

State of the **ENVIRONMENT** 2002



AIR



WATER



BIOLOGICAL RESOURCES



**Presented by:
Orange County
Commission for the Environment**



ACKNOWLEDGEMENTS



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Orange County is a wonderful place to live and work. The quality of life within the County continues to attract residents and workers at a rapid rate. One challenge the County faces now is accommodating this growth while maintaining the high quality of life that current residents enjoy. To meet this challenge, the County's environmental policies must ensure that the air is clean, that drinking water is safe and abundant, and that biodiversity in plants and animals is maintained. The sustenance of these fragile elements is crucial to the health and welfare of all County residents – human and nonhuman.

Although the County has been moderately successful in preserving and protecting its natural community, the rapid increase in development here is creating issues that must be addressed if we are to preserve the environment on which our quality of life depends. In order to adequately address these issues, the decision-makers and the public must be equipped with current and accurate information on the status of the environment. The *2002 State of the Environment* report provides this information as well as recommendations intended to facilitate policy decisions that affect the County's natural resources. Its format, which is new this year, shows the current state of the County's environment as well as benchmarks that can be compared year to year going forward.

We hope that this report will be helpful in ensuring that Orange County remains a wonderful place to live and work.

Sincerely,

Cara Crisler and Richard Whisnant, Co-Chairs
Commission for the Environment

Purpose

Orange County
Commission for the Environment
presents the
State of the Environment Report to:

- ~ Describe Orange County's current environmental status;
- ~ Give the County objective measures to help evaluate progress toward a clean, healthy environment;
- ~ Highlight the major environmental issues facing the County; and
- ~ Recommend direction concerning those issues.

2002 Orange County State of the Environment

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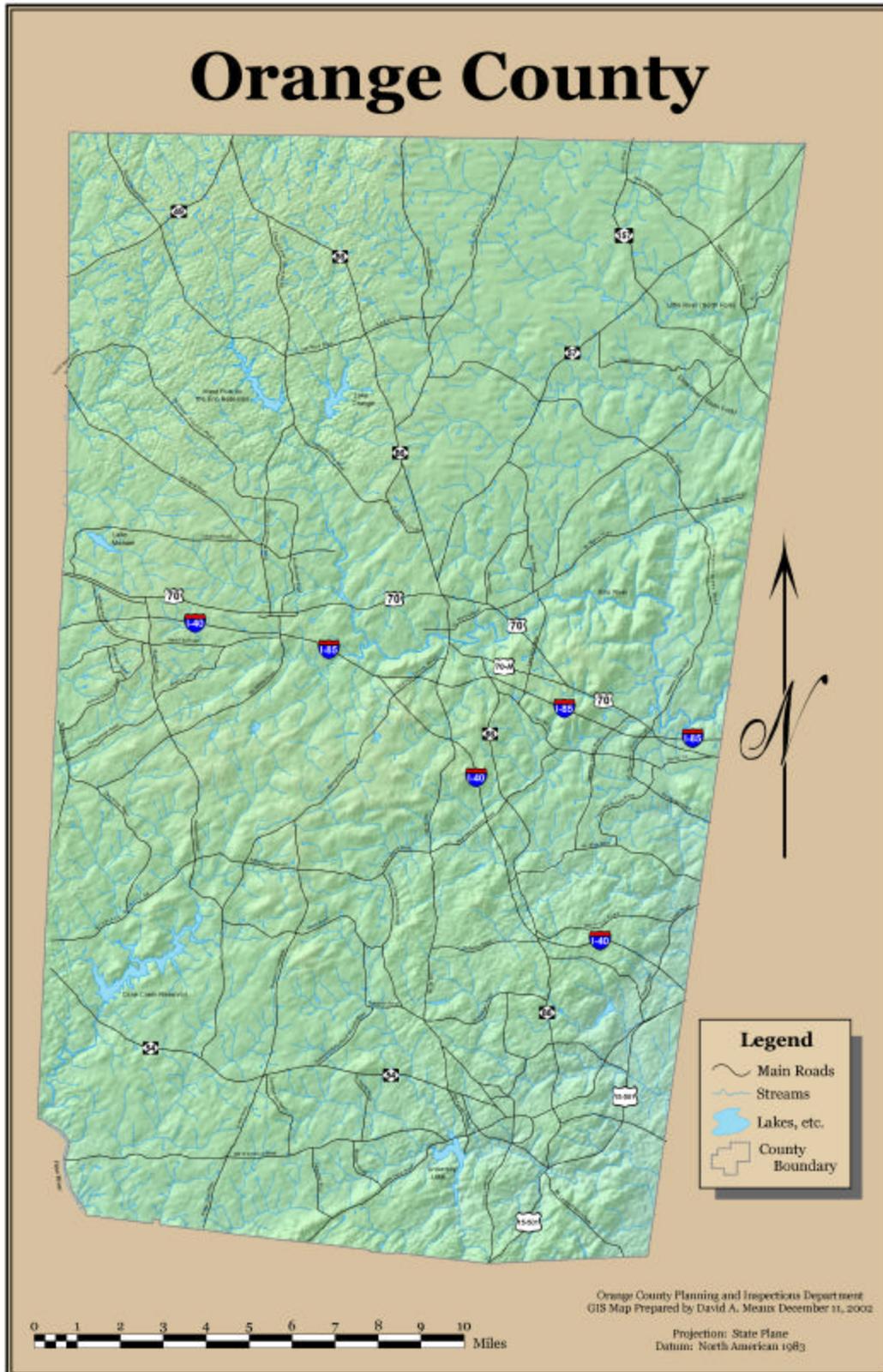
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Issues and Recommendations

