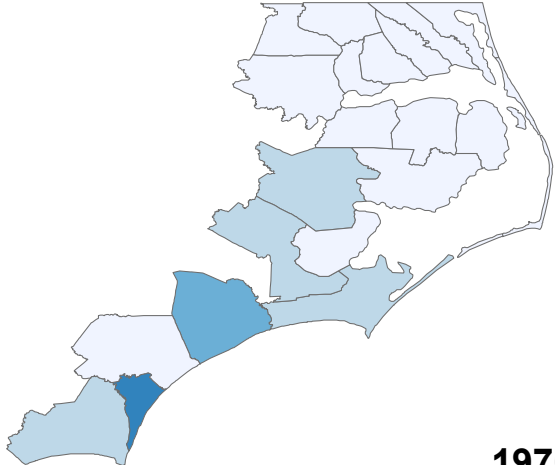
The total number of housing units in a given area includes single family homes, multi-family dwellings, apartments and condos, mobile homes and trailers, which can be occupied or vacant, and rented or owned. Measuring new residential housing can serve as an indicator of changes to the local economy, labor demand and input, and needs for transportation, infrastructure, community service, and natural resources. Assessing the distribution of housing units can aid planning for new development, community amenities, or resource management. Proportional increases in total housing units for Brunswick, Currituck, and Dare Counties were over 220 percent from 1970 to 2000; increases for Carteret, New Hanover, and Pender Counties were over 120 percent.



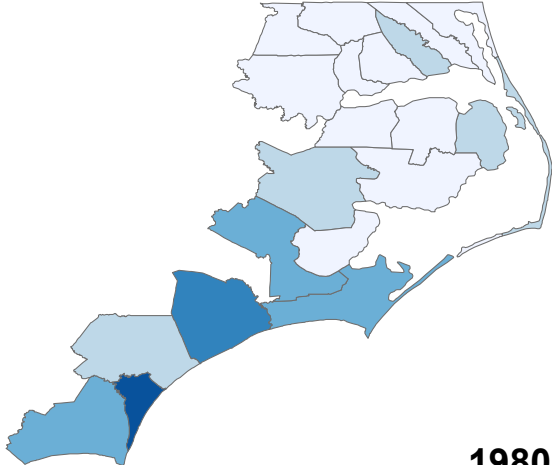
**Percent Change in the Number of Total Housing Units, 1970 - 2000**

< 48%   -48 - 70%   70 - 90%   90 - 127%   127 - 222%   > 222%

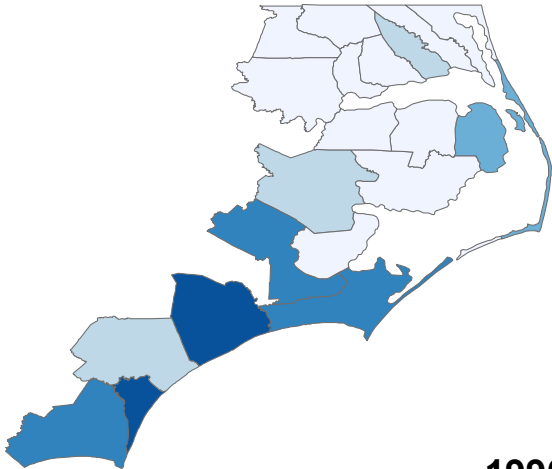
Source: US Census Bureau



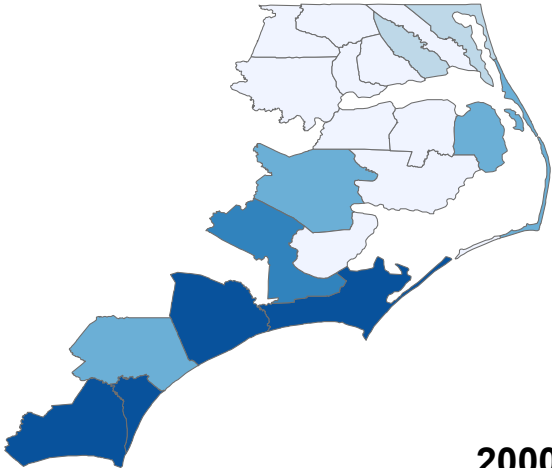
1970



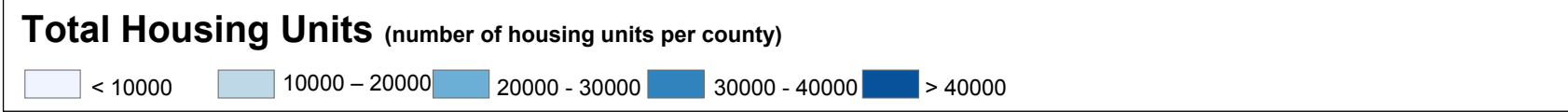
1980



1990



2000

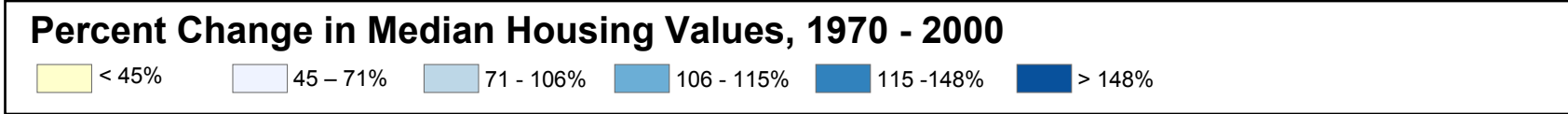
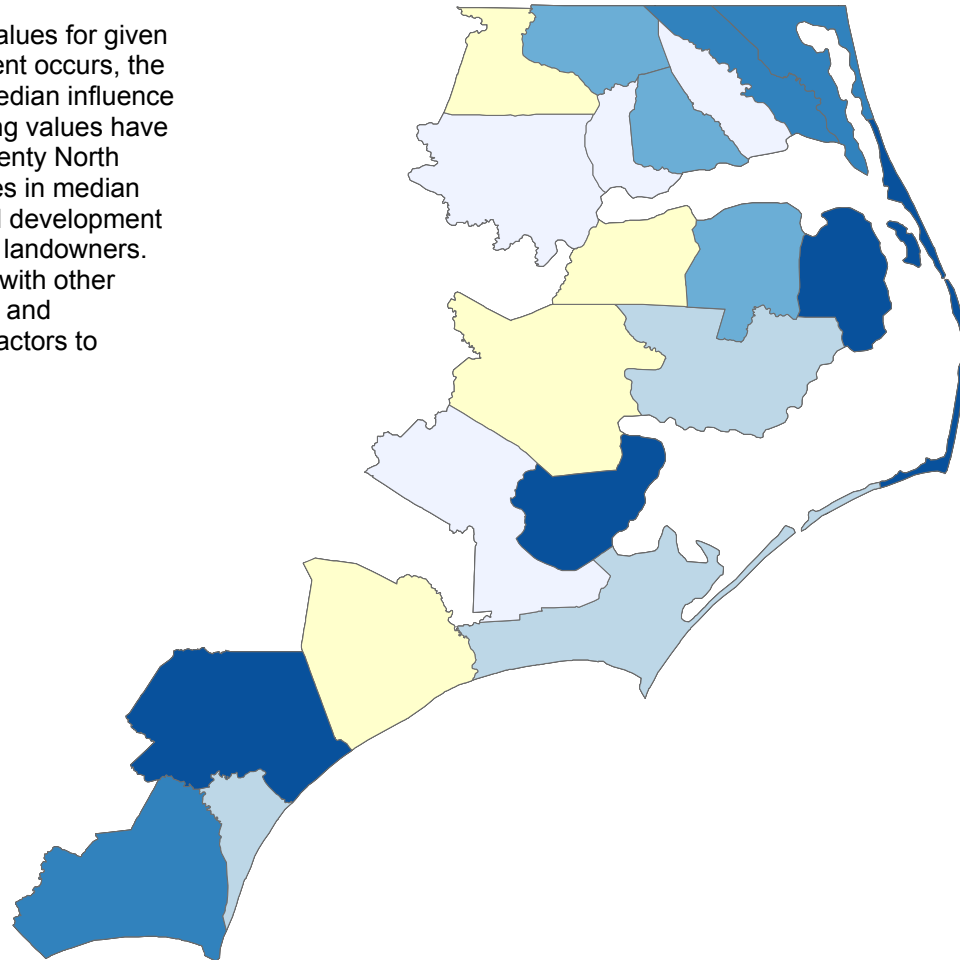


Source: US Census Bureau

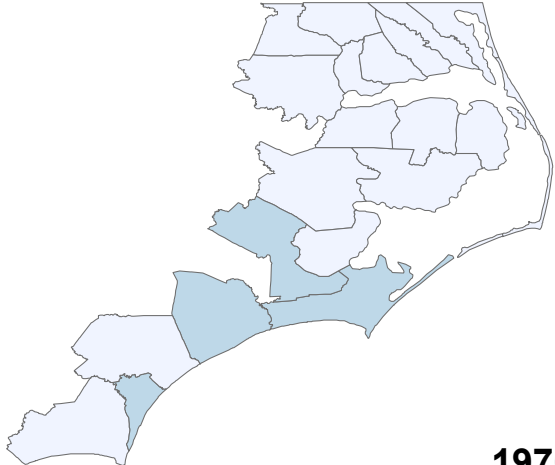


## Median Housing Value

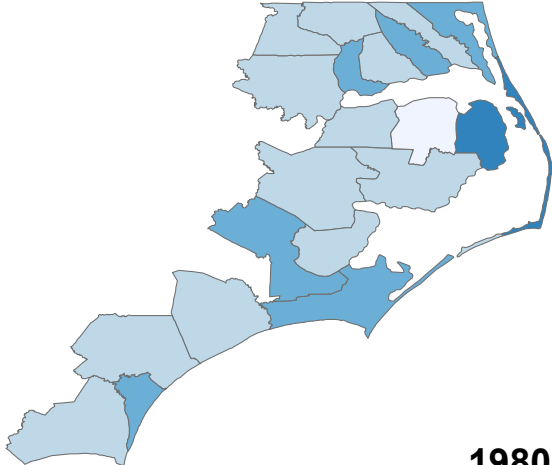
Median housing values reflect the midpoint of home values for given geographic areas. As additional residential development occurs, the number of homes with values above and below the median influence the position of the median home value. Median housing values have increased by more than 100 percent for nine of the twenty North Carolina coastal counties from 1970 to 2000. Increases in median home values in several areas reflect recent residential development of large vacation and seasonal homes by nonresident landowners. Median housing value can be compared or combined with other social variables to gauge relationships between social and environmental change and that can serve as limiting factors to access for segments of the population.



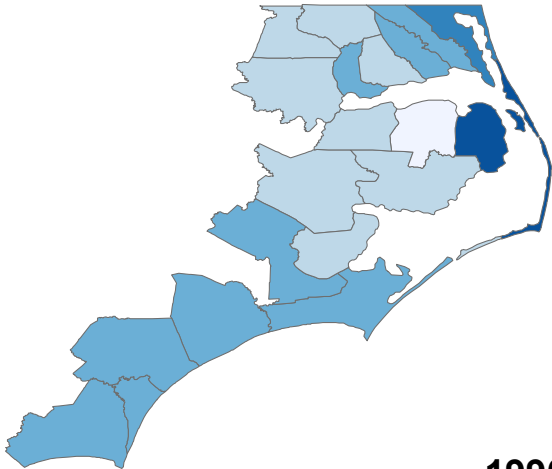
Source: US Census Bureau



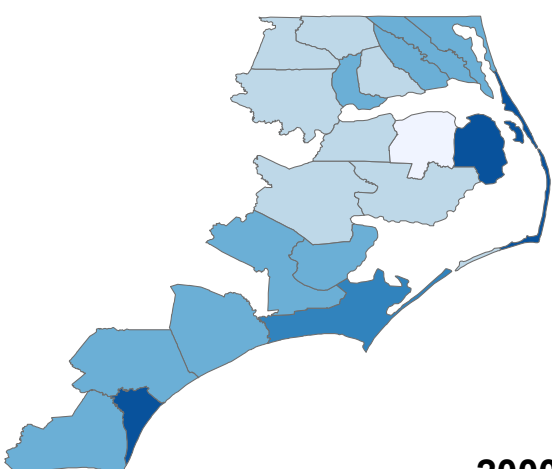
1970



1980








1990



2000

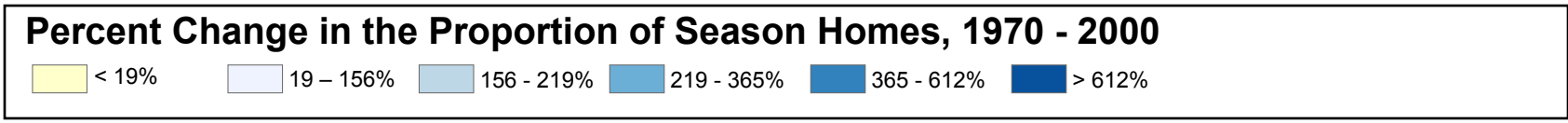
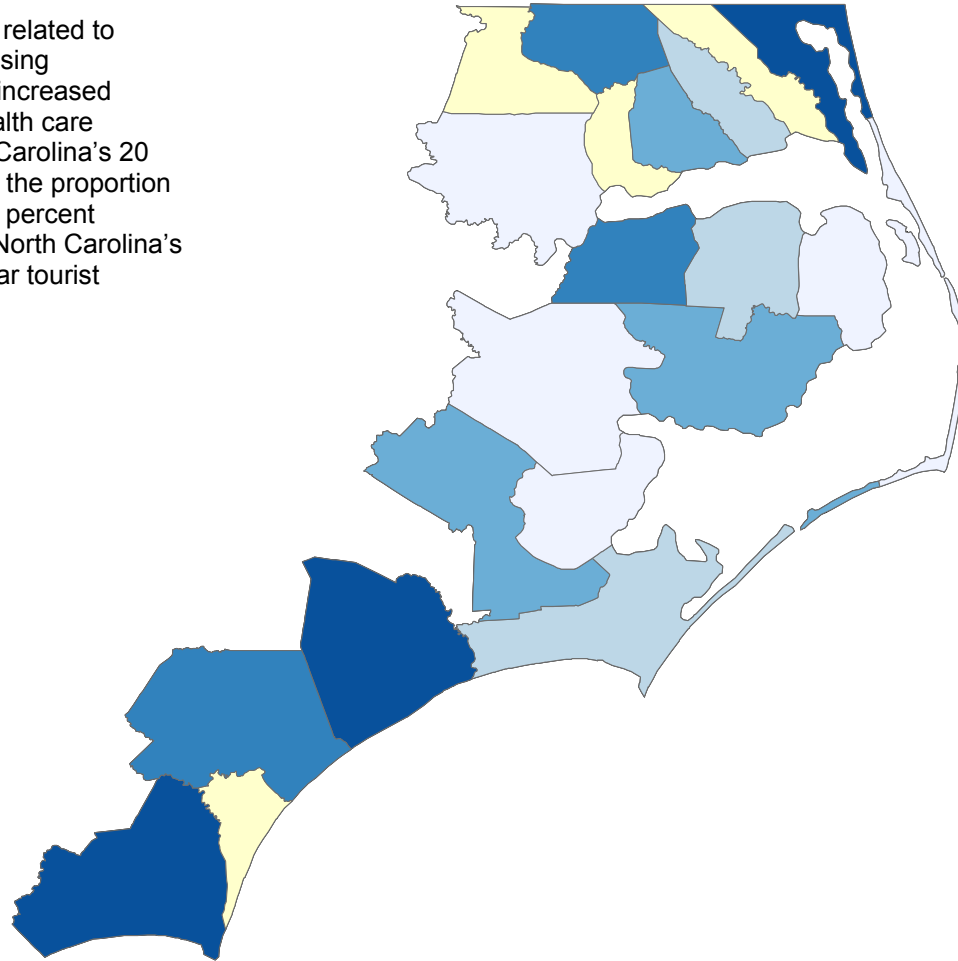
**Median Housing Values** (converted to 1999 dollars using Consumer Price Index Inflation Calculator)

 < \$50k	 \$50k – \$75k	 \$75k - \$100k	 \$100k - \$125k	 > \$125k
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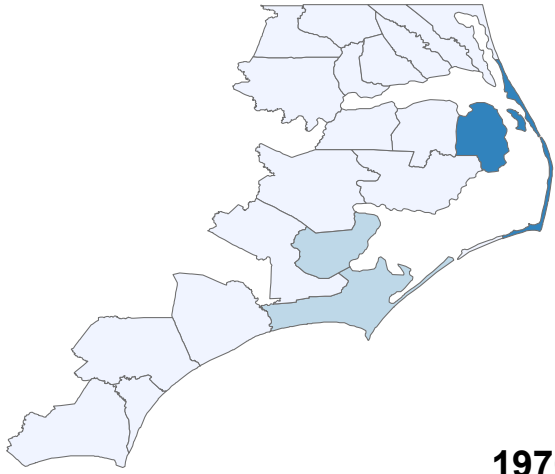
Source: US Census Bureau

## Seasonal Homes

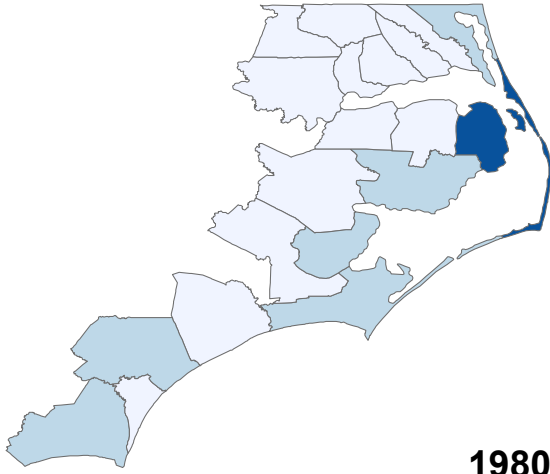
Seasonal homes can serve as an indicator of change related to increases in nonresident landownership, reduced housing affordability, and infrastructure expansion, as well as increased demands for cultural amenities and emergency or health care services. Between 1970 and 2000, fourteen of North Carolina's 20 coastal counties observed 100% or greater change in the proportion of seasonal homes. The largest change at over 1000 percent occurred in Brunswick County, which is near coastal North Carolina's sole urban center, Wilmington, and north of the popular tourist destination, Myrtle Beach, South Carolina.



