Chapter 16
Community Changes and Challenges
-Population Growth, Land Use, Development and Water Quality

16.1 Our Changing Waterfronts and Loss of Public Access

Waterfronts in North Carolina are changing. Historic landmarks for those that have been born and raised on the waterfronts are disappearing; as are fish houses and fishing fleets. These historic uses of waterfronts are being replaced with "urban waterfronts". Many waterfronts are redeveloping into waterfronts more like Wilmington's waterfront – the state's only designated "urban waterfront". Redevelopment projects on historically working waterfronts include activities such as restaurants, condominiums and mixed-use buildings. Fishing fleets are being replaced by yachts, charter boats or sport fishing boats. Even smaller coastal communities are feeling the brunt of coastal redevelopment for residences and businesses near the water. While land closest to the ocean has seen the first wave of development, the second and third waves of development on the sound and tidal creeks are already here.

Loss of Access to Public Use of Coastal Waters
North Carolina citizens and elected officials are concerned about the loss of working waterfronts, as fewer marinas and fishing piers are available for public access. The North Carolina Marine Fisheries Commission (MFC) passed a resolution asking that state leaders "recognize the vital importance of public access to State estuarine and marine fisheries and waters". As a result a Waterfront Access Study Committee was created to study the degree of loss and potential loss of the diversity of uses along the North Carolina coastal shoreline, and how these losses impact access to the public trust waters of the state. The Committee asks for the cooperation of municipalities, public agencies, resource and facility-development granting entities, coastal developers, businesses, and other coastal resource users to recognize and integrate enhanced waterfront-use diversity and increased public access as beneficial factors and/or criteria in their decision making. The Committee supports the use of limited public funds to achieve enhanced water quality, protection of natural and cultural/maritime heritage sites and resources, and maintaining or advancing waterfront-use diversity and public access. A final committee report is available online at: *www.ncseagrant.org/waterfronts*. The General Assembly created the Watershed Access and Marine Industry Fund to address some of the issues identified by the Waterfront Access Study Committee. There were 13 sites selected by Division of Marine Fisheries to receive the $20 million allocated to the fund in its first year.

16.2 Population Growth and Development

North Carolina's coastal counties are some of the fastest growing areas in the state and the associated development is impacting water quality. Four of the 18 counties in the basin are expected to experience growth rates in excess of thirty-five percent by 2020 (Table 49; Figure 38). As the counties in the Neuse River basin continue to grow there will likely be a loss of natural areas and an increase in the amount of impervious surface associated with new homes and businesses. Impacts are quickly felt with population increases resulting in an increase in runoff