As with the 2000 Orange County State of the Environment report, the primary purpose of this report is to identify the main environmental issues within the County and to make specific recommendations to the Orange County Board of Commissioners on how to further our protection efforts. Orange County is a wonderful place to live and work, but it is at a pivotal point in its evolution. Decisions made in the next several years may determine whether the quality of life within the County is enhanced or greatly decreased. The natural environment, which is directly linked to our quality of life, is susceptible to serious degradation from the steady, long-term conversion of natural land to urban and suburban infrastructure. In a recent study, Orange County (along with five other Triangle counties) was ranked as the third most sprawling metropolitan area in the nation. A study by Reid Ewing of Rutgers University and Rolf Pendall of Cornell University found that sprawling development is linked to increased levels of ozone pollution and increased consumption of land. While Orange has been foremost among the region's counties in working to discourage sprawl, decision-makers and the public need a clear understanding of the environmental consequences of sprawl and of the strategies that will serve to protect our water, air and biological resources in the context of rapid growth.

The Orange County Commission for the Environment (CfE) and the Orange County Environment and Resource Conservation Department (ERCD) have created this report to provide a clear analysis of the current status of the County's natural environment and to make recommendations that will help the County create and implement environmental policies to effectively address these issues. One new addition this year is the inclusion of environmental indicators. The report uses widely accepted, measurable "indicators" to reveal the status and trends in the County's environmental conditions and their impacts on human health and natural resources. The indicators also help identify where additional research, monitoring, and information are needed.

The indicators are grouped into three different categories representing each of the main groups of natural resources: air, biological resources, and water. Each category of indicators is addressed by a separate committee within the Commission for the Environment (along with a fourth committee on Environmental Education). In developing the report, each committee identified the most representative set of indicators available for each natural resource, analyzed existing data and trends, and developed recommendations for the Board of Commissioners' consideration. The issues and recommendations presented below represent the most pressing environmental concerns that came out of this analysis.

CRITICAL ISSUES:

- **The amount of developed land per person increased 31% from 1982 to 1997. This indicates that Orange County residents are consuming more land and developing in a more sprawling pattern than in previous years.**
- **The Triangle region is rated as one of the worst ozone-polluted areas in the United States. The continuing unhealthy ozone levels threaten human health and Orange County's ecosystem. The County lacks the necessary data and analysis for developing strategies that will significantly improve air quality.**
- **Habitat for Orange County's native flora and fauna, ecosystems, and natural communities continues to be destroyed or significantly degraded as a result of conversion of natural land cover to suburban, urban, and transportation uses. Protection efforts do not appear to be keeping pace with the loss of biological diversity associated with habitat loss and degradation.**
- **Water resources in the area are inadequate during periods of drought. Per capita water usage increased at least 15% from 1985 to 2000.**
- **While many residents of Orange County rely on groundwater, little attention is given to incidents of groundwater contamination of wells or to groundwater quality generally.**

RECOMMENDATIONS

Pages

Air Resources

1. Orange County should establish a short-term Air Quality committee to develop strategies for improving ambient air quality in Orange County, with an emphasis on reducing our contributions to local and regional ozone levels. The Air Quality committee should include, at a minimum, stakeholders ranging from Orange County citizens, environmental groups, health professionals, businesses, transportation specialists, industry, trade organizations, and government officials. 7-24
2. Orange County should collaborate with other Triangle Counties to establish a comparable short-term Air Quality committee that will develop strategies for improving air quality in the Triangle. 7-24
3. Orange County should develop the in-house capability to generate accurate and comprehensive air emission inventories for the County, particularly for area and mobile sources. 7-12
4. Orange County should hire a full-time staff member to support the development and assessment of County strategies for improving ambient air quality, generate air emission inventories, compile human health data indicators to gauge trends in air quality in Orange County, and coordinate with Triangle Counties and the State to improve ambient air quality. 7-24