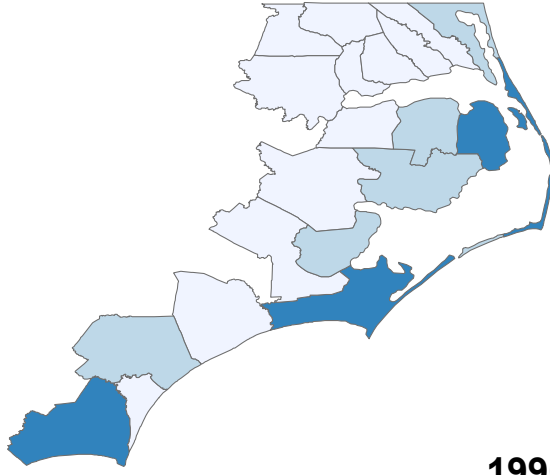
Source: US Census Bureau



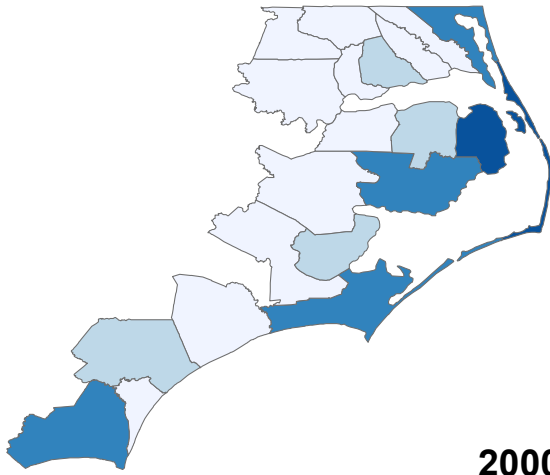
1970



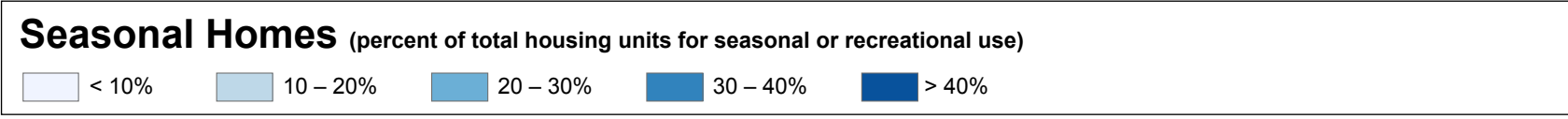
1980



1990



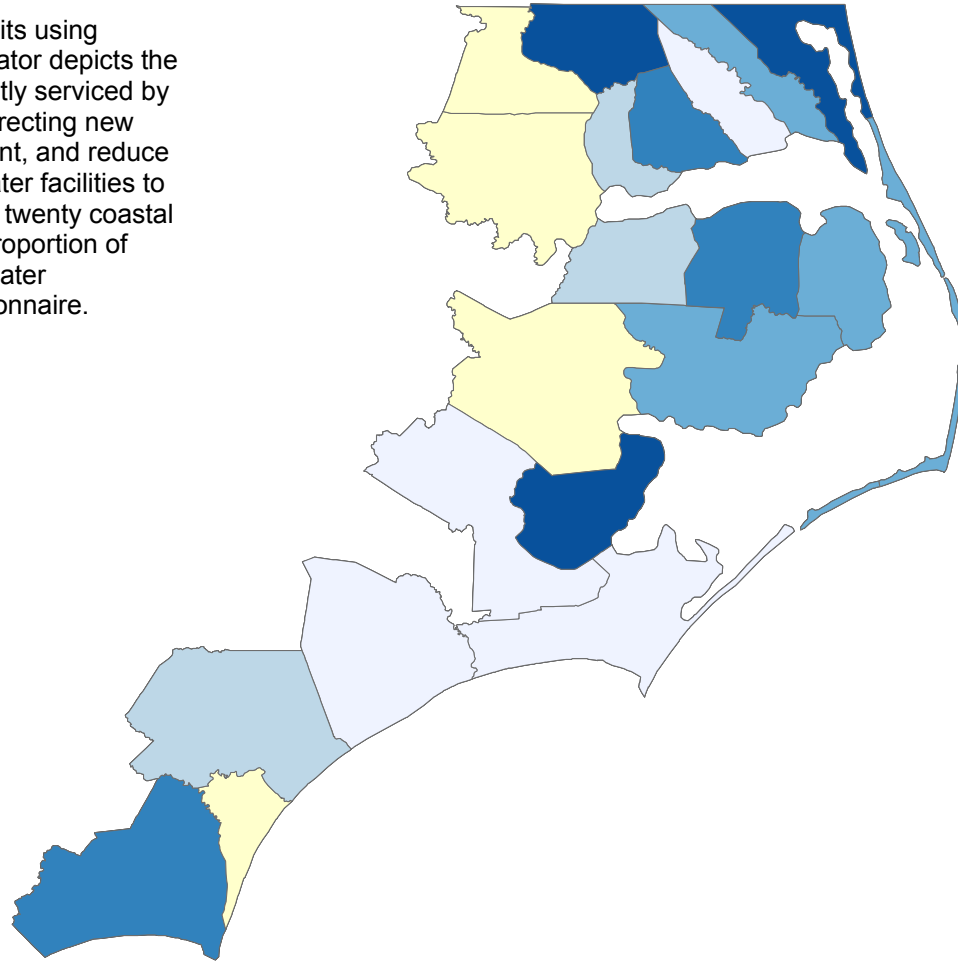
2000



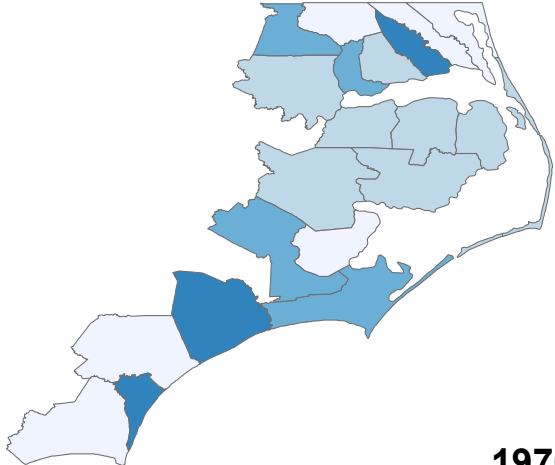
Source: US Census Bureau

## Source of Water

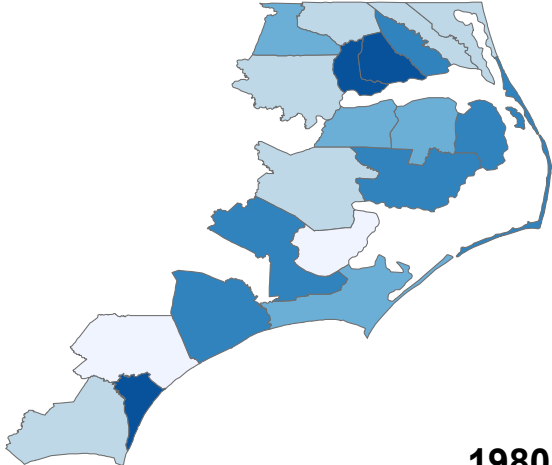
Source of water includes the proportion of housing units using municipally supplied water or ground wells. This indicator depicts the extent of infrastructure and can illustrate areas currently serviced by water delivery. This information can aid planners in directing new development to areas adjacent to existing development, and reduce costs typically associated with construction of new water facilities to currently under-served areas. In 1990, twelve of the twenty coastal counties had more than a 60 percent change in the proportion of homes using public water. In 2000, the collection of water information was removed from the US Census questionnaire.



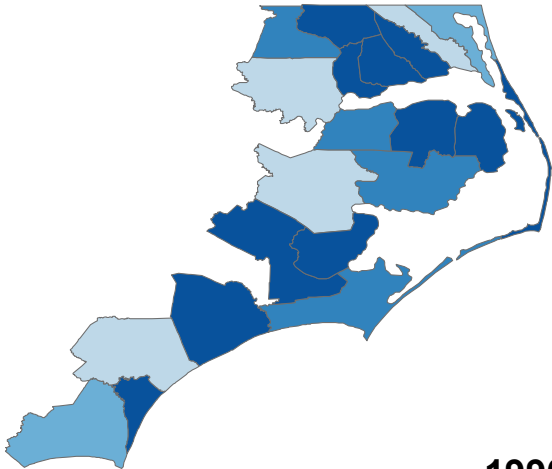
Source: US Census Bureau



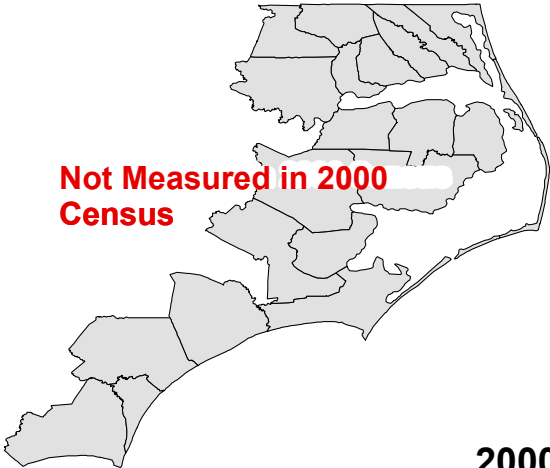
1970



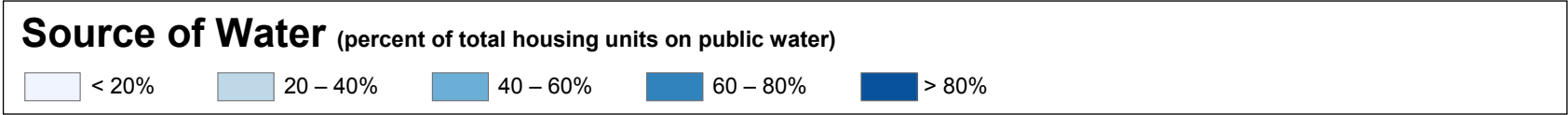
1980



1990



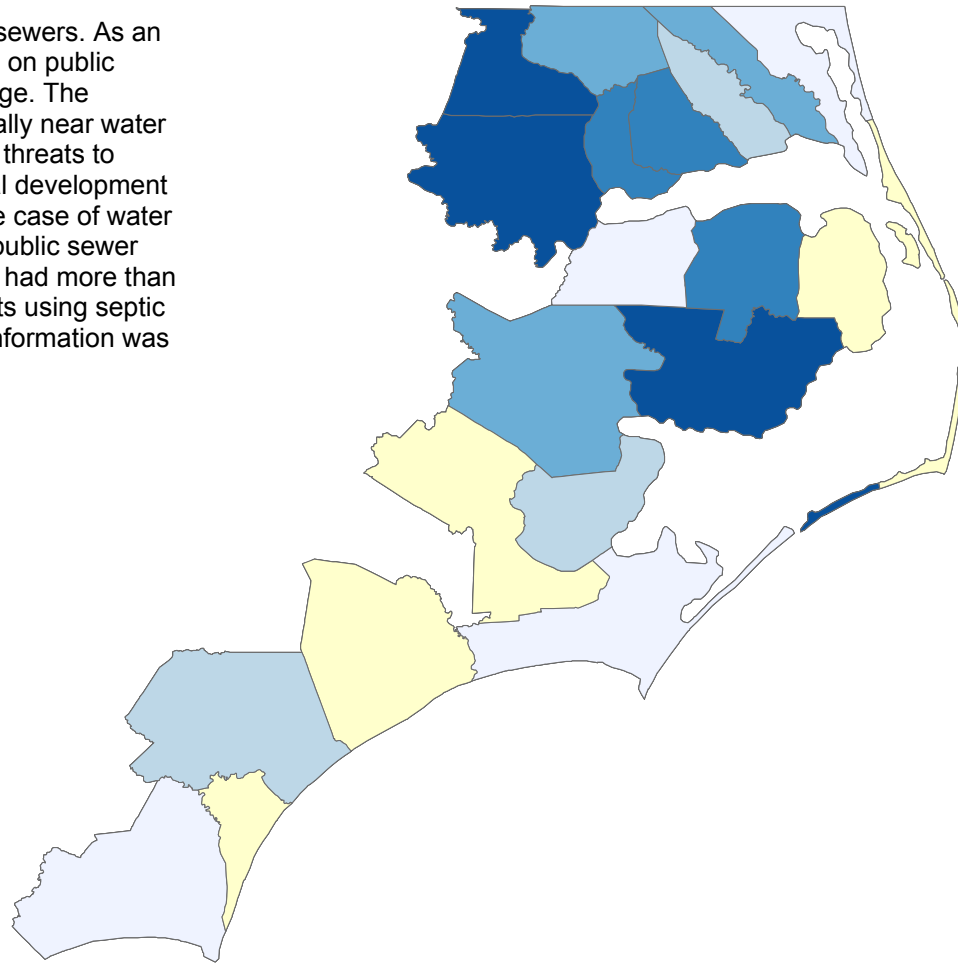
2000



Source: US Census Bureau

## Sewage Disposal

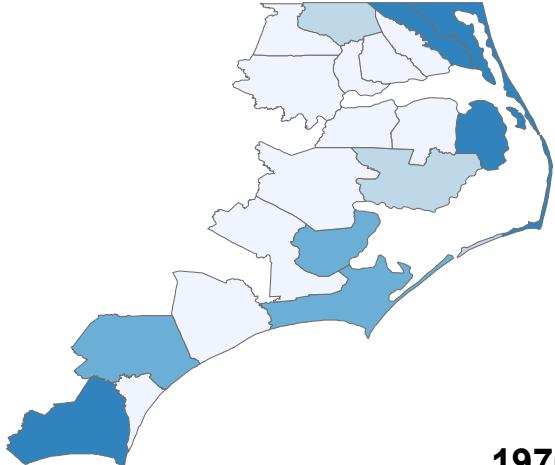
Sewage disposal includes septic systems and public sewers. As an indicator, sewage disposal depicts extent of coverage on public sewer systems as well as extent of septic system usage. The implications of widespread septic system use, especially near water courses and other water resources, suggest potential threats to water supplies and aquatic ecosystems. As residential development continues out from existing developed areas, as in the case of water delivery, proposed development adjacent to existing public sewer systems can reduce infrastructure costs. Six counties had more than a 50 percent change in the proportion of their residents using septic systems. In 2000, the collection of sewage disposal information was removed from the US Census questionnaire.