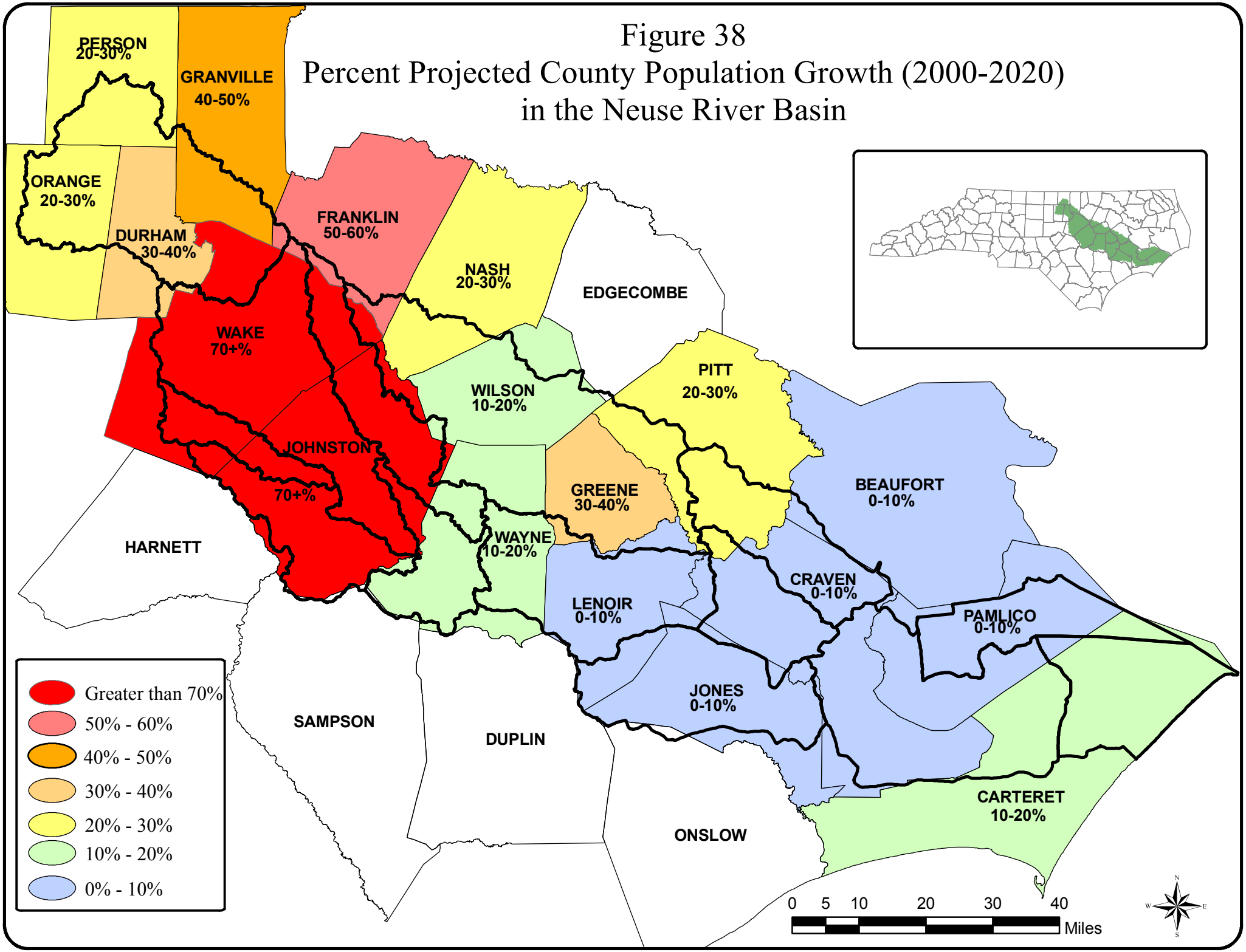


Figure 38
Percent Projected County Population Growth (2000-2020)
in the Neuse River Basin
PERSON
20-30%
GRANVILLE
40-50%
ORANGE
20-30%
DURHAM
30-40%
FRANKLIN
50-60%
NASH
20-30%
EDGECOMBE
WAKE
70+%
WILSON
10-20%
PITT
20-30%
JOHNSTON
70+%
GREENE
30-40%
BEAUFORT
0-10%
HARNETT
WAYNE
10-20%
CRAVEN
0-10%
LENOIR
0-10%
PAMLICO
0-10%
JONES
0-10%
SAMPSON
DUPLIN
CARTERET
10-20%
ONSLOW
Greater than 70%
50% - 60%
40% - 50%
30% - 40%
20% - 30%
10% - 20%
0% - 10%
0 5 10 20 30 40
Miles

from roads and new developments, increase in wastewater treatment options, a change in the shoreline fronts from fish houses to condominiums, reduced public access to waterfronts, beach closures and a decline in our freshwater, estuarine and marine resources. Between 2003-2006, DEH Recreational Water Quality Monitoring Program in the Neuse Basin reported 367 postings of beach closure days.

County population data present projected county growth estimates based on Office of State Planning information (June and September 2004) (Table 49). Counties with the highest expected growth are associated with the largest municipal areas and the most densely populated subbasins in the basin.