Biological Resources

1. Ensure that at least 10 percent of Orange County's land area (25,600 acres) is in permanently protected status by the year 2010. 27-28
2. Continue to intensify efforts to permanently protect both recognized significant natural areas and large tracts of "prime forest" (mature hardwood and mixed hardwood-pine forests), by using fee simple acquisition, acquisition of conservation easements, the development approval process and by promoting the use of native species for landscaping. 29-34
3. Develop a comprehensive conservation plan for the County that addresses threats to and viability of natural areas and populations of rare species, connectivity among protected areas, and coordination with neighboring Counties and conservation partners, with the goal of achieving long-term protection for the County's biological resources. 25-38
4. Develop and institutionalize methodologies to monitor regularly the status of remaining "prime forest" and recognized significant natural areas in Orange County. 33-34

Water Resources

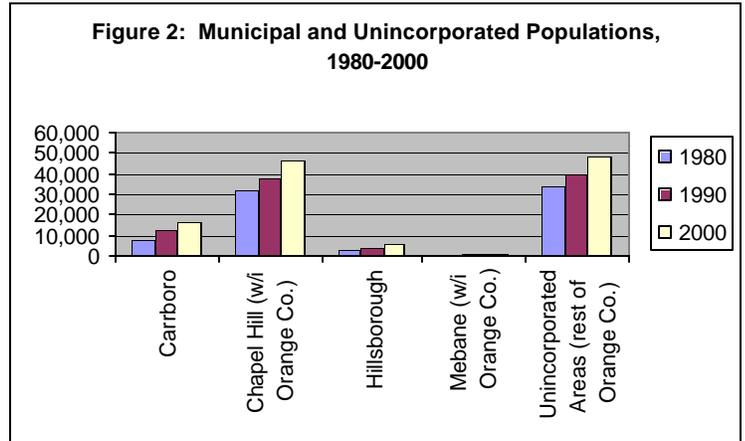
1. To meet the need for an adequate safe yield of high quality water in the future the County should take the lead in having the interested parties in the county engage in planning wastewater reclamation programs for the purpose of providing water for nonpotable purposes, which would reduce the demand on existing limited resources of water public water supply. 39-42
2. The County should be responsible for monitoring and acting upon reported incidents of groundwater contamination while advising residents of the need to test and protect their groundwater resources. 45-48



Population and Land Use

Population

Residential growth is the most fundamental factor affecting the pattern of development throughout Orange County. As has been the case for many years, the County continues to experience dramatic population growth. From 1980 to 2000 the County's population grew from 77,055 to 118,227, a 53% increase (2.7% average annual growth rate). In contrast, during the same time period, North Carolina grew by 37% and the United States grew at a rate of 24%. This impressive population growth reflects the relative locational advantages and attractiveness of Orange County as a place to live.



Source: U.S. Census Bureau

As shown in Figure 2, population growth has occurred throughout the County. All of the municipal and unincorporated areas have had significant increases in population. The highest rate of increase occurred in Carrboro, a 129% increase from 1980-2000. Hillsborough had the second highest rate (80% over 20 years). Although the Town of Chapel Hill remains the dominant residential and commercial center in the County, unincorporated areas also continue to contain a large portion of the population (41%). This rural growth poses challenges in both the planning and provision of expected public services.

Table 1: Municipal and Unincorporated Populations, 1980-2000

	1980	1990	2000	% Change '80-'90	% Change '90-'00	% Change '80-'00
Carrboro						
Population	7,336	12,134	16,782	65.4%	38.3%	128.8%
Land area (sq. mi.)	2.47	3.53	4.47	42.9%	26.6%	81.0%
Persons per sq. mi.	2,970	3,437	3,754	15.7%	9.2%	26.4%
Chapel Hill (w/i Orange Co.)						
Population	32,038	37,596	46,798	17.3%	24.5%	46.1%
Land area (sq. mi.)	12.37	15.98	18.37	29.2%	15.0%	48.5%
Persons per sq. mi.	2,590	2,353	2,548	-9.2%	8.3%	-1.6%
Hillsborough						
Population	3,019	4,263	5,446	41.2%	27.8%	80.4%
Land area (sq. mi.)	2.16	3.55	4.58	64.4%	29.0%	112.0%
Persons per sq. mi.	1,398	1,201	1,189	-14.1%	-1.0%	-14.9%
Mebane (w/i Orange Co.)						
Population	379	485	675	28.0%	39.2%	78.1%
Land area (sq. mi.)	0.20	0.25	0.57	25.0%	126.0%	182.5%
Persons per sq. mi.	1,895	1,940	1,195	2.4%	-38.4%	-37.0%
Unincorporated Areas						
Population	34,283	39,373	48,526	14.8%	23.2%	41.5%
Land area (sq. mi.)	383	377	372	-1.6%	-1.2%	-2.8%
Persons per sq. mi.	90	105	130	16.7%	24.8%	45.7%
TOTAL COUNTY						
Population	77,055	93,851	118,227	21.8%	26.0%	53.4%
Land area (sq. mi.)	400	400	400	0.0%	0.0%	0.0%
Persons per sq. mi.	193	235	296	21.7%	26.0%	53.4%

Source: U.S. Census Bureau

Land Cover

Over the last 20 years, Orange County land use has gradually changed from a rural pattern to a more suburban pattern consistent with the larger Triangle metropolitan area. The dramatic increase in development over the past 20 years has had substantial impact on the land use and natural land cover of the County. As shown in Table 2, the 15 years from 1982 to 1997 witnessed an 87% increase in urban land, a 13% decrease in forests, and a 4% loss in farmland.