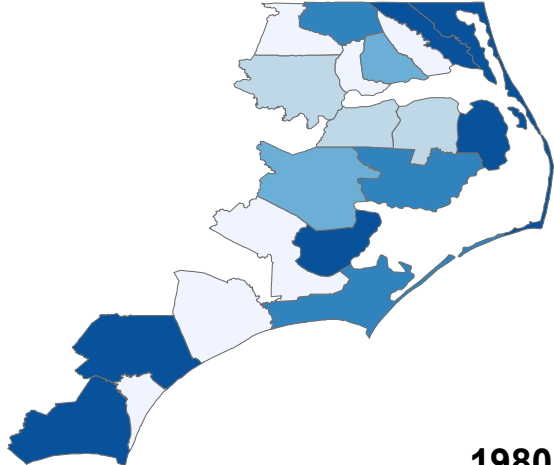
**Percent Change in the Proportion of Housing Units with Septic Systems, 1970 - 2000**

< 3%    3 - 18%    18 - 28%    28 - 52%    52 - 74%    > 74%

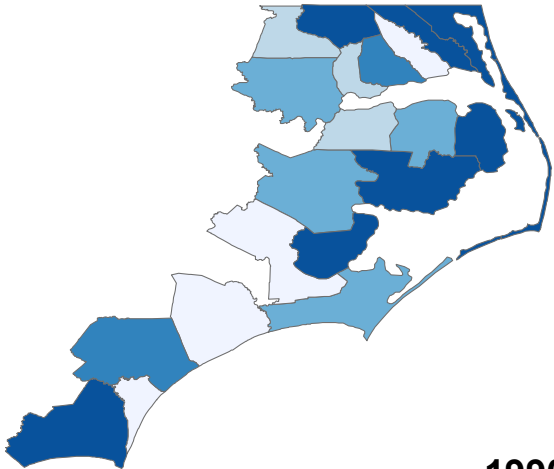
Source: US Census Bureau



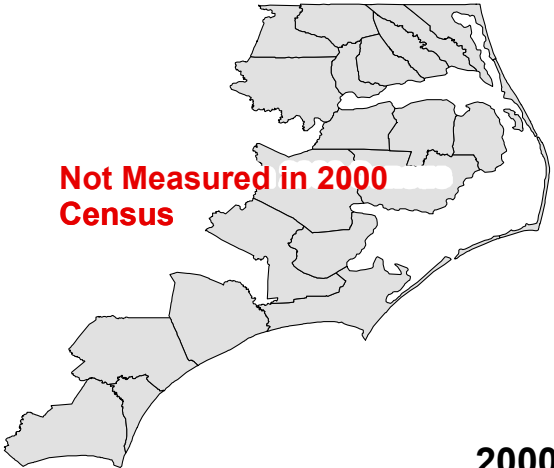
1970



1980

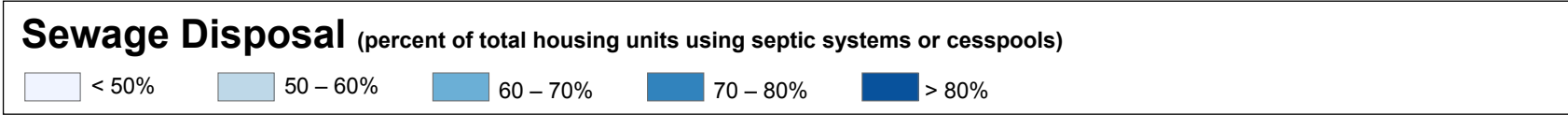


1990



2000

Not Measured in 2000 Census

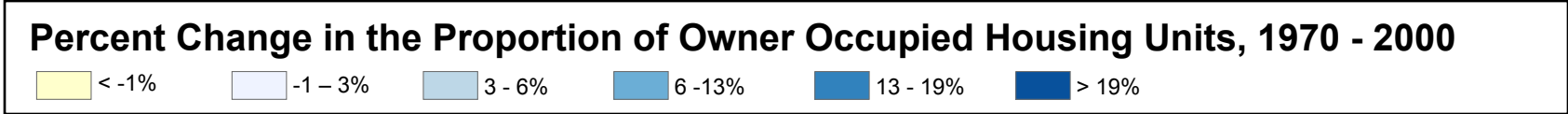
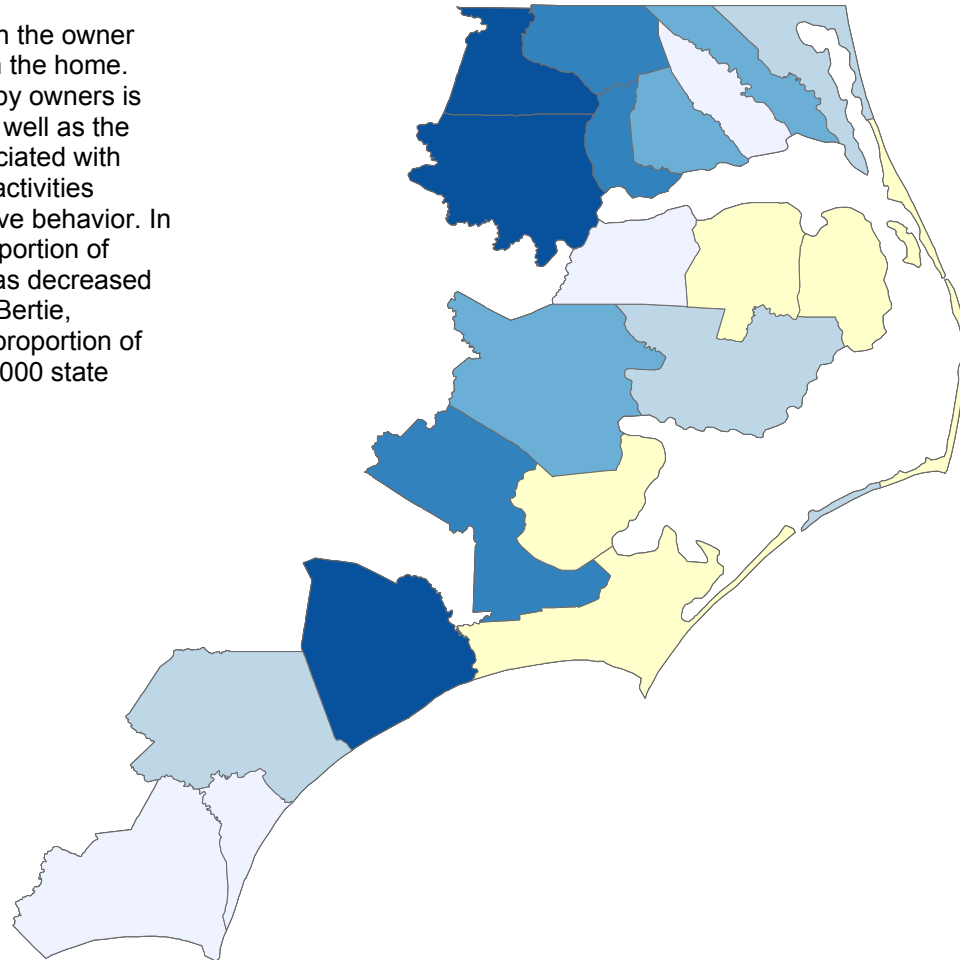


Source: US Census Bureau

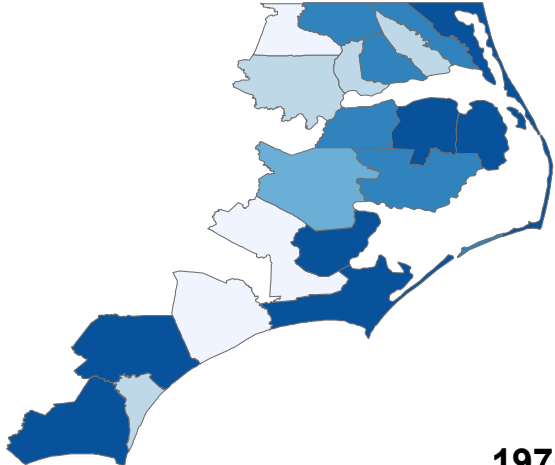


## Owner-Occupied Housing

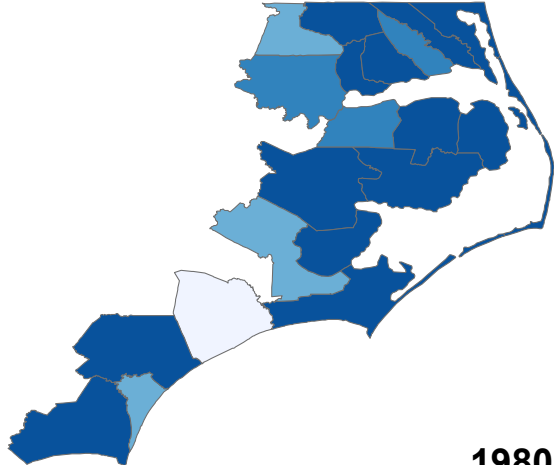
Owner-occupied housing units are those units in which the owner resides regardless of whether s/he has a mortgage on the home. Depiction of the proportion of housing units occupied by owners is related to the availability of and access to housing, as well as the property rights and land and water resource use associated with ownership. Absentee landowners can be unaware of activities occurring on their property and be at risk of depreciative behavior. In four of the 20 North Carolina coastal counties, the proportion of owner-occupied housing units to total housing units has decreased since 1970 (that is, Tyrrell, Pamlico, Dare, Carteret). Bertie, Hertford, and Onslow counties have increased their proportion of owner-occupied housing by at least 19 percent. The 2000 state owner-occupied housing rate was 69.4 percent.



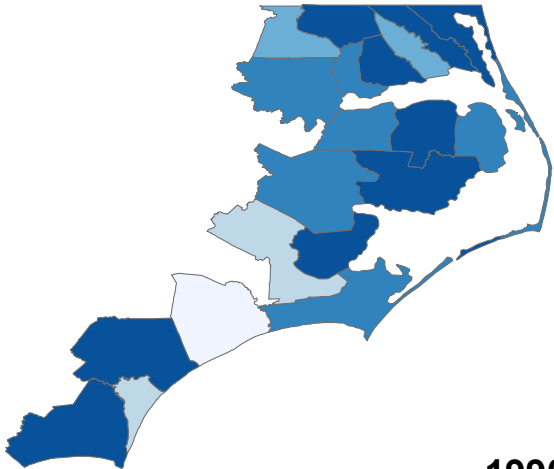
Source: US Census Bureau



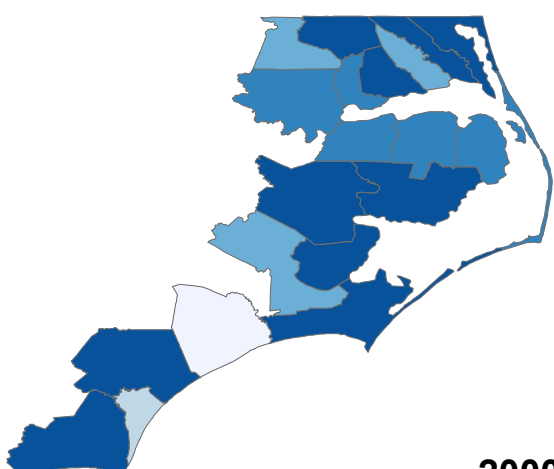
1970



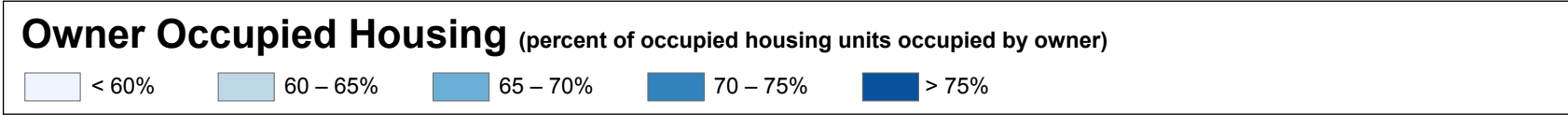
1980



1990



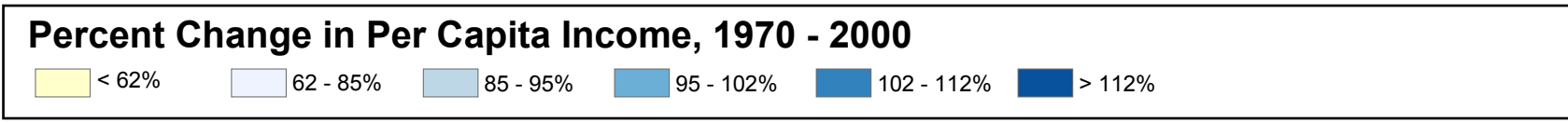
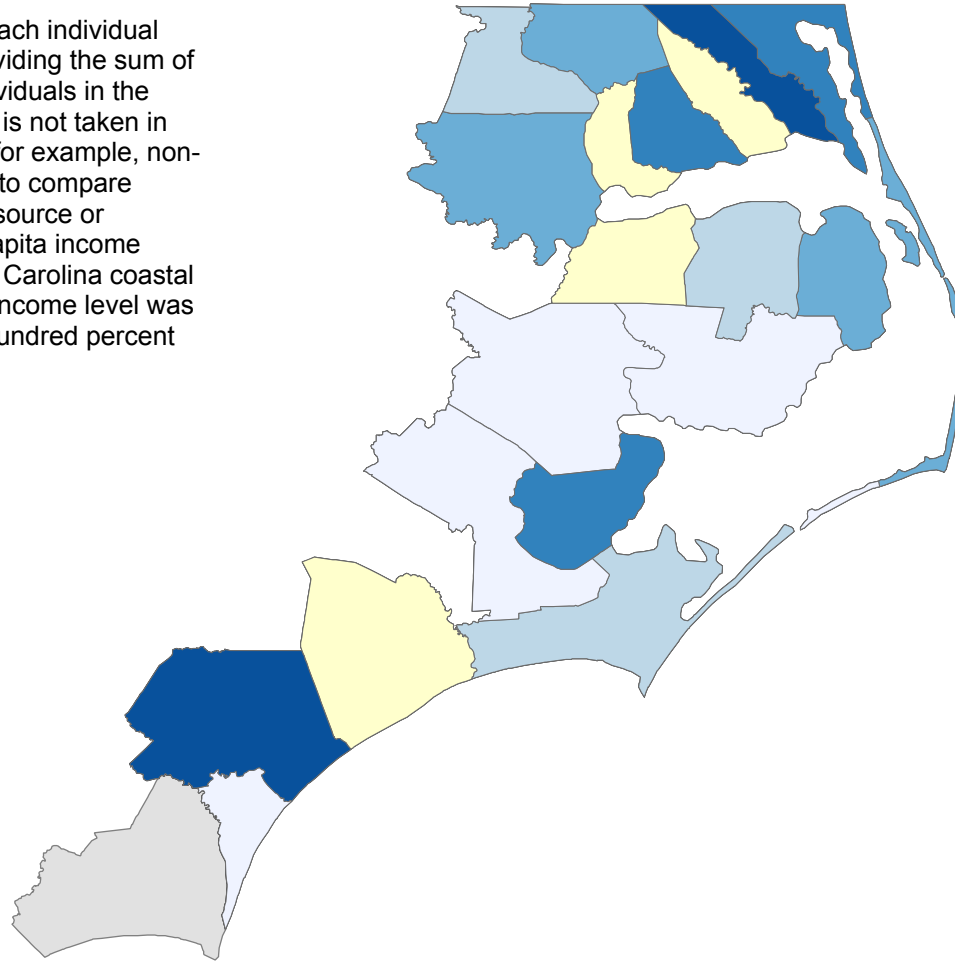
2000



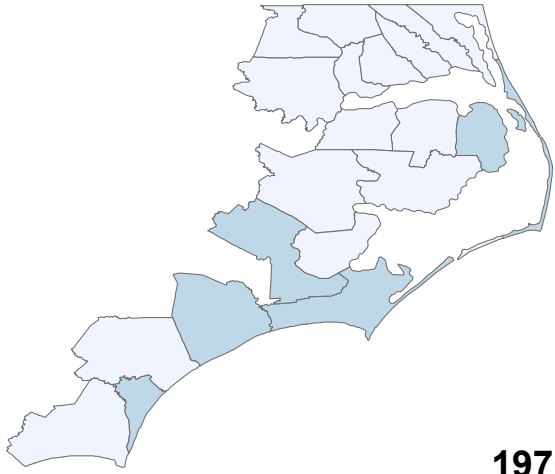
Source: US Census Bureau

## Per Capita Income

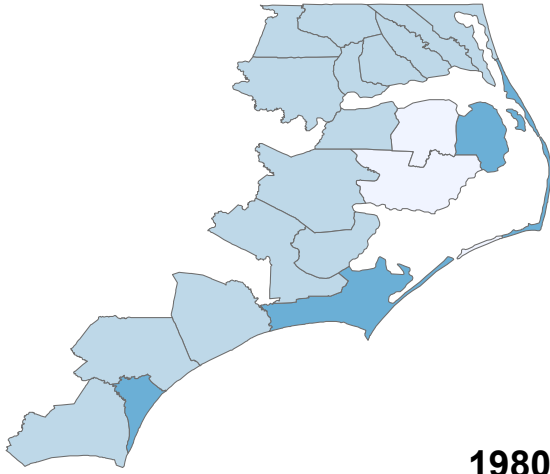
Per capita income reflects the average income for each individual (that is, man, woman, and child) as calculated by dividing the sum of all income from a given group by the number of individuals in the group. This measure is subject to inaccuracy if care is not taken in the compilation of all available income information (for example, non-wage income). Per capita income can also be used to compare across variables to characterize spending ability, resource or commodity affordability, and the like. In 2000, per capita income levels were above \$18,000 for eight of twenty North Carolina coastal counties. The 1999 North Carolina state per capita income level was \$20,307. Seven of the twenty counties had over a hundred percent increase in their per capita income.