Table 49 County Population and Growth Estimates

County	% County in the Basin	County Population in 1990	County Population in 2000	% Growth 1990-2000	Estimated Population for 2020	Estimated % Growth 2000-2020
Beaufort	2	42,283	44,958	6.3	49,046	9.1
Carteret	50	52,407	59,383	13.3	69,000	16.2
Craven	95	81,812	91,523	11.9	96,449	5.4
Durham	73	181,844	223,318	28.3	297,461	27.5
Franklin	10	36,414	47,260	29.8	73,037	54.5
Granville	25	38,341	48,498	26.5	69,054	42.39
Greene	100	15,384	18,974	23.3	24,892	31.19
Johnston	98	81,306	121,900	49.9	217,764	78.64
Jones	81	9,361	10,419	11.3	10,499	0.8
Lenoir	99	57,274	59,598	4.1	57,437	-3.6
Nash	20	76,677	87,385	14.0	104,871	20.0
Orange	49	93,662	115,533	23.4	149,080	29.0
Pamlico	83	11,368	12,934	13.8	14,136	9.3
Person	32	30,180	35,623	18.0	43,901	23.2
Pitt	42	108,480	133,719	23.3	172,440	29.0
Wake	85	426,311	627,866	47.3	1,106,218	76.2
Wayne	91	104,666	113,329	8.3	125,614	10.8
Wilson	81	66,061	73,811	11.7	86,916	17.8
		1,513,831	**1,936,031**	**27.9**	**2,767,815**	**43.0**

♦ Source: http://www.osbm.state.nc.us/ncosbm/facts_and_figures/socioeconomic_data/census_home.shtm, 2007. Note: The numbers reported reflect county population; however, these counties may not entirely be within the basin. The intent is to demonstrate growth for counties located wholly or partially within the basin.

Urban growth poses one of the greatest threats to aquatic resources more than any other human activity. Greater numbers of homes, stores, and businesses require greater quantities of water. Growing populations not only require more water, but they also lead to the discharge and runoff of greater quantities of waste and pollutants into the state's streams and groundwater. Thus, just as demand and use increases, some of the potential water supply is lost (Orr and Stuart, 2000). The Neuse River basin municipal population and growth trends are reported in Table 50. Population fluctuations occur in developing coastal communities as seasonal changes bring time-share and rental property residents creating an increased demand on municipality resources and natural resources. County, city and town planners need to account for these fluctuations and

recognize that temporary residents may have less incentive to invest in sustainable community development efforts. Table 50 below presents population data from Office of State Planning for municipalities located wholly or partly within the basin. Data presented by municipality summarize information on past growth of urban areas in the basin.

Table 50 Municipal Population and Growth Trends

Municipality	County	Apr-80	Apr-90	Apr-00	Percent Change (1980-1990)	Percent Change (1990-2000)
Apex *	Wake	2,847	4,789	20,212	68.2	322.1
Ayden	Pitt	4,361	4,883	4,622	12.0	-5.3
Benson *	Johnston	2,792	3,044	2,993	9.0	-1.7
Cary *	Chatham, Wake	21,763	44,397	94,536	104.0	112.9
Clayton	Johnston	4,091	4,756	8,126	16.3	70.9
Creedmoor	Granville	1,641	1,506	2,232	-8.2	48.2
Durham	Durham	101,149	136,612	187,035	35.1	36.9
Farmville	Pitt	4,707	4,446	4,421	-5.5	-0.6
Fuquay-Varina *	Wake	3,110	4,447	7,898	43.0	77.6
Garner	Wake	10,073	14,716	17,787	46.1	20.9
Goldsboro	Wayne	31,871	40,709	39,147	27.7	-3.8
Greenville *	Pitt	35,740	46,305	61,209	29.6	32.2
Grifton	Pitt	2,179	2,393	2,123	9.8	-11.3
Havelock	Craven	17,718	20,300	22,442	14.6	10.6
Hillsborough	Orange	3,019	4,263	5,446	41.2	27.8
Holly Springs *	Wake	688	1,024	9,192	48.8	797.7
Kinston	Lenoir	25,234	25,295	23,688	0.2	-6.4
Knightdale	Wake	985	1,884	5,658	91.3	200.3
La Grange	Lenoir	3,147	2,805	2,844	-10.9	1.4
Morrisville *	Durham, Wake	251	1,489	5,208	493.2	249.8
Mount Olive *	Duplin, Wayne	4,876	4,582	4,567	-6.0	-0.3
New Bern	Craven	14,557	17,363	23,111	19.3	33.1
Raleigh	Wake	150,255	212,092	276,093	41.2	30.2
River Bend	Craven	959	2,408	2,923	151.1	21.4
Roxboro *	Person	7,532	7,332	8,696	-2.7	18.6
Selma	Johnston	4,762	4,600	5,914	-3.4	28.6
Smithfield	Johnston	7,288	7,540	10,867	3.5	44.1
Trent Woods	Craven	1,177	2,366	4,224	101.0	78.5
Wake Forest	Wake	3,780	5,832	12,588	54.3	115.8
Wendell	Wake	2,222	2,921	4,247	31.5	45.4
Wilson	Wilson	34,424	36,930	44,405	7.3	20.2
Winterville	Pitt	2,052	3,069	4,791	49.6	56.1
Zebulon	Wake	2,055	3,173	4,046	54.4	27.5