Table 2: Land Cover (acres), 1982-1997

Land Cover Categories ¹	1982	1987	1992	1997	% Change 1982-1997
Farmland	78,900	79,700	74,100	75,500	-4%
Forest land	140,400	135,400	129,500	122,200	-13%
Minor land cover ²	5,300	5,300	3,200	3,400	-36%
Urban	24,400	28,000	40,500	45,600	87%
Rural roads and railroads	4,900	4,900	6,000	6,300	29%
Water	2,800	3,400	3,400	3,700	32%
Total Land in County	256,800	256,800	256,800	256,800	0%

¹ Each land cover category contains a standard error of the estimate which averages 17%

² Minor land cover = all other land uses that are not included in the specified land cover categories

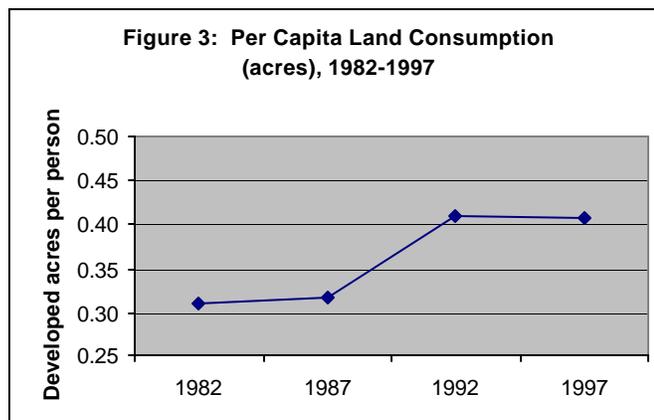
The main form of development that has occurred in the County over the last 20 years is decentralized residential development. Subdivisions within easy commuting distance of employment centers like UNC, RTP, and Duke have increasingly dotted the landscape.

As shown in Table 3, the amount of developed land per person increased 31% from 1982 to 1997. The increase indicates that Orange County residents are consuming more land for residential purposes and that development has occurred in a more sprawling pattern. This trend supports the recent findings by Reid Ewing of Rutgers University and Rolf Pendall of Cornell University that ranked the Triangle as the **third most sprawling area in the nation**. Unless strong growth management policies are implemented, this trend will most likely continue as the region grows economically.

Table 3: Per capita land consumption in acres (developed land / population), 1982-1997

	1982	1987	1992	1997	% Change '82-'87	% Change '87-'92	% Change '92-'97	% Change '82-'97
Total land area	256,800	256,800	256,800	256,800	0%	0%	0%	0%
Developed land	24,400	28,000	40,500	45,600	14.8%	44.6%	12.6%	86.9%
Population	78,617	87,993	98,900	111,804	11.9%	12.4%	13.0%	42.2%
Developed acres per person	0.310	0.318	0.410	0.408	2.5%	28.7%	-0.4%	31.4%

Source: USDA National Resource Inventory



AIR RESOURCES

Emissions estimates

Why the indicator was selected

Tracking trends in air pollutant emissions is critical in assessing air quality impacts and in developing and implementing strategies to improve air quality. Emissions of nitrogen oxides (NO_x) and reactive organic gases (ROG) are presented here because they are the primary contributors to the ground-level ozone levels which are the air quality of most general concern in Orange County, the Triangle and other urban areas in North Carolina. Emissions of carbon monoxide (CO) are also presented because CO participates in ozone photochemistry (though of lesser importance than NO_x and ROG) although ambient CO levels were historically of concern at the urban scale - emissions have been reduced to the point where CO exposure is only of minor concern in limited small-scale areas of high traffic concentration. Some of the individual components of the ROG family are volatile hydrocarbons which are also of concern as hazardous pollutants.