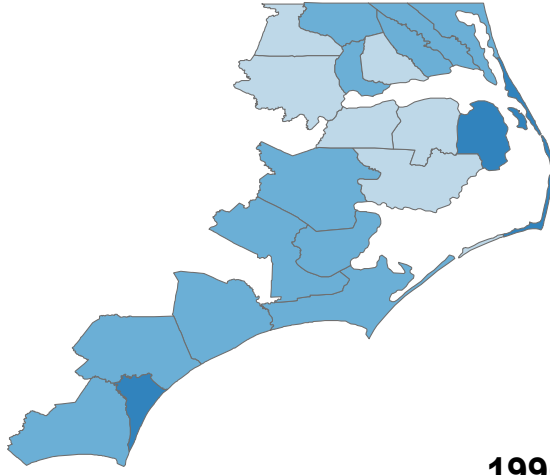
Source: US Census Bureau



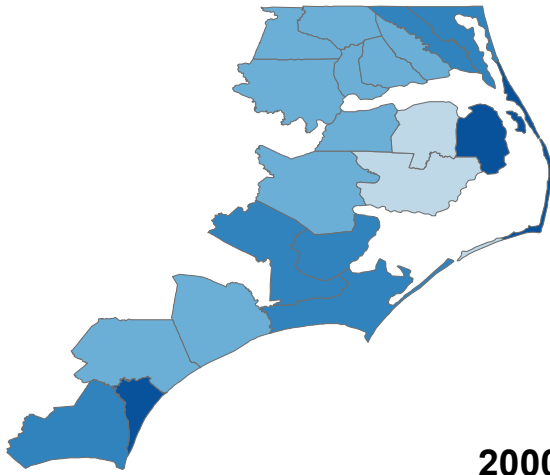
1970



1980



1990



2000

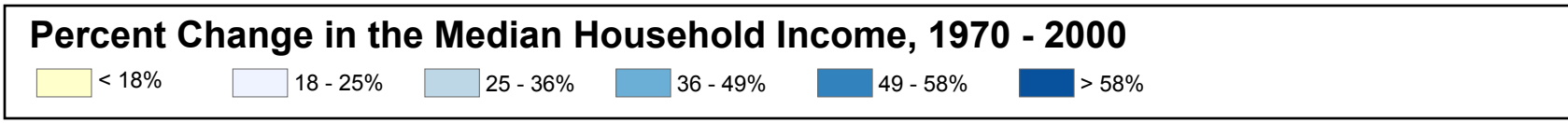
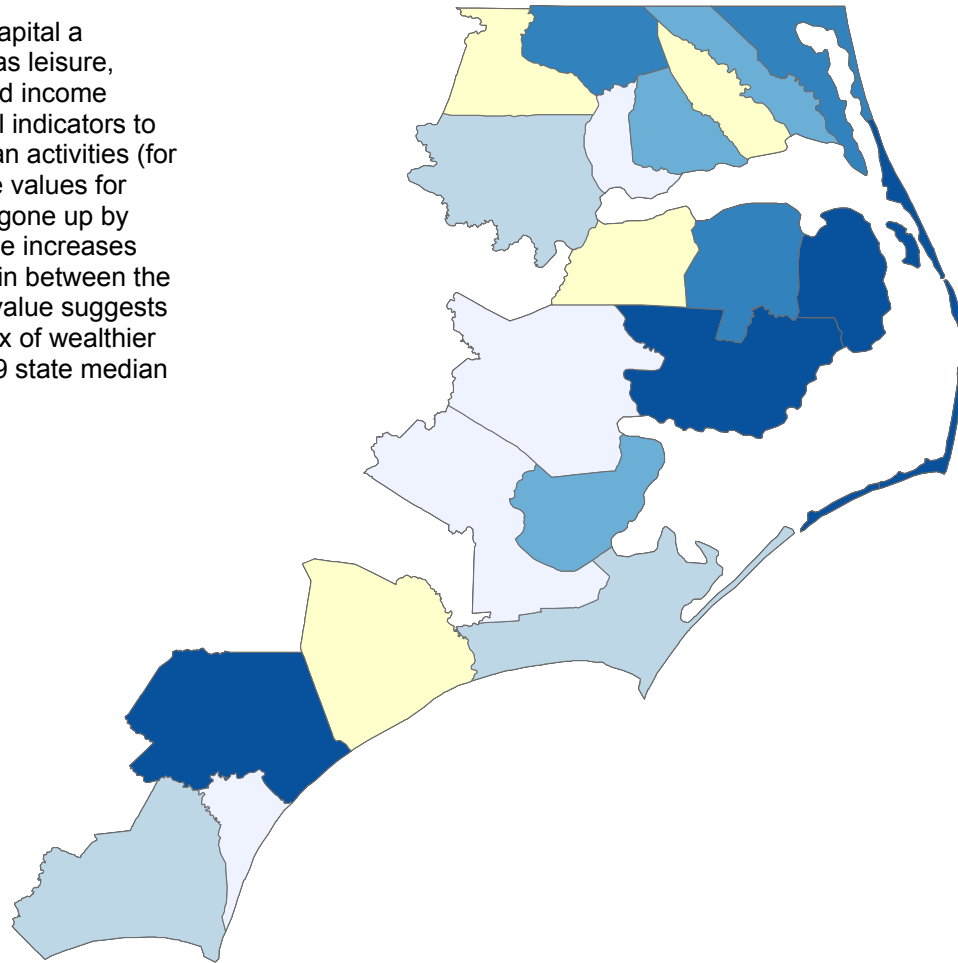
**Per Capita Income** (converted to 1999 dollars using Consumer Price Index Inflation Calculator)

	< \$10k		\$10k - \$14k		\$14k - \$18k		\$18k - \$22k		> \$22k
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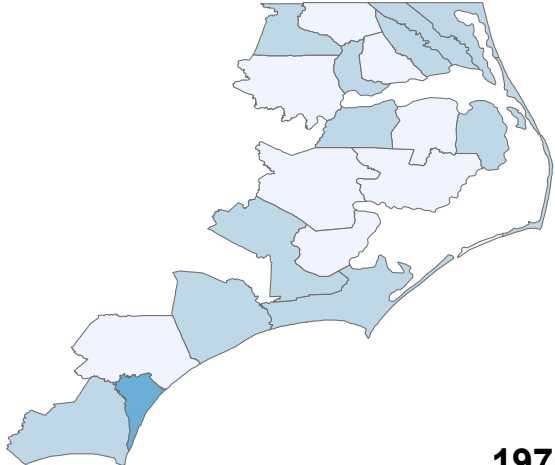
Source: US Census Bureau

## Median Household Income

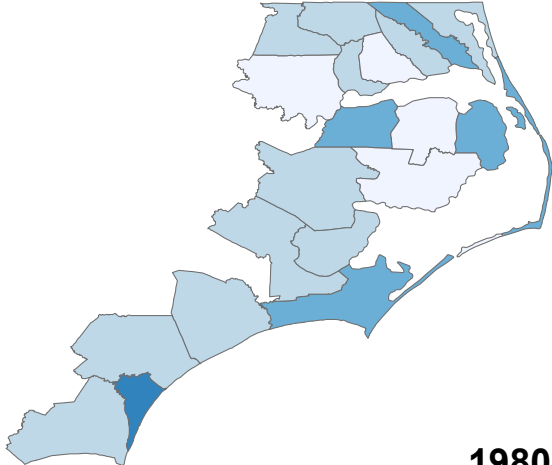
Median household income data reflect the available capital a household has to spent on all human activities, such as leisure, health, entertainment, or education. Median household income information can also be compared with different social indicators to assess relationships between income and other human activities (for example, home purchase). Median household income values for Currituck, Dare, Hyde, and Pender Counties have all gone up by more than fifty percent over the last few years. Notable increases also occurred between the 1980s and 1990s and again between the 1990s and 2000. The increase in median household value suggests a change in available income earnings and/or an influx of wealthier residents (for example, retirees) to the area. The 1999 state median household income level was \$39,184.



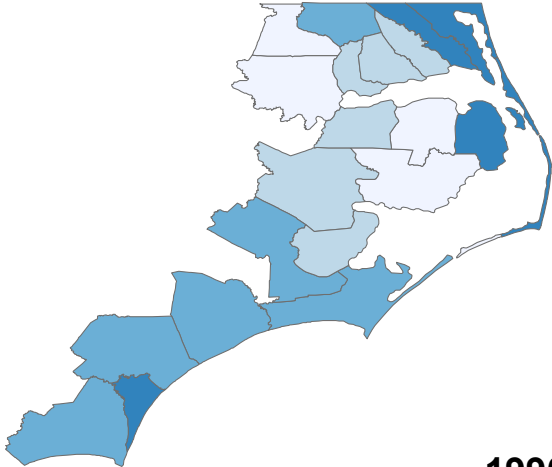
Source: US Census Bureau



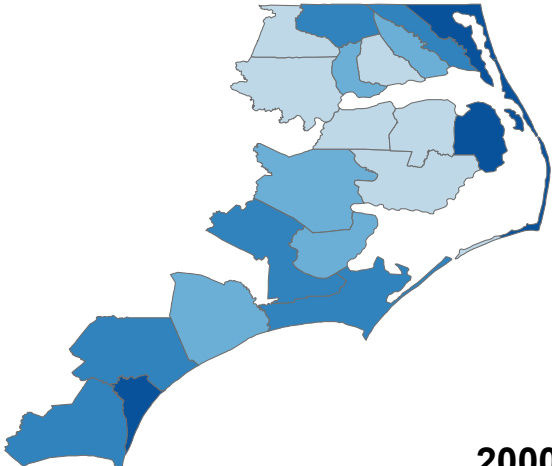
1970



1980



1990



2000

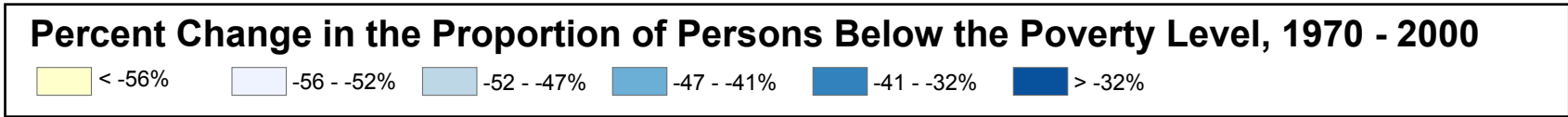
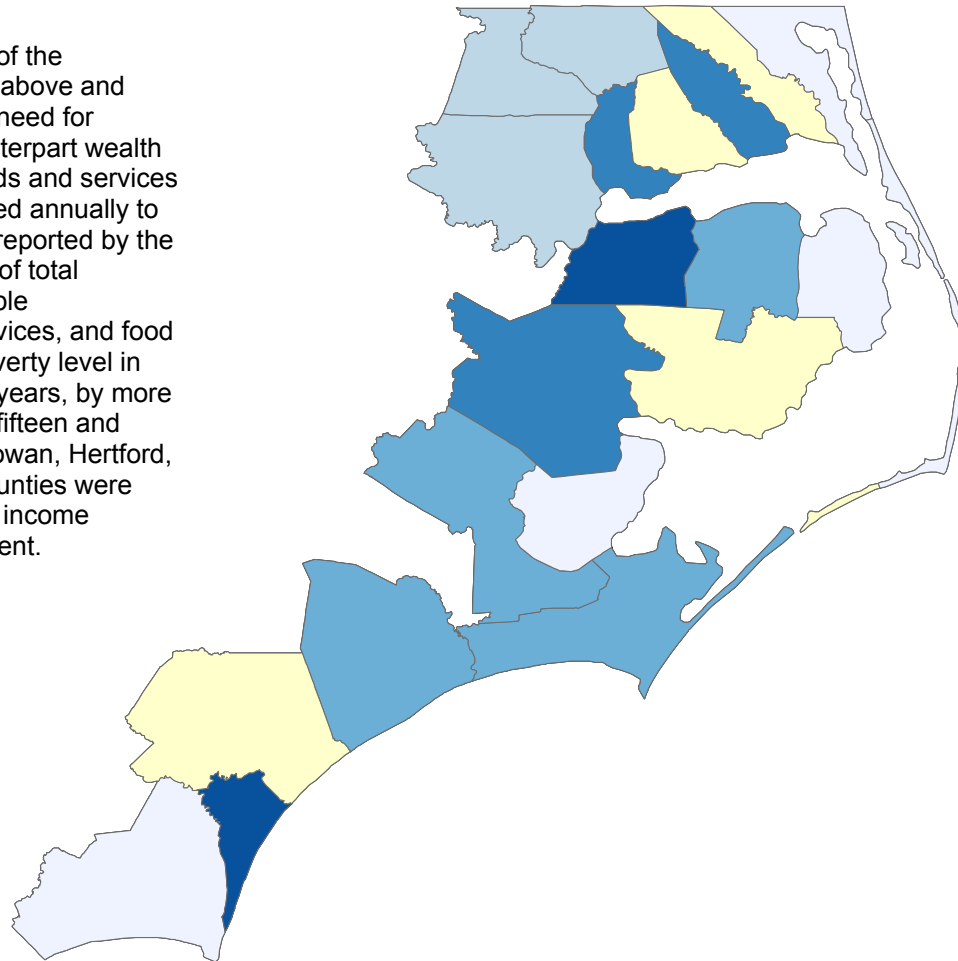
**Median Household Income** (converted to 1999 dollars using Consumer Price Index Inflation Calculator)

				
< \$25k	\$25k - \$30k	\$30k - \$35k	\$35k - \$40k	> \$40k

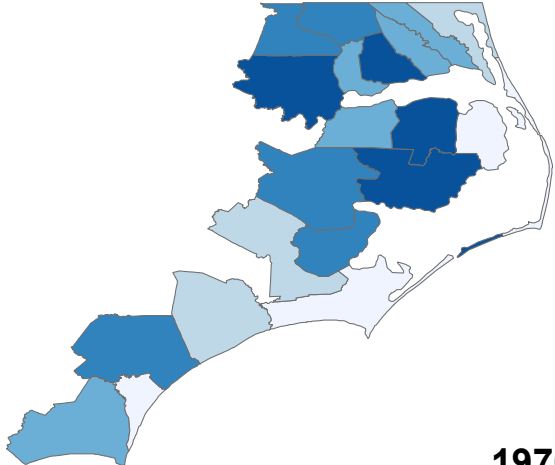
Source: US Census Bureau

## Poverty Status

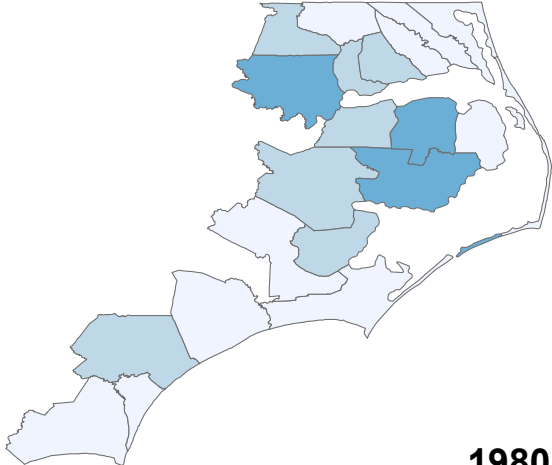
Poverty status is reported based upon measurement of the proportion of families within the total population living above and below the poverty level, which indicates the status of need for segments of a given community. Poverty and its counterpart wealth are indicators of the distribution of and access to goods and services including natural resources. Poverty levels are adjusted annually to accommodate changes in cost of living standards as reported by the Consumer Price Index. Fluctuations in the proportion of total population at poverty level suggest changes in available employment, affordable housing, adequate social services, and food programs. The percent of families living below the poverty level in coastal North Carolina has declined over the past 30 years, by more than twenty percent in all the counties. Still, between fifteen and twenty-five percent of families in Beaufort, Bertie, Chowan, Hertford, Pasquotank, Perquimans, Tyrell, and Washington Counties were living below the poverty level in 2000 (based on 1999 income figures). The 2000 state poverty status was 12.3 percent.