* - The numbers reported reflect municipality populations; however, these municipalities are not entirely within the basin. The intent is to demonstrate growth for municipalities located wholly or partially within the basin.

As development in urbanizing areas consumes neighboring forests and fields, the impacts on rivers, lakes, and streams can be significant and permanent if stormwater runoff is not controlled (Orr and Stuart, 2000). As watershed vegetation is replaced with impervious surfaces in the form

of paved roads, buildings, parking lots, and residential homes and driveways, the ability of the environment to absorb and diffuse the effects of natural rainfall is diminished. Urbanization results in increased surface runoff and correspondingly earlier and higher peak stream flows after rainfall. Flooding frequency also increases. These effects are compounded when small streams are channelized (straightened) or piped, and storm sewer systems are installed to increase transport of stormwater downstream. Bank scour from these frequent high flow events tends to enlarge urban streams and increase suspended sediment. Scouring also destroys the variety of habitat in streams, leading to degradation of benthic macroinvertebrate populations and loss of fisheries (EPA, 1999).

16.3 Changes in Land Cover

Land cover can be an important way to evaluate the effects of land use changes on water quality. Unfortunately, the tools and database to do this on a watershed scale are not yet available. Land cover information from the National Resources Inventory (NRI) published by the Natural Resource Conservation Service (NRCS) is presented only at an 8-digit hydrologic unit scale. This information is presented to provide a picture of the different land covers and developing land use trends in the Neuse River Basin, while noting that the data is outdated and does not reflect recent development along North Carolina's waterways.

Land cover information in this section is from the most current NRI, as developed by the NRCS (USDA-NRCS, June 2001). The NRI is a statistically based longitudinal survey that has been designed and implemented to assess conditions and trends of soil, water and related resources on the Nation's nonfederal rural lands. The NRI provides results that are nationally and temporally consistent for four points in time -- 1982, 1987, 1992 and 1997. The USDA is working to provide updates to land cover data in the near future.

In general, NRI protocols and definitions remain fixed for each inventory year. However, part of the inventory process is that the previously recorded data are carefully reviewed as determinations are made for the new inventory year. For those cases where a protocol or definition needs to be modified, all historical data must be edited and reviewed on a point-by-point basis to make sure that data for all years are consistent and properly calibrated. The following excerpt from the *Summary Report: 1997 National Resources Inventory* provides guidance for use and interpretation of current NRI data:

> *The 1997 NRI database has been designed for use in detecting significant changes in resource conditions relative to the years 1982, 1987, 1992 and 1997. All comparisons for two points in time should be made using the new 1997 NRI database. Comparisons made using data previously published for the 1982, 1987 or 1992 NRI may provide erroneous results because of changes in statistical estimation protocols, and because all data collected prior to 1997 were simultaneously reviewed (edited) as 1997 NRI data were collected.*

The following Table 51 summarizes acreage and percentage of land cover from the 1997 NRI for the major watersheds within the basin, as defined by the USGS 8-digit hydrologic units, and compares the coverages to 1982 land cover.