How the indicator was measured

The North Carolina Department of Environment and Natural Resources, Division of Air Quality (DAQ) estimates emissions by county and road type. Highway mobile sources are automobiles and trucks. These emissions estimates are primarily based on estimated vehicle miles traveled (VMT) for the local road system and corresponding per-mile emission factors. Emission factors for highway vehicles are estimated and projected by the US EPA "MOBILE" emission factor model - the emissions presented here were based on MOBILE5b. Nonroad mobile sources are sources that have engines and can move from one place to another, but do not use the highway systems. Examples of this type of source include lawn and garden equipment, marine equipment, agricultural equipment, and construction equipment. The Division of Air Quality estimates nonroad emissions by using the EPA draft NON-ROAD2000 emissions model (except for emissions from aircraft engines and locomotive engines which are calculated using emission factors for various engine types and the estimated number of airplane take-offs and landings and the amount of locomotive trackage and freight hauled). Area sources are small stationary sources, such as gas stations, dry cleaners, repair shops, etc., that by themselves are not very large but combined could be significant sources. These emissions are generally estimated from per capita or per employee emissions factors. Point sources are large stationary sources, like factories and electric power plants. Biogenics are emissions created by living organisms such as trees, plants, and cattle. These emissions estimates are subject to many kinds of uncertainties and potential inaccuracies.

The trend in Orange County

For the purposes of this Report, two of the most relevant aspects of these trends are the amount of uncertainty involved in their development, and the accuracy with which these data represent actual activities and emissions in Orange County. Continued reduction of NO_x emissions for mobile sources depends on the accuracy of EPA and DAQ projections regarding the durability of new cars' emission controls, the types of vehicles that will enter the fleet, future growth, travel patterns and other variables, which depend in turn on the future economic status of Orange County, the Triangle and the State. As other indicators will show, our County may vary from typical NC Counties in a number of ways, including the overall levels of growth we may experience, the proportion of our VMT that occurs on the large interstate highways, and the special profile of our "local" transportation patterns. Our ability to achieve and maintain healthy air quality depends on our understanding of how these and other issues affect our emissions inventory.

Basis for recommendations

Orange County should develop the in-house capability to generate accurate and comprehensive emission inventories for point, area, and mobile sources. Orange County should assess the validity of the State's current and future estimates of VMT, transportation modes, and other issues critical to our emissions inventory, to determine how these estimates can be improved.