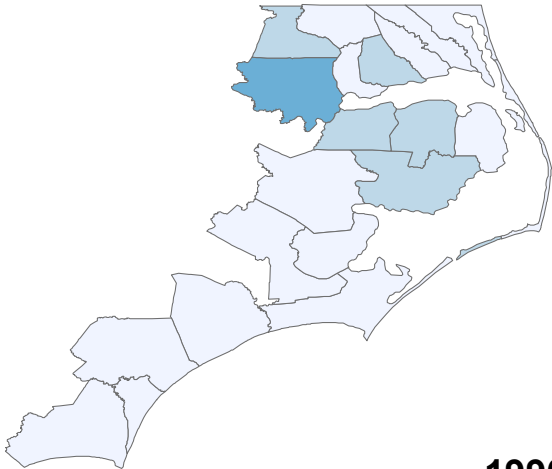
Source: US Census Bureau



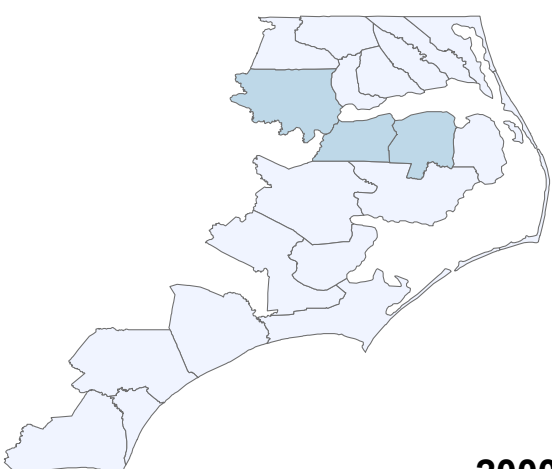
1970



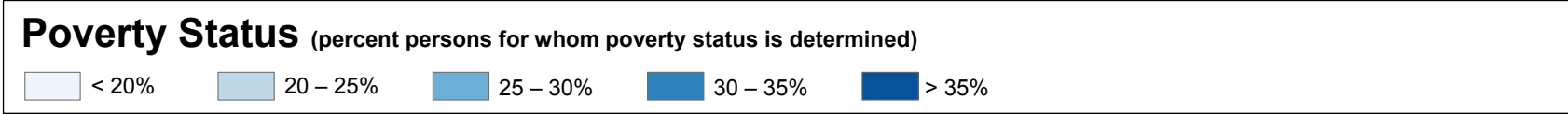
1980



1990



2000

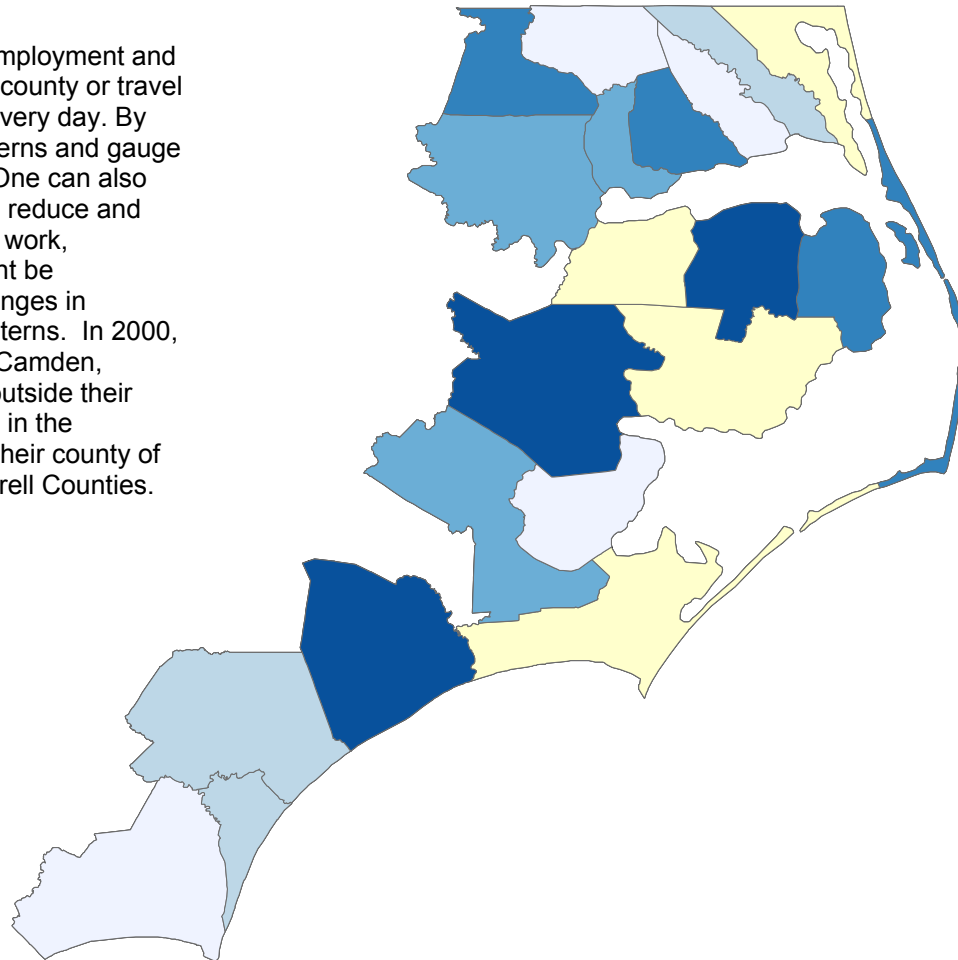


Source: US Census Bureau



## Place of Work

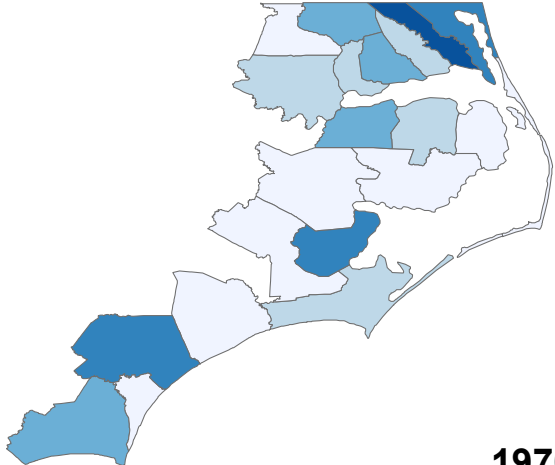
Place of work measures individuals' real location of employment and depicts whether residents work within their residence county or travel to other (for example, neighboring) counties to work every day. By measuring place of work, one can see commuter patterns and gauge the potential need for services such as mass transit. One can also gauge the level of commuter traffic mass transit could reduce and inform infrastructure planning. By examining place of work, additional topics associated with civil society that might be considered for analysis can be identified, such as changes in dominant industry, taxation, and economic growth patterns. In 2000, more than 45 percent of the working population from Camden, Pamlico, Pender, and Perquimans Counties worked outside their county of residence. From 1970 to 2000, the increase in the proportion of the working population working outside their county of residence was greatest for Beaufort, Onslow, and Tyrrell Counties.



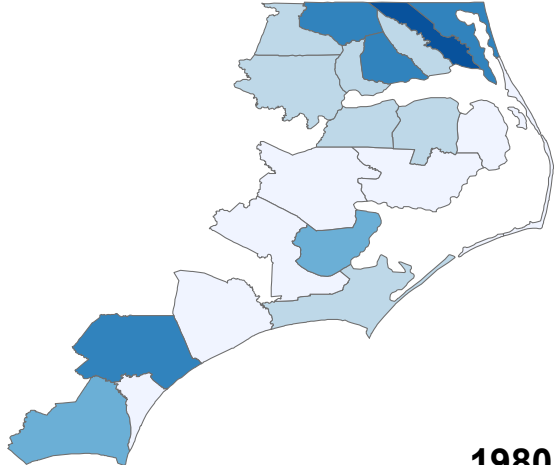
### Percent Change in the Proportion of Workers Employed Outside Their County of Residence, 1970 - 2000

< -28%    
  -28 - 147%    
  147 - 259%    
  259 - 309%    
  309 - 391%    
  > 391%

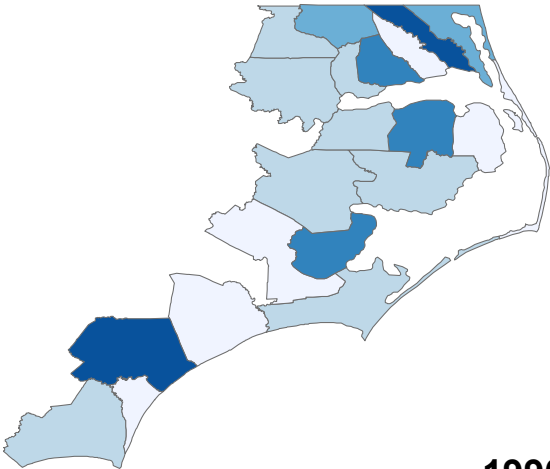
Source: US Census Bureau



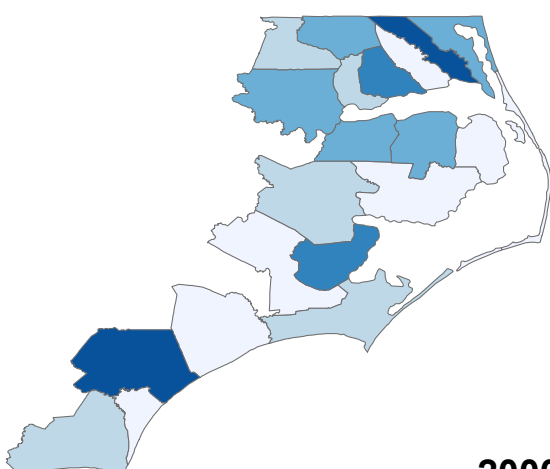
1970



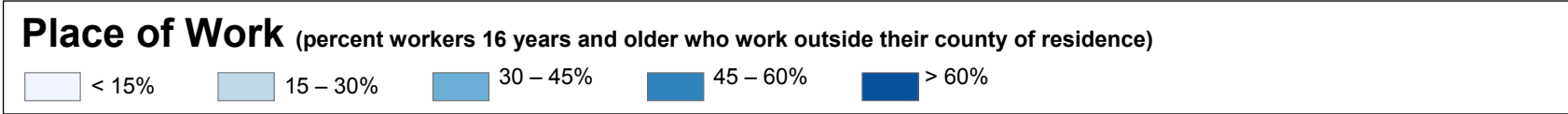
1980



1990



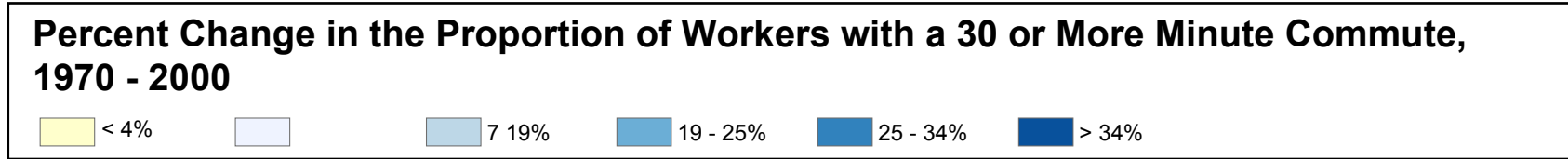
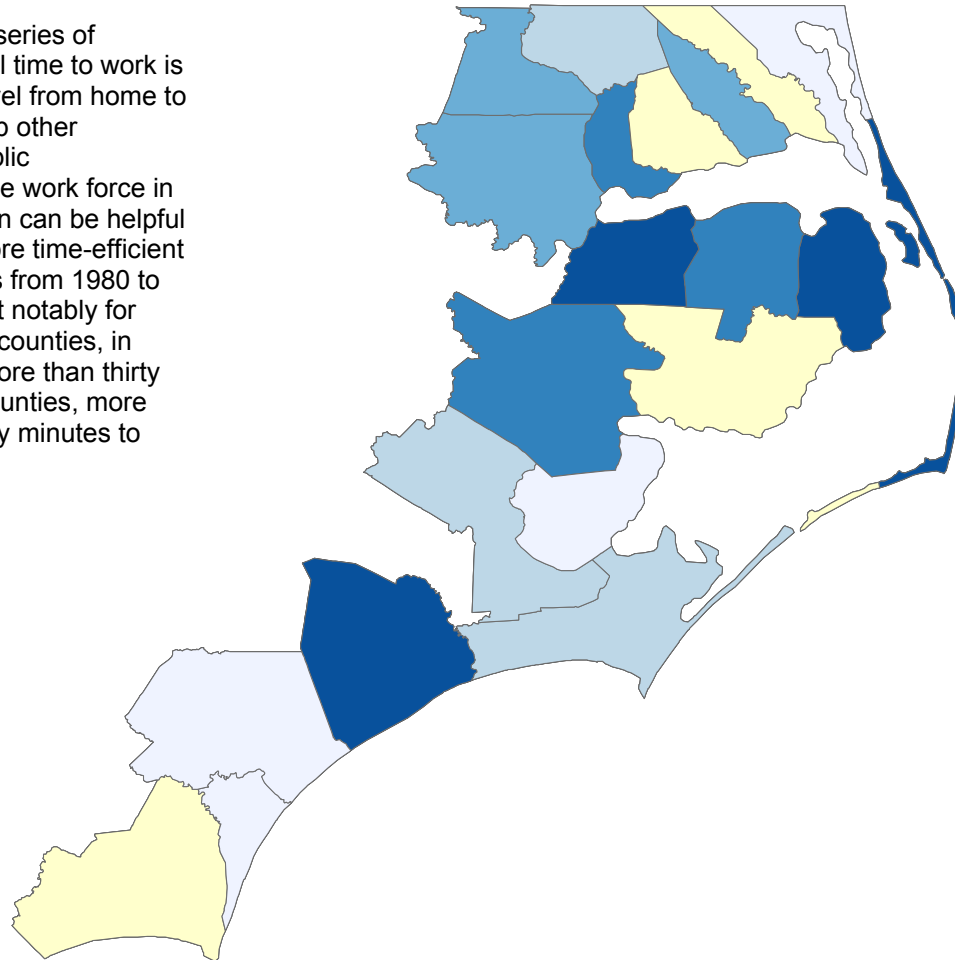
2000



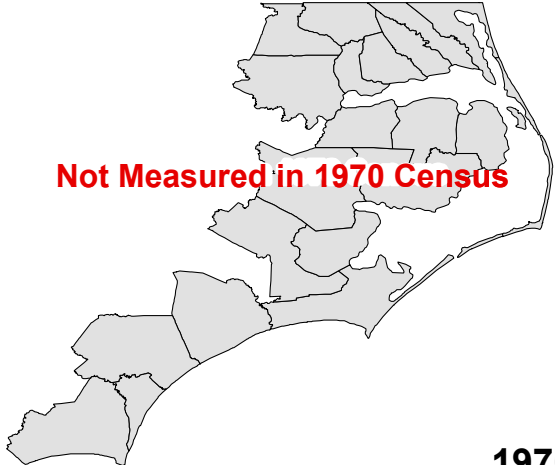
Source: US Census Bureau

## Travel Time to Work

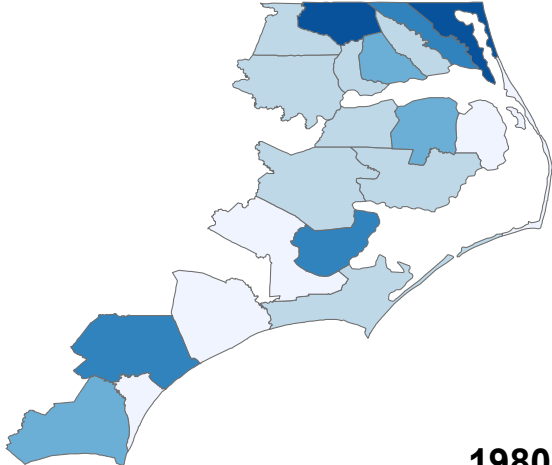
Travel time to work is part of the “Journey to Work” series of measurements conducted by the US Census. Travel time to work is the amount of time it normally takes a person to travel from home to the workplace, including waiting for traffic, picking up other passengers in carpools, parking, and waiting for public transportation. This indicator depicts the extent of the work force in terms of travel time for a given area. This information can be helpful for planners and municipal managers in creating more time-efficient travel routes or public transportation. Over the years from 1980 to 2000, travel time increased for all counties, but most notably for Dare, Onslow, and Washington Counties. For most counties, in 2000, fewer than fifty percent of workers required more than thirty minutes to travel to work. In Gates and Currituck Counties, more than fifty percent of workers traveled more than thirty minutes to work.