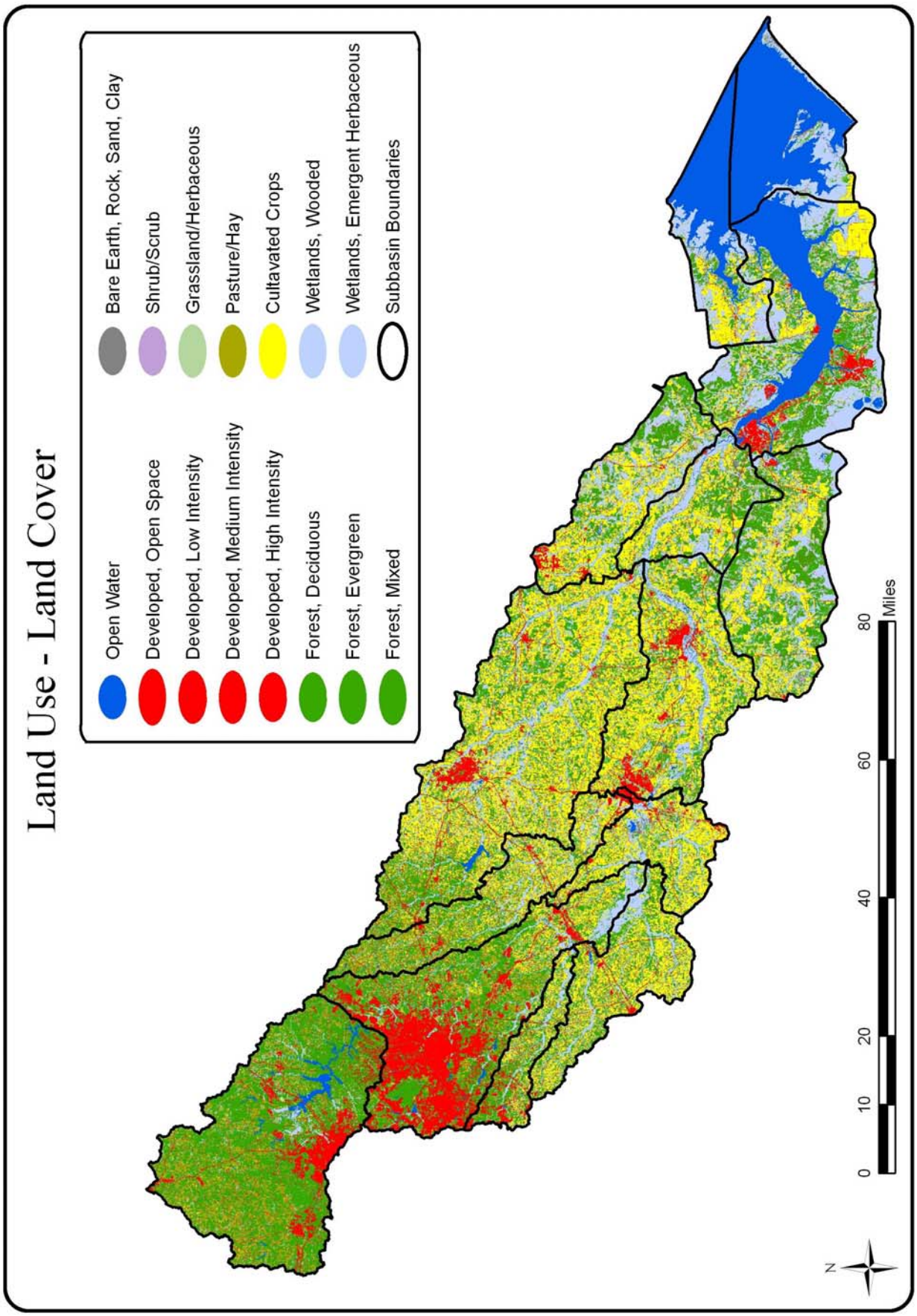
Table 51 Land Cover in the Neuse River Basin: 1982 vs. 1997