Figure 4: Percentage of Estimated and Projected Emissions by Source, 1997-2015

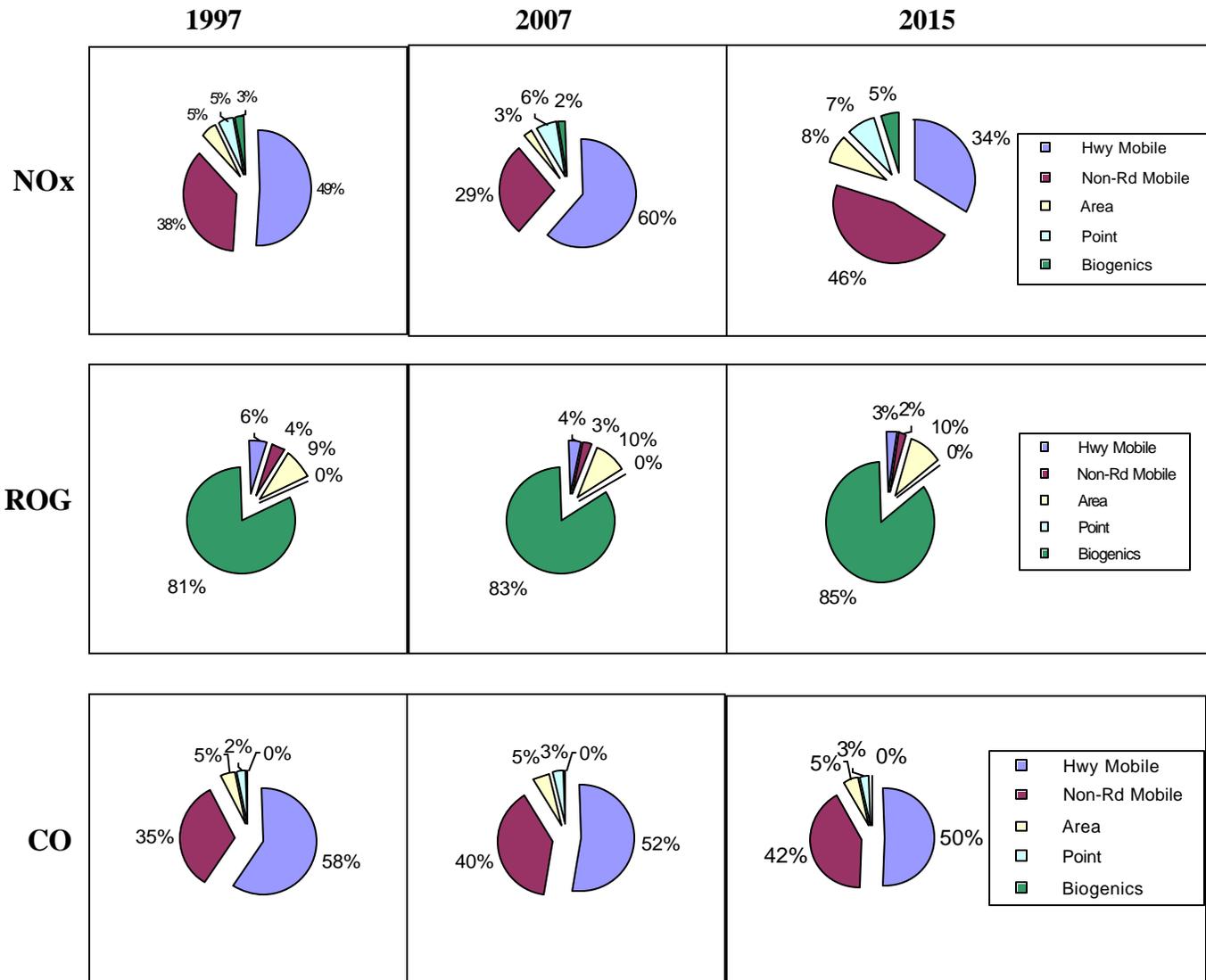


Table 4: Emissions (tons per day), 1997-2015

NOx	1997	2007	2015
Hwy Mobile	15.5	8.7	3.6
Non-Rd Mobile	7.32	6.56	4.92
Area	0.75	0.87	0.87
Point	1.6	0.8	0.8
Biogenics	0.5	0.5	0.5
Total	25.67	17.43	10.69
ROG			
Hwy Mobile	5	3.2	2.7
Non-Rd Mobile	3.83	2.59	2
Area	7.76	8.96	8.96
Point	n/a	n/a	n/a
Biogenics	73.56	73.56	73.56
Total	90.15	88.31	87.22
CO			
Hwy Mobile	64	52.2	55.5
Non-Rd Mobile	38.75	40.89	46.16
Area	5.02	5.05	5.05
Point	2.7	3.4	3.4
Biogenics	0	0	0
Total	110.47	101.54	110.11

AIR RESOURCES

Emissions from point sources

Why the indicator was selected

Due to the economic makeup of Orange County, there are relatively few substantial point sources of air emissions, and those which exist are relatively small compared to similar sources elsewhere. However, the potential impact of these concentrated emission sources on their immediate localities, as well as their potential cumulative impact on the surrounding region, and their possible growth, make it important to obtain basic information for tracking of point sources over time.

How the indicator was measured

NC DENR, Division of Air Quality (DAQ) collects estimates of emissions of air pollution from point sources. The data are broken down into the following major pollutants:

- Sulfur Dioxide (SO₂) - A gas formed when fuel containing sulfur, such as coal and oil, is burned, and when gasoline is extracted from oil or metals are extracted from ore.
- Nitrogen Oxide (NO_x) - A gas formed when fuel is burned at high temperatures, a primary contributor to ground-level ozone production.
- Carbon Monoxide (CO) - A colorless, odorless gas formed when carbon in fuel is not burned completely.
- Particulate Matter (PM) - A term for particles found in the air, including dust, dirt, soot, smoke and liquid droplets. These particles can be suspended in the air for long periods of time. PM_{2.5} is particulate matter that has a diameter of less than or equal to 2.5 micrometers. PM₁₀ is particulate matter that has a diameter of less than or equal to 10 micrometers. PM (TSP) is the total amount of suspended particulate matter.
- Volatile Organic Compound (VOC) - Hydrocarbon compounds such as volatile fuels, solvents, etc., which contribute to ground-level ozone production. Essentially the same as "ROG".

These pollutants contribute to respiratory illnesses, aggravate existing heart and lung diseases, help form acid rain, create visibility impairment, contribute to global warming, and cause nutrient overloading that deteriorates water quality.

The trend in Orange County

As can be seen in Figure 5, there appear to have been substantial fluctuations in various local point source emissions between 1993 and 1999. Reasons for these changes are not clear, and, in the case of NO_x, this represents an increase of a factor of three. Although the projections under the previous indicator indicate that point source NO_x is projected to decline again in the future, it behooves us to understand the assumptions and other factors involved in these expected changes. On the other hand, the point source emissions of particulate matter are estimated to have declined substantially in the past few years. However, TSP and PM₁₀ have been shown to be poor indicators of the health impacts of particulate matter, and concern has shifted to PM_{2.5} (fine particulates that penetrate deeper into the lungs). Emission estimates and ambient measurements for PM_{2.5} are a new part of the picture, so future tracking of PM_{2.5} emissions is important.

Basis for recommendations

The County should track local point source emissions and assess the assumptions that go into the projections as well as reviewing potential localized impacts of these sources, including any ambient modeling studies done as part of the relevant State permits.