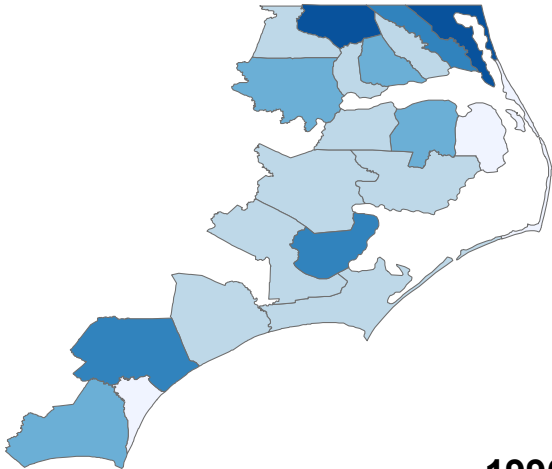
Source: US Census Bureau



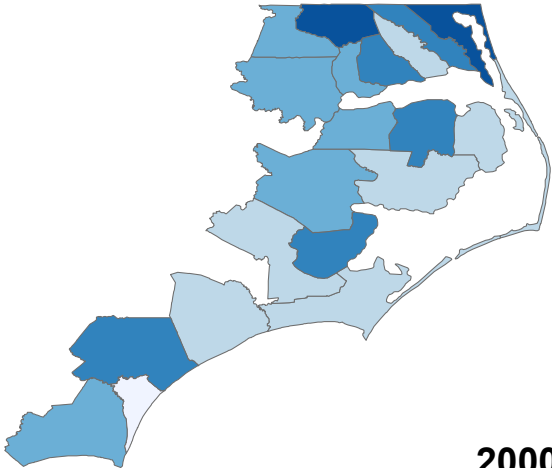
1970



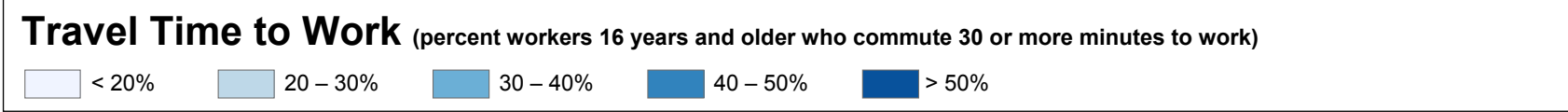
1980



1990



2000



Source: US Census Bureau

## VIRTUAL REGIONS

One of the central themes for the National Sea Grant Program is “Coastal Communities and Economies,” which focuses on the balance between maintaining and protecting environmental quality and fostering sustainable economic growth toward improved quality of life. Across the U.S., staff from state Sea Grant programs work to enhance coastal communities through partnerships, technical assistance, workshops, and technology transfer related to coastal population growth and “communities in transition,” “smart growth” and waterfront revitalization, and nonpoint source pollution.

While the level and breadth of knowledge and expertise within the Sea Grant community is extensive, there is presently no easy way to identify partners across the 30 Sea Grant programs to work together to address coastal development problems. At a smaller scale, variability in social changes across North Carolina’s coastal counties presents similar challenges related to location and availability of Sea Grant staff expertise and experience to address particular issues. This project looks at patterns of change to identify commonalities across variables and geographic areas to identify “virtual regions.” The virtual region concept and practice rely on thematic rather than geographic delineations; that is, the virtual region may consist of numerous counties with common issues and needs, but no common political boundaries.

The virtual region concept originated, and is currently practiced, in the form of cross-border networks of cities and trade markets to facilitate inter-municipal decision

making and exchange of experiences and information (Boisier 1993). For example, in central South America, the Mercociudades network, beginning with a membership of 11 cities in 1995, now comprises the common interests of 79 cities in Argentina, Bolivia, Chile, Paraguay, and Uruguay (URB-AL/INFO 2001). In the North Carolina project, virtual regions represent networks of constituent groups—cities, counties, or communities—based on common issues or needs arising from social changes in coastal counties. Identification of common issues across counties can aid Sea Grant staff in information exchange and program planning to address specific constituent needs.

Presentation of social change across coastal counties can confirm or dispel perceptions of change. Displaying data graphically enables decision makers to better discern changes in individual social indicators, visualize connections between multiple indicators, compare across time and space, and begin to establish communication networks for the exchange of information and expertise. This graphical component provides valuable information to inform management and planning decisions, outreach and education programming, and targeted delivery of technical assistance to meet constituents’ needs.



**VIRTUAL REGION 1 –  
Currituck, Dare, Hyde,  
and Carteret Counties**

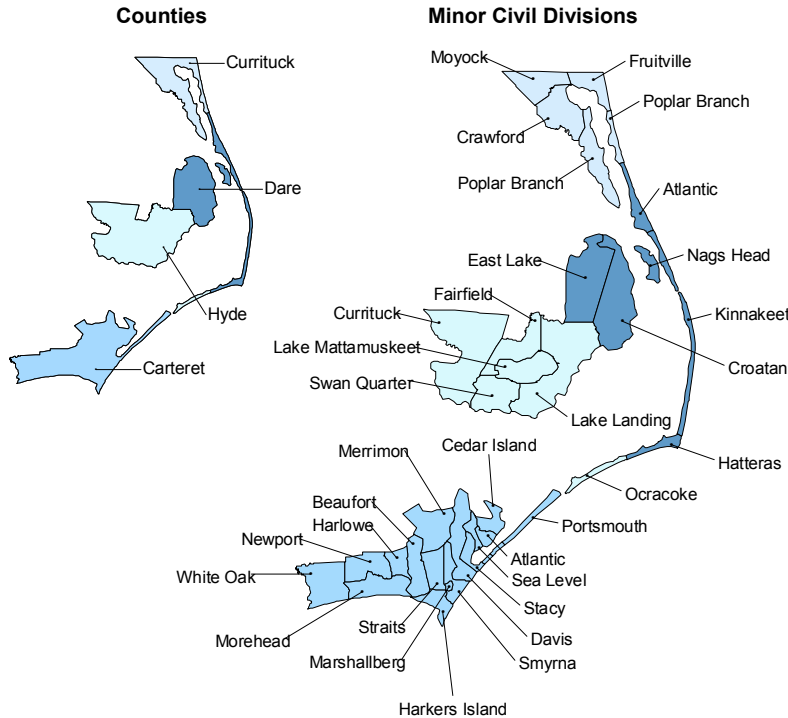
This case study profiles social changes occurring from 1990 to 2000 for four North Carolina coastal counties—Currituck, Dare, Hyde, and Carteret Counties. These four counties comprise a virtual region based on their similar physical characteristics (that is, mainland components and large barrier island complexes), high proportions of seasonal homes, and high median housing values. These commonalities led to further comparisons at the sub-county level (Figure 1.1) to ascertain whether similar patterns of change existed for other related social indicators, such as population density, age, total housing units, and housing affordability. Land cover change (that is, loss of acreage in select land cover classifications) was also measured for barrier island components of each county.

The examples included in this case study demonstrate how closer review of specific attributes can confirm or dispel assumptions regarding relationships between various social indicators, and help identify patterns of change across geographic areas. Looking at age and population density revealed that the increase in total

housing units did not necessarily track with increases in retirement aged individuals and increased numbers of permanent residents, possibly attributable to nonresident property ownership.

**Population Density**

Population density increased from 1990 to 2000 by more than 25 percent in three Currituck County sub-divisions—Moyock, Fruitville, and Poplar Branch (Figure 1.2). Population density increased at a similar level in two

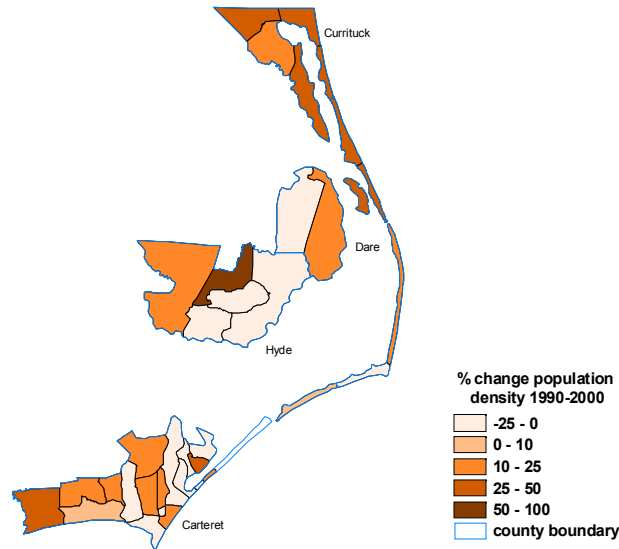


**Figure 1.1. Virtual Region 1: Currituck, Dare, Hyde, and Carteret Counties and sub-county minor civil divisions.**

Carteret County sub-divisions—White Oak and Atlantic—and in Atlantic and Nags Head county sub-divisions in Dare County. Population density in the Hyde County sub-division of Fairfield increased by more than 50 percent over the same period.

**Total Housing Units**

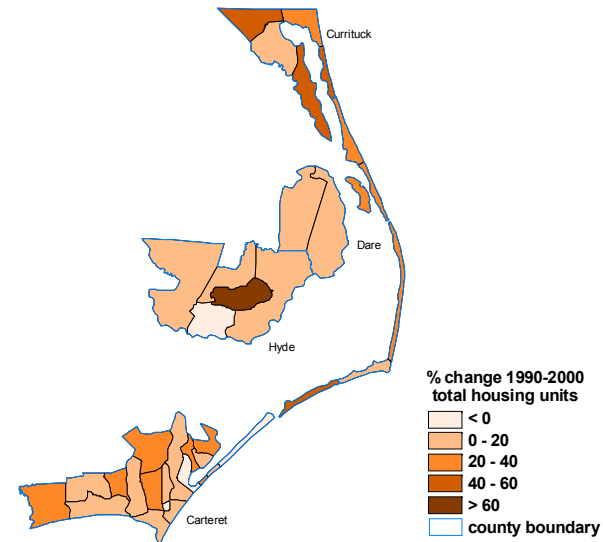
The percent increase in total housing units from 1990 to 2000 was highest in Hyde County’s Lake Mattamuskeet sub-division (greater than 60 percent), followed by moderately high (40-60 percent) increases in Ocracoke in



**Figure 1.2. Virtual Region 1: Change in population density, 1990-2000.**

Hyde County and Mayock and Poplar Branch in Currituck County. Moderate increases (20-40 percent) occurred in

Fruitville in Currituck County, Atlantic, Nags Head, and Kinnakeet in Dare County, and White Oak, Merrimon, Harlowe, Straits, Sea Level, and Cedar Island in Carteret County. While these numbers do not correspond directly to the increases in population density depicted above for all areas shown, they do correspond closely to increases in seasonal homes and median housing values measured for many of these counties’ minor civil divisions.



**Figure 1.3. Virtual Region 1: Change in total housing units, 1990-2000.**

**Median Housing Age**

In areas with little new residential development, median housing age will increase (that is, homes will get older) with each decadal census. In areas with a substantial

influx of new residential development, median housing age will decrease decade to decade as newer homes are added to the calculation. In the four counties included in this virtual region, the median housing age decreased in several sub-county minor civil divisions, suggesting the addition of new homes. In Currituck County, this was the case in Mayock, Fruitville, and Poplar Branch. In Hyde County, median housing age decreased in Lake Mamuskeet, Fairfield, Lake Landing, and Ocracoke. In Carteret County, median housing age decreased in Portsmouth, Merrimon, Marshallberg, Davis, and Stacy. Median housing aged increased in all Dare County minor civil divisions.

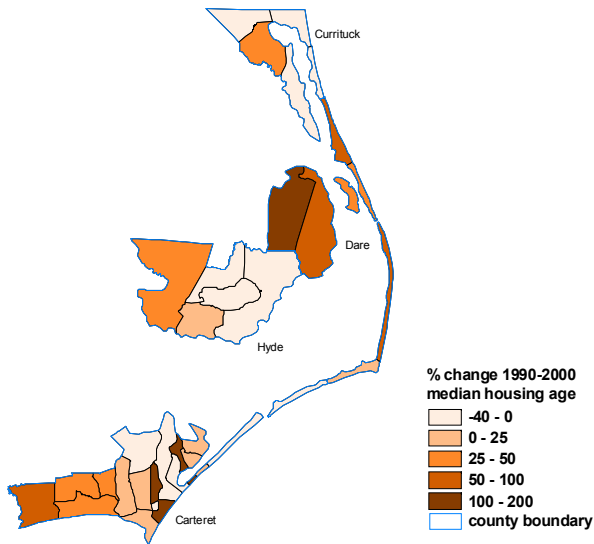


Figure 1.4. Virtual Region 1: Change in median housing age, 1990-2000.

### Median Household Income

Median household income was compared to median housing value (both adjusted to 1999 dollar) to determine changes in housing affordability from 1990 to 2000 and to compare differences between the mainland portions of each county and their barrier island counterparts. Median household income was highest for people living on barrier islands in all counties.

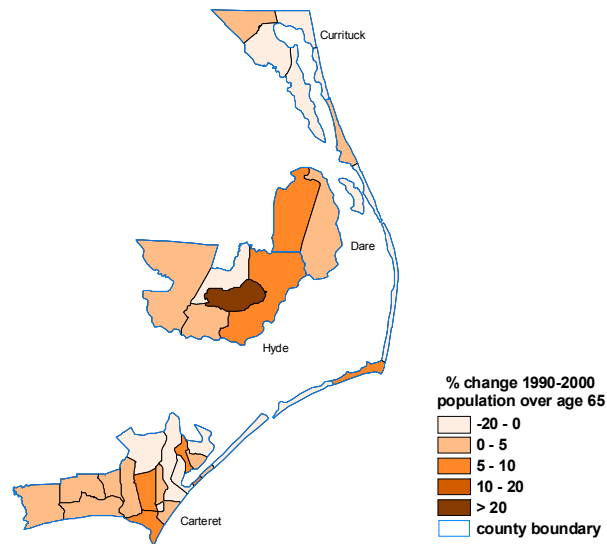


Figure 1.5. Virtual Region 1: Change in median household income, 1990-2000.

### Seasonal Homes

The increases in seasonal homes from 1990 to 2000 were highest for Ocracoke in Hyde County, Nags Head and Kinnakeet in Dare County, Poplar Branch in Currituck County, and Cedar Island and Sea Level in



Carteret County. Atlantic and Hatteras in Dare County experienced increases in seasonal homes of between 10 and 20 percent, as did several more inland areas.