LAND COVER	MAJOR WATERSHED AREAS								1997 TOTALS		1982 TOTALS		% Change Since 1982
	Upper Neuse		Middle Neuse		Contentnea		Lower Neuse						
	Acres (1000s)	% of TOTAL	**Acres (1000s)**	% of TOTAL	Acres (1000s)	% of TOTAL	Acres (1000s)	% of TOTAL	**Acres (1000s)**	**% of TOTAL**	**Acres (1000s)**	**% of TOTAL**	
Cult. Crop	296.7	19.3	208.7	30.7	240.0	38.6	129.3	15.7	874.7	23.9	1054.4	28.8	-17.0
Uncult. Crop	25.4	1.7	16.3	2.4	8.8	1.4	3.4	0.4	53.9	1.5	13.1	0.4	311.5
Pasture	73.2	4.8	44.0	6.5	13.6	2.2	5.4	0.7	136.2	3.7	116.7	3.2	16.7
Forest	684.1	44.6	330.8	48.7	269.7	43.3	356.9	43.4	1641.5	44.9	1769.4	48.4	-7.2
Urban & Built-Up	349.7	22.8	47.7	7.0	48.1	7.7	35.5	4.3	481.0	13.1	254.1	6.9	89.3
Federal	5.8	0.4	2.9	0.4	0.0	0.0	75.1	9.1	83.8	2.3	75.1	2.1	11.6
Other	99.4	6.5	29.2	4.3	42.3	6.8	216.0	26.3	386.9	10.6	381	10.4	1.5
Totals	1534.3	100.0	679.6	100.0	622.5	100.0	821.6	100.0	3658.0	100.0	3663.8	100.0	
% of Total Basin		41.9		18.5		17.0		22.4		99.8		100.2	
Subbasins	03-04-01, 03-04-02, 03-04-03, 03-04-04, 03-04-06, 03-04-12		03-04-05, 03-04-08, 03-04-09		03-04-07		03-04-10, 03-04-11						
8-Digit Hydraulic Units	03020201		03020202		03020203		03020204						

Table 52 Land Use Percentages for the Neuse Basin based on the National Land Cover Database 2001

Type	Entire Basin	Upper Neuse	Middle Neuse	Contentnea	Lower Neuse	30201050401
Developed, Open Space	7.6	10.8	5.5	5.9	4.4	1.7
Developed, Low Intensity	2.7	4.2	1.8	1.8	1.2	0.3
Developed, Medium Intensity	1.0	1.6	0.6	0.5	0.4	0.2
Developed, High Intensity	0.3	0.4	0.2	0.1	0.1	0.0
Developed, Total	11.5	17.0	8.2	8.3	6.2	2.2
Bare Earth, Rock, Sand, Clay	0.1	0.2	0.1	0.1	0.1	5.7
Forest, Deciduous	12.8	22.6	6.1	10.2	1.6	0.0
Forest, Evergreen	15.2	12.1	16.9	11.7	23.3	7.1
Forest, Mixed	4.0	4.7	3.1	3.1	3.9	0.6
Forest, Total	32.0	39.4	26.2	24.9	28.8	7.7
Shrub/Scrub	1.9	1.6	2.3	1.0	2.7	3.3
Grassland/Herbaceous	8.1	7.3	9.5	7.9	8.6	2.9
Pasture/Hay	7.2	12.6	2.6	7.2	0.5	0.0
Cultivated Crops	22.3	14.2	31.8	36.9	18.1	0.0
Agriculture, Total	29.5	26.8	34.4	44.1	18.5	0.0
Wetlands, Wooded	14.9	7.2	18.7	13.3	28.5	18.6
Wetlands, Emergent Herbaceous	1.9	0.3	0.7	0.4	6.5	59.6
Wetlands, Total	16.8	7.5	19.4	13.7	35.1	78.2

Figure 39 Land Cover/Land Use Map 2001.