Figure 5: Point Source Air Pollution, 1993-1999

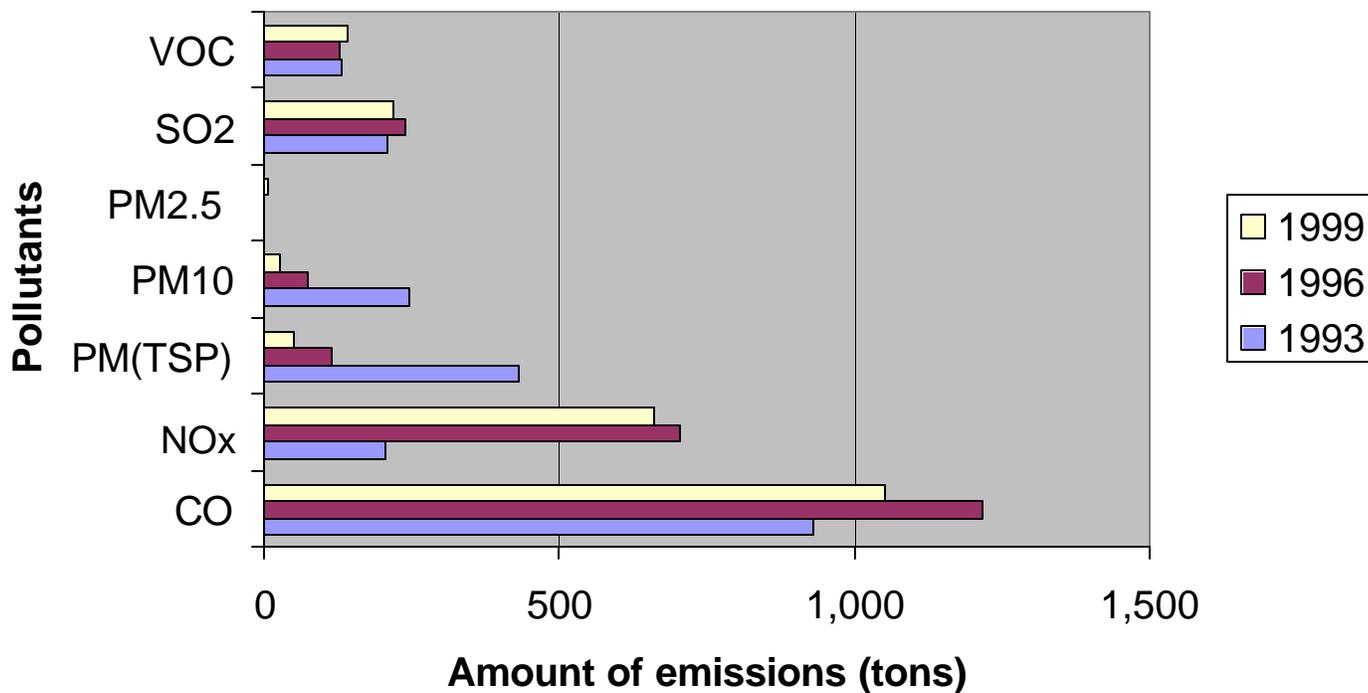


Table 5: Point Source Air Pollution, 1993-1999

Pollutant Name	1993		1996		1999	
	Facilities Reporting	Output (tons)	Facilities Reporting	Output (tons)	Facilities Reporting	Output (tons)
Total facilities reporting	19		21		18	
Criteria pollutants						
CO	10	932	10	1,216	12	1,051
NOx	11	206	11	706	13	661
PM(TSP)	13	432	17	115	15	51
PM10	12	247	16	74	15	28
PM2.5 (not available until 1999)					4	8
SO2	7	208	8	238	11	220
VOC	12	133	12	129	10	143

AIR RESOURCES

Hazardous air pollutants

Why the indicator was selected

Hazardous air pollutants (HAPs), also known as toxic air pollutants, are “non-criteria” pollutants from point sources. HAPs are a significant portion of the total amount of air pollution and include more than 180 different air pollutants that have been determined to be hazardous. These pollutants are suspected to cause cancer and other serious health effects, such as reproductive problems and birth defects, as well as adverse environmental effects. Data on these pollutants must be traced and analyzed in order to account for and address these negative impacts.

How the indicator was measured

NC DENR, Division of Air Quality (DAQ) collects estimates of HAPs, which are summed and reported in pounds emitted annually. The data on these pollutants and the criteria pollutants are reported by each facility emitting HAPs within Orange County. There are a large number of individual HAPs emitted by a variety of point sources in the County (mostly in very small amounts), and assessment of the available data was beyond the scope of this report. We hope to be able to present and assess these data in future reports, but for the time being enter as place-holder the total amount of HAPs estimated to have been emitted in 1993-1999.