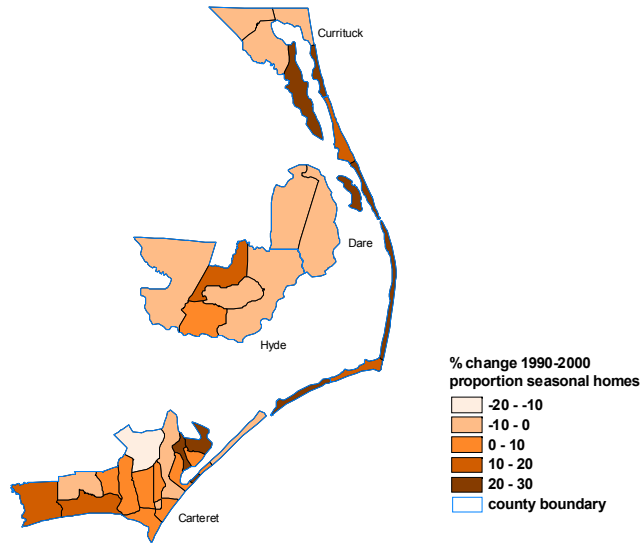


Figure 1.6. Virtual Region 1: Increase in seasonal homes, 1990-2000.

### Median Housing Value

Several of the highest median housing values, for both 1990 and 2000 (adjusted to 1999 dollars), were in minor civil divisions on the barrier islands, such as Atlantic and Hatteras in Dare County and Ocracoke in Hyde County. Median housing values were also moderately high in other minor civil divisions in Dare and Currituck Counties. Several of these areas also experienced some of the highest percent increases in residential and seasonal home development during the 1990s.

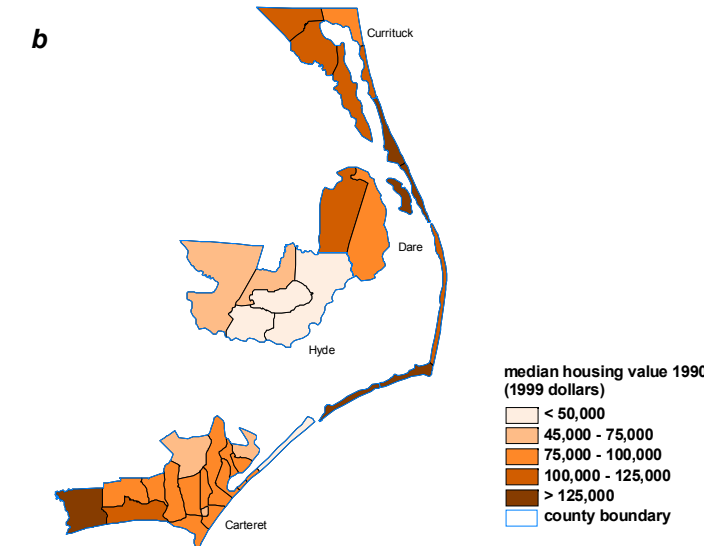
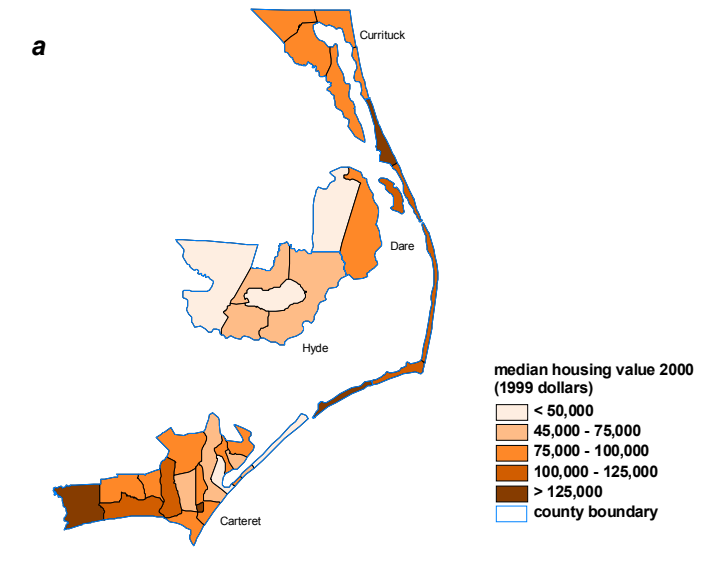


Figure 1.7. Virtual Region 1: Median housing value in (a) 1990 and (b) 2000 (dollars adjusted to 1999 dollars for comparison).

Comparisons of median household income with median gross rent and median housing value suggest that housing affordability—using a traditional lender rule of thumb, maximum of 30 percent gross monthly household income toward housing costs, and an 80 percent home value mortgage for 30 years at 6 percent interest—is decreasing for several of the barrier island minor civil divisions.

### Age

With the influx of seasonal homes and high value housing in these four counties, especially along the Atlantic Ocean, a possible relationship between the segment of the population over age 65 was considered to check for similar patterns of change. The increase in the proportion of the population over age 65 was highest in Hyde County’s Lake Mattamuskeet minor civil division (greater than 20 percent). Large increases in retirement aged individuals did not occur in the barrier islands where a substantial increase in housing development occurred. In fact, the percent change from 1990 to 2000 for most of the barrier islands was negative—that is, a decline in the proportion of the population over the age of 65. This could be attributable to the fact that even in light of new residential development, much of the development is for second or seasonal homes and population characteristics of nonresident property owners are not measured by the Census at the local level.

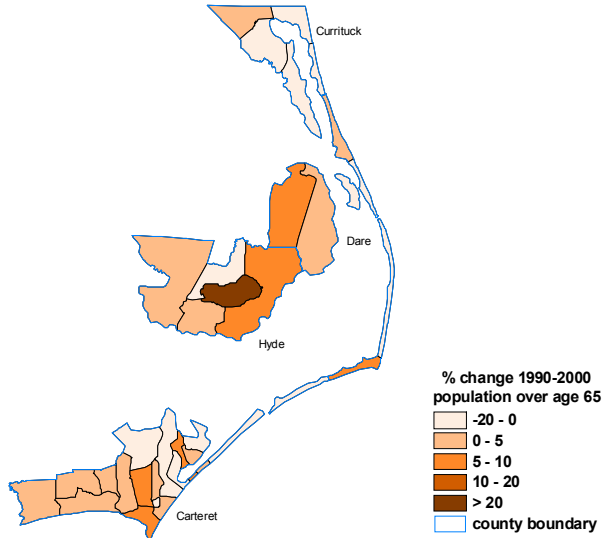
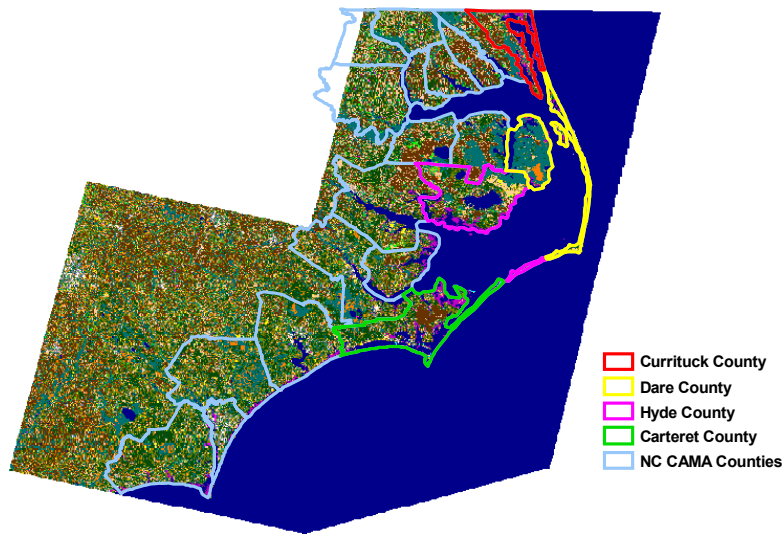


Figure 1.7. Virtual Region 1: Percent change in the proportion of the population over the age of 65, 1990-2000.

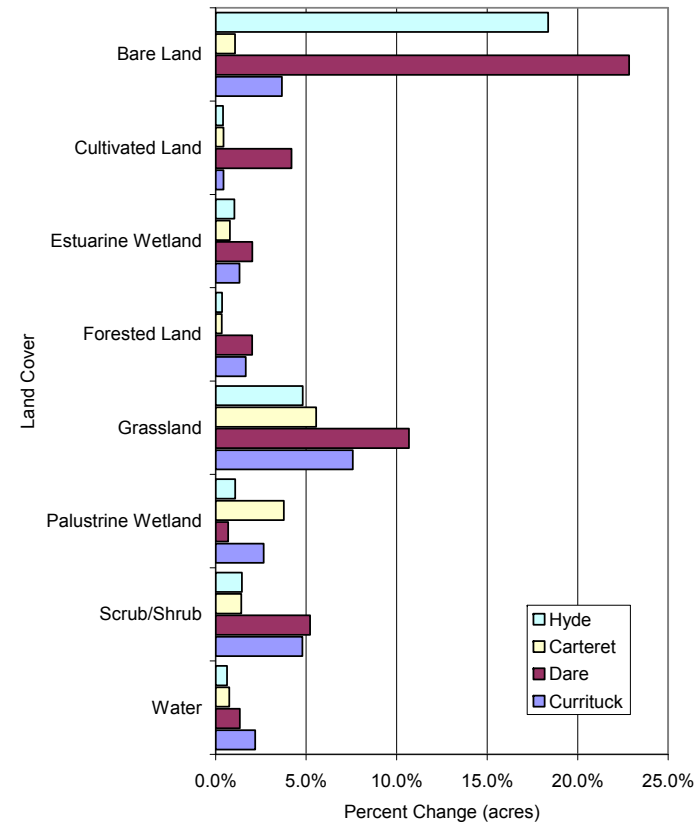
### Land Cover Change

Landscape changes associated with population increases include loss of habitat, conversion of open space, increases in impervious surface, and altered appearances and aesthetics. Land cover change was considered for the four counties to assess roughly the changes in particular land cover classes during the 1990s. Satellite images (30 meter resolution) from 1991 and 1997 (Figure 1.8) from NOAA’s Coastal Change Analysis Program were used to determine land cover losses for each of the four counties.

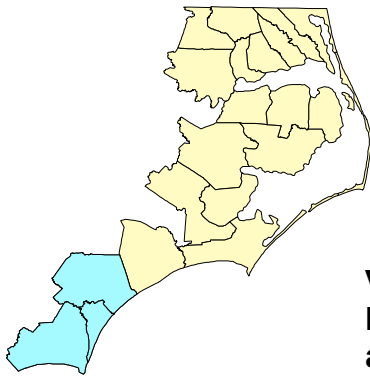


**Figure 1.8. Satellite land cover image (1997) of North Carolina coastal counties. (Source: NOAA Coastal Change Analysis Program)**

The largest proportion of land cover losses were quantified for bare land, grassland, and scrub/shrub cover types (Figure 1.9). Grassland and scrub/shrub cover types are often located on barrier islands in these counties on the upland or landward portion of beach dunes. Barrier island residential development is largely constrained by oceanic beach and dune systems and lagoon-side marshlands. While further investigation is warranted, a potential link between beach dune residential development and particular land cover losses should be considered.



**Figure 1.9. Percent land cover change (loss) 1991 to 1997 in Currituck, Dare, Hyde, and Carteret Counties.**

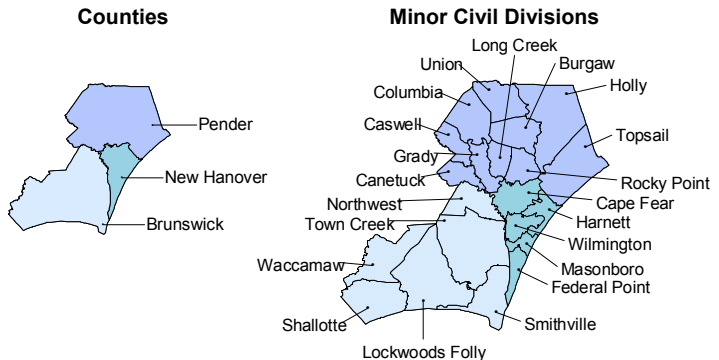


**VIRTUAL REGION 2 –  
Pender, New Hanover,  
and Brunswick Counties**

This case study profiles social changes occurring from 1990 to 2000 for three North Carolina coastal counties—Pender, New Hanover, and Brunswick (Figure 2.1). These three counties comprise a virtual region based on similar characteristics related to population growth and residential development, which prompted additional review of characteristics related to the work force population. These three counties are the southernmost on the North Carolina coast. New Hanover County contains North Carolina’s only coastal urban center, Wilmington. The tourism destination city of Myrtle Beach, South Carolina, lies just south of the North Carolina border.

This case study reviewed patterns of change related to increased population and residential development in Pender, New Hanover, and Brunswick Counties. Review of indicators related to increased workforce population, travel time to work, working outside of the county of residence, and increases in the Hispanic proportion of the population all showed relatively little relationship to

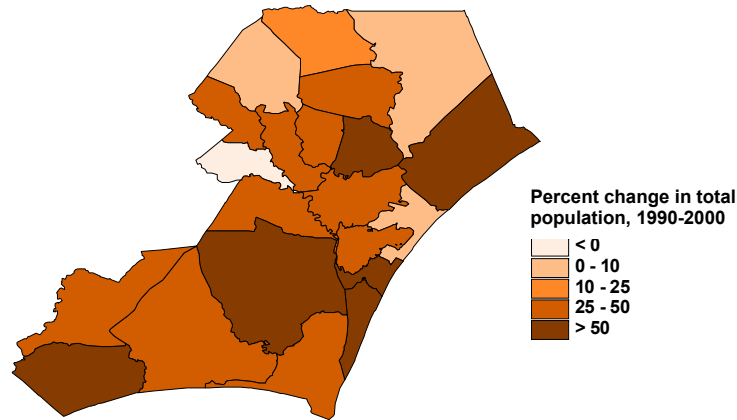
the growth of the greater Wilmington area. Some growth could likely be attributable to other population and employment centers (for example, North Myrtle Beach, Camp LeJeune Marine Base).



**Figure 2.1. Virtual Region 2: Pender, New Hanover, and Brunswick Counties and sub-county minor civil divisions.**

**Total Population**

The areas with the highest percent population increase (that is, greater than 50 percent) from 1990 to 2000 included three minor civil divisions near Wilmington, Masonboro and Federal Point in New Hanover County, and Town Creek in Brunswick County. Additional areas exhibiting substantial growth were Rocky Point and Topsail in Pender County and Shallotte in Brunswick County. All other minor civil divisions from the South Carolina border northward and surrounding Wilmington, except Harnett in Pender County, exhibited population increases of 25-50 percent.

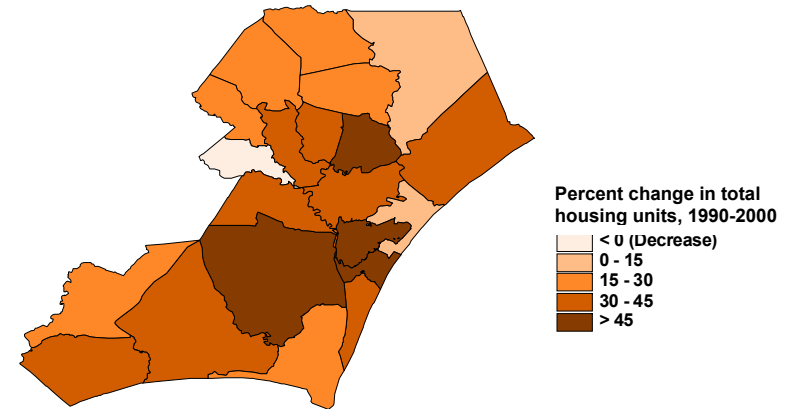


**Figure 2.2. Virtual Region 2: Percent change in total population, 1990-2000.**

**Total Housing Units**

Increases in total housing units indicate residential development and are reflective of population growth. The highest increases in total housing units from 1990 to 2000 (that is, greater than 45 percent) were for the minor civil divisions of Wilmington and Masonboro in New Hanover County, Town Creek in Brunswick County, and Rocky Point in Pender County. Most areas adjacent to these four county subdivisions exhibited total housing unit increases of 30-45 percent. Increases in residential development in areas at the northern and southern end of this virtual region—Topsail in Pender County and Smithville in Brunswick County—were potentially influenced by Camp LeJeune Marine Base and North Myrtle Beach, South Carolina, respectively. This phenomenon of relatively high increases in residential

development prompted further inquiry into workforce characteristics and commuting (“journey to work”) patterns.



**Figure 2.3. Virtual Region 2: Percent change in total housing units, 1990-2000.**

**Adult Workforce Population**

Age, as an indicator, can be used in several different ways to learn about different facets of social change. Looking at the age distribution of people in these three counties, one can determine whether the adult workforce population (that is, people 18-64 years old) is growing or shrinking. This, in turn, can be indicative of increasing employment opportunities and the need for housing, transportation, and associated infrastructure. The greatest increases in workforce population were in Long Creek, Canetuck, and Grady in Pender County. However, the remaining 18 minor civil divisions that comprise this virtual region exhibited workforce population increases of 6 percent or less.