16.3.1 National Land Cover Database (NLCD) 2001 Description and Definitions

The national land cover database (2001) is a geographic information systems raster file that was developed by the Multi-Resolution Land Characterization Consortium which is made up of several federal government agencies. These agencies include the US Geological Survey, the Environmental Protection Agency, National Oceanic and Atmospheric Administration, US Forest Service, Bureau of Land Management, National Aeronautics and Space Administration, National Park Service, and Natural Resources Conservation Service. It was developed using multiple datasets including, three sets of infrared landsat imagery that were collected during the spring, summer, and fall seasons. This data was then improved upon using ancillary data files such as a 30 meter digital elevation model, population density, buffered roads, and city lights. The percent impervious cover and the percent tree canopy were created to show the intensity at which land was either developed or forested. Due to differences in methodology of how the data was created and how land cover types were defined this data can not be compared directly to the 1982-1997 NRI data. The definition for the NLCD 2001 can be found below.

Open Water - All areas of open water, generally with less than 25 percent cover of vegetation or soil

Developed, Open Space - Includes areas with a mixture of some constructed materials, but mostly vegetation in the form of lawn grasses. Impervious surfaces account for less than 20 percent of total cover. These areas most commonly include large-lot single-family housing units, parks, golf courses, and vegetation planted in developed settings for recreation, erosion control, or aesthetic purposes.

Developed, Low Intensity -Includes areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 20-49 percent of total cover. These areas most commonly include single-family housing units.

Developed, Medium Intensity - Includes areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 50-79 percent of the total cover. These areas most commonly include single-family housing units.

Developed, High Intensity - Includes highly developed areas where people reside or work in high numbers. Examples include apartment complexes, row houses and commercial/industrial. Impervious surfaces account for 80 to100 percent of the total cover.

Barren Land (Rock/Sand/Clay) - Barren areas of bedrock, desert pavement, scarps, talus, slides, volcanic material, glacial debris, sand dunes, strip mines, gravel pits and other accumulations of earthen material. Generally, vegetation accounts for less than 15 percent of total cover.

Deciduous Forest - Areas dominated by trees generally greater than 5 meters tall, and greater than 20 percent of total vegetation cover. More than 75 percent of the tree species shed foliage simultaneously in response to seasonal change.

Evergreen Forest - Areas dominated by trees generally greater than 5 meters tall, and greater than 20 percent of total vegetation cover. More than 75 percent of the tree species maintain their leaves all year. Canopy is never without green foliage.

Mixed Forest - Areas dominated by trees generally greater than 5 meters tall, and greater than 20 percent of total vegetation cover. Neither deciduous nor evergreen species are greater than 75 percent of total tree cover.

Shrub/Scrub - Areas dominated by shrubs; less than 5 meters tall with shrub canopy typically greater than 20 percent of total vegetation. This class includes true shrubs, young trees in an early successional stage or trees stunted from environmental conditions.

Grassland/Herbaceous - Areas dominated by grammanoid or herbaceous vegetation, generally greater than 80 percent of total vegetation. These areas are not subject to intensive management such as tilling, but can be utilized for grazing.

Pasture/Hay - Areas of grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops, typically on a perennial cycle. Pasture/hay vegetation accounts for greater than 20 percent of total vegetation.

Cultivated Crops - Areas used for the production of annual crops, such as corn, soybeans, vegetables, tobacco, and cotton, and also perennial woody crops such as orchards and vineyards. Crop vegetation accounts for greater than 20 percent of total vegetation. This class also includes all land being actively tilled.

Woody Wetlands - Areas where forest or shrub land vegetation accounts for greater than 20 percent of vegetative cover and the soil or substrate is periodically saturated with or covered with water.

Emergent Herbaceous Wetlands - Areas where perennial herbaceous vegetation accounts for greater than 80 percent of vegetative cover and the soil or substrate is periodically saturated with or covered with water.