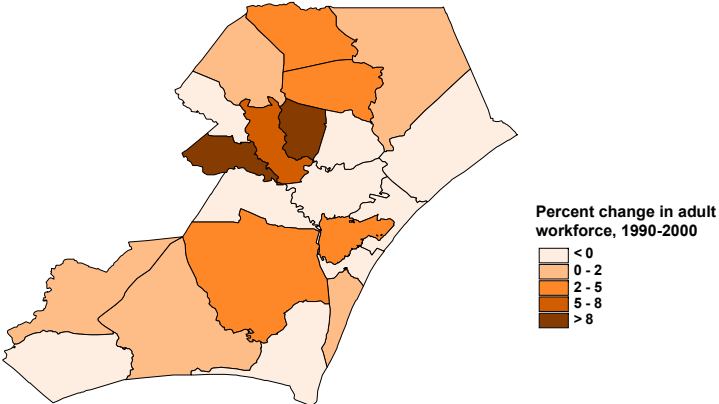


Figure 2.4. Virtual Region 2: Percent change in adult workforce population (ages 18-64), 1990-2000.

Travel Time to Work

Travel time to work can indicate to what extent the workforce travels out of their community (based on amount of time traveled) to work on a daily basis, no matter the means of travel. Changes in the travel time to work can suggest an increase in the number of workers who travel more than 30 minutes to work or, similarly, it can indicate a workforce moving out of the urban center. Additionally, it can be indicative of transportation networks operating in excess of intended capacity. Further investigations would be needed to corroborate the true nature of increasing percent of the workforce traveling more than 30 minutes to work.

The minor civil division with the greatest increase from 1990 to 2000 in the percent of workers traveling more than 30 minutes to work was Canetuck in Pender County. Two other areas in Pender County, Caswell and Grady,

exhibited increases of 4-8 percent. The 18 remaining areas had increases of 4 percent or less. This suggests that most workers were not traveling far from home to work.

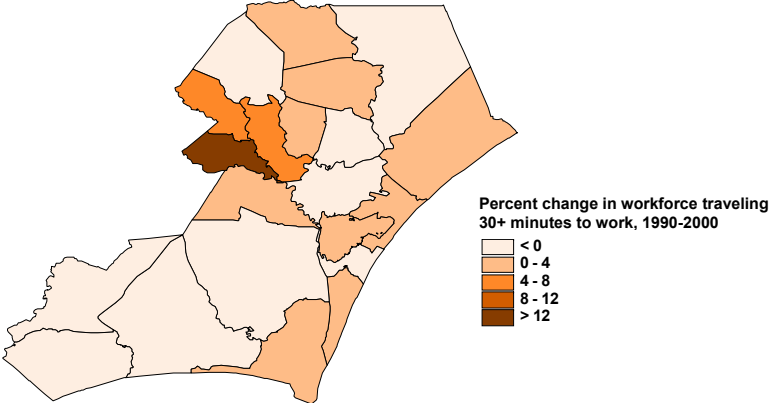
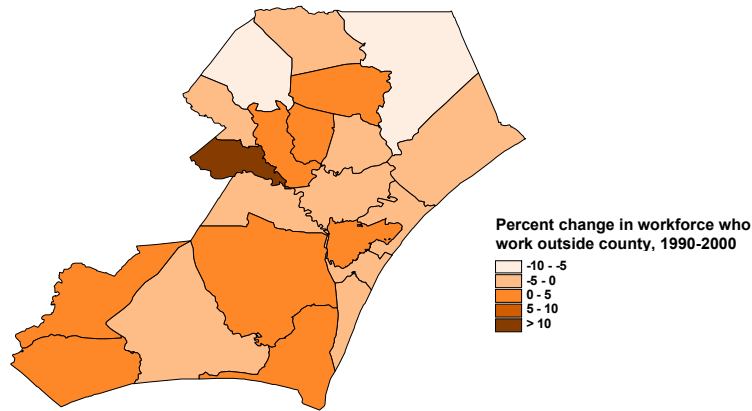


Figure 2.5. Virtual Region 2: Percent change in workforce traveling more than 30 minutes to work, 1990-2000.

Place of Work

Another useful indicator for characterizing the workforce, which is related to travel time, is place of work. Place of work can be used to indicate whether people work in their own home, work nearby, or travel outside of their community of residence (also place, county, or state) to their place of business. The greatest change in the percent of workers who work outside their county of residence was once again in Canetuck in Pender County.

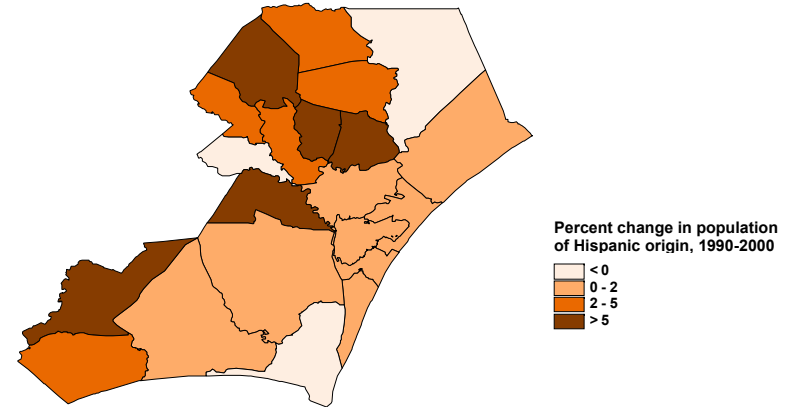


**Figure 2.6. Virtual Region 2: Percent change in workforce who work outside their county of residence, 1990-2000.**

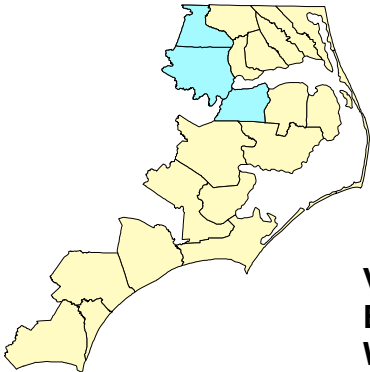
### Population of Hispanic Origin

As more people move into areas to take service and wage labor jobs, one assumption is that there is an associated increase in migrant labor and international laborers. Of interest for community development and educational programming is how population demographics are changing. Measuring changes in the proportions of the population from different ethnic and linguistic backgrounds can identify needs for programming for diverse and special needs audiences. The areas with the greatest increases (that is, greater than 6 percent) in the proportion of the population from Hispanic origin were the internal minor civil divisions of Rocky Point, Long Creek, and Columbia, in Pender County, and Northwest and Waccamaw, in Brunswick

County. Overall, the increases were relatively small, especially given that the proportion of the population in each of the three counties was 4 percent or less in 2000 and 2 percent or less in 1990.



**Figure 2.7. Virtual Region 2: Percent change in population of Hispanic origin, 1990-2000.**

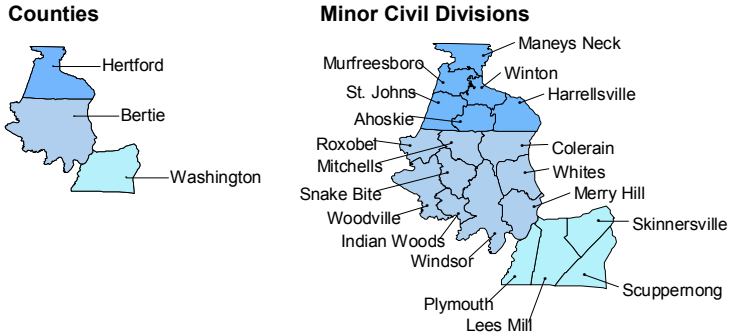


**VIRTUAL REGION 3 – Bertie, Hertford, and Washington Counties**

This case study profiles social changes occurring from 1970 to 2000 for three northern North Carolina coastal counties—Hertford, Bertie, and Washington (Figure 3.1). These three counties comprise a virtual region based on similar characteristics related to population decline over the past 30 years, which prompted additional review of characteristics related to changes in the dominant industries and work force characteristics. These three counties are located at the northeastern end of the 20 CAMA counties. Bertie and Washington counties lie at the eastern end of the Albemarle Sound.

This case study reviewed patterns of change related to declining populations in Hertford, Bertie, and Washington Counties in northeastern North Carolina. Review of population data for 1970 through 2000 revealed a general and slight downward trend over the past 30 years. Manufacturing had been the dominant industry over the past 30 years, with the exception of Hertford County, which had retail industry in the 1970s, followed by manufacturing, and has now moved to educational, health, and social services as its dominant industry.

Review of indicators related to declining employment in resource-dependent industries—forestry, farming, fishing—showed a decline in the proportion of the workforce employed in these occupations in the past 20 years. The proportion of the workforce who travel outside their county of residence is fairly high at 39, 24, and 32 percent for Bertie, Hertford, and Washington Counties, respectively.



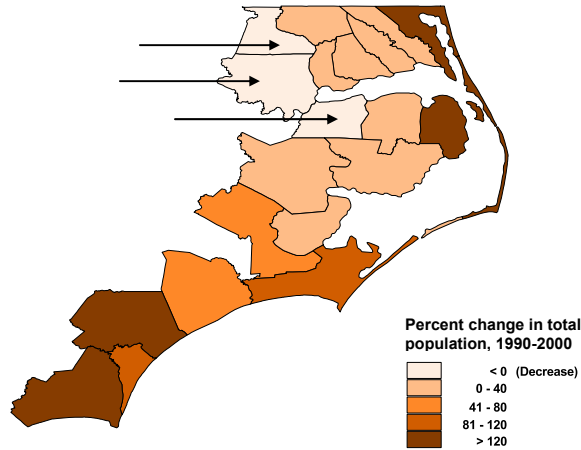
**Figure 3.1. Virtual Region 3: Percent change in workforce who work outside their county of residence, 1990-2000.**

**Total Population**

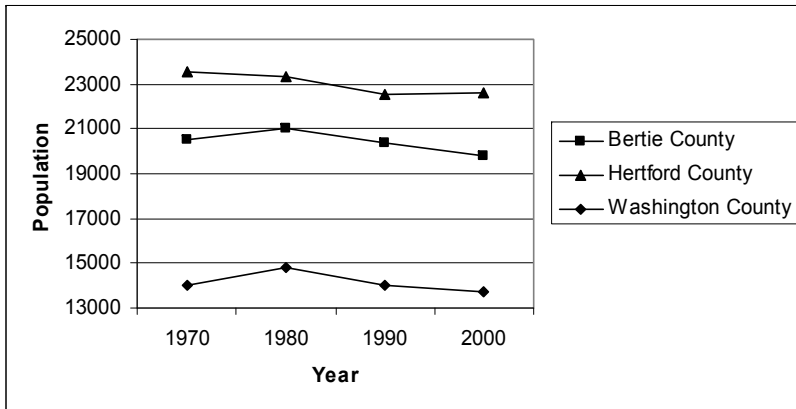
The populations of Hertford, Bertie, and Washington Counties have exhibited a declining population trend over the past four decadal U.S. Censuses (Figure 3.2). Bertie and Washington Counties' populations grew slightly (2 percent and 5 percent, respectively) from 1970 to 1980, but declined in each subsequent decade. Hertford County's population declined from 1970 to 1980 and again from 1980 to 1990, but increased slightly (that is, less than one percent) from 1990 to 2000. Hertford County's 2000 population was 2 percent lower than its



1970 population (Figures 3.2 and 3.3). The 2000 total populations for Hertford, Bertie, and Washington Counties were 19,773, 22,601, and 13,723 respectively.



**Figure 3.2. Virtual Region 3: Percent change in total population, 1970-2000.**



**Figure 3.3. Virtual Region 3: Total population, 1970-2000.**

### Dominant Industry

The dominant industries for Bertie and Washington Counties have remained relatively constant over the past 30 years, both focusing on manufacturing (Table 3.1). Hertford County’s dominant industry has changed from wholesale and retail trade in 1970, to manufacturing in 1980, back to wholesale and retail trade in 1990, then to educational, health, and social services.

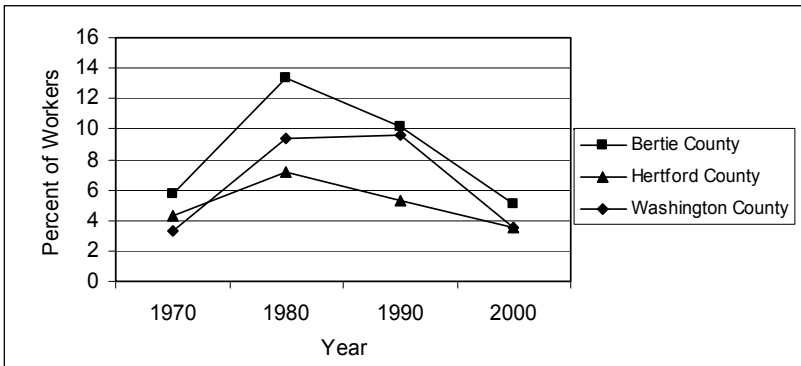
**Table 3.1. Virtual Region 3: Dominant industries, 1970-2000.**

County	1970	1980	1990	2000
Bertie	Manufacturing Non-Durable Goods	Manufacturing Non-Durable Goods	Manufacturing Non-Durable Goods	Manufacturing
Hertford	Wholesale and Retail Trade	Manufacturing Durable Goods	Wholesale and Retail Trade	Educational; health and social services
Washington	Manufacturing Durable Goods	Manufacturing Non-Durable Goods	Manufacturing Non-Durable Goods	Manufacturing

### Resource-dependent Occupations

One area of interest related to the loss of population over time is the percent of the workforce employed in resource-dependent occupations—forestry, farming, and fishing. All three counties experienced an increase in the proportion of the workforce employed in forestry, farming, and fishing between 1970 and 1980. In Washington County, the proportion of the workforce continued to rise slightly from 1980 to 1990, then as in Bertie and Hertford Counties, the proportion of the workforce employed in forestry, farming, and fishing occupations declined to near 1970 levels. Although the proportion of the

workforce was generally less than ten percent, the decline in positions from 1980 on could imply outmigration to seek similar work elsewhere.

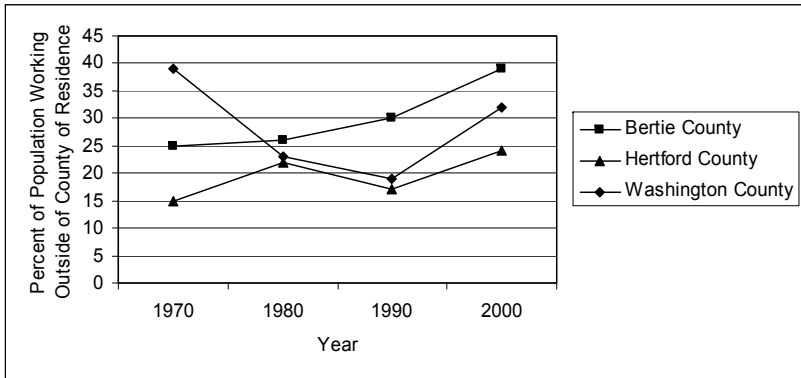


**Figure 3.4. Virtual Region 3: Percent of workforce employed in forestry, farming, or fishing occupations, 1970-2000.**

**Place of Work**

Loss of resident population and loss of resource-dependent occupations can be related to employment mobility in terms of working outside one’s place of residence. Beginning in 1970, 25 percent of Bertie County residents worked outside their county of residence. The proportion of the Bertie County workforce working outside the county has steadily increased each decade since then, to 39 percent in 2000. Nearly 40 percent of the workforce in Washington County worked outside their county of residence in 1970. The proportion of the Washington County workforce that worked outside the county declined in 1980 and again in 1990, but rose to 32 percent again in 2000. Only 15 percent of the Hertford County workforce worked outside their county of residence in 1970. This proportion rose to 22 percent in

1980, declined to 17 percent in 1990, and rose again to 24 percent in 2000. An appreciable segment of North Carolina’s northern tier counties travel out of state to Virginia daily for work. Place of work “outside your state of residence” is another indicator that could be reviewed to ascertain the proportion of the workforce leaving the state for employment.



**Figure 3.5. Virtual Region 3: Percent of workforce working outside their county of residence, 1970-2000.**

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