The trend in Orange County

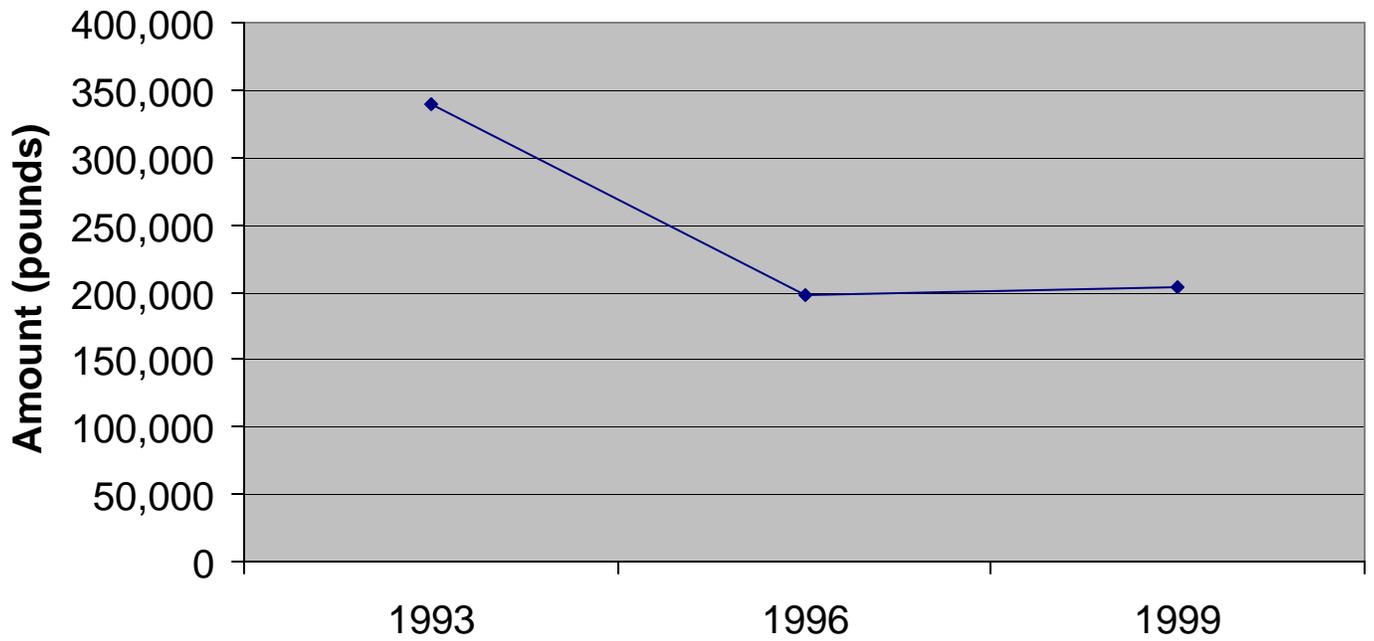
Since these data are for a total composed of a variety of individual HAPs, it is hard to draw any conclusions regarding the importance of the changes in the overall emissions shown.

Basis for recommendations

As with the previous indicator, the County should develop and maintain an awareness of the sources and degree of hazard involved with these emissions and track them over time. In this case, potential interfaces with County emergency management personnel and other relevant authorities should be considered since the same information may be of concern or already known to those agencies.

In addition, development or procurement of similar data for the non-point parts of the inventory (mobile and area) should be pursued to assess the relative magnitudes of risk and concern attendant to these categories.

**Figure 6: Hazardous Air Pollutants from Point Sources,
1993-1999**



AIR RESOURCES

Ozone exceedances

Why the indicator was selected

Ozone can be “good” or “bad” depending on its location to the earth. “Good” ozone (the Ozone Layer) is located approximately 10 to 30 miles above the earth’s surface and protects us from the sun’s harmful rays. “Bad” ozone (smog) is created at the ground-level through the action of intense sunlight on nitrogen oxides (Nox) and volatile organic compounds (VOCs) emitted by motor vehicles, industries and other sources. Ground-level ozone is dangerous since it may cause permanent lung damage, trigger health problems, and destroy plants and ecosystems.

How the indicator was measured

NC DENR, Division of Air Quality (DAQ) monitors ozone exceedance levels according to EPA monitoring protocols for urban areas, which are designed for assessment of the typical regional-scale ozone formation regime in a given area. These protocols do not require an ozone monitoring site in Orange County, so none has been established, and actual ozone levels in the County are not known. Since urban non-attainment status is assessed at the Metropolitan Statistical Area (MSA) level, Orange County’s official status and control-level requirements are generated by assessments of the nine ozone monitors elsewhere in the Triangle area. To provide a general profile of ozone levels in our area, this section presents statistics for a number of individual monitoring stations surrounding Orange County, including some in the Triangle and others to the north, west and south.

The trend in Orange County

The number of ozone exceedance days climbed to a spike in 1998 and then decreased. It climbed to another spike in 2002. These fluctuations are related to particularly hot, sunny weather in the summer and therefore will likely continue to occur during this type of weather. Next year, it is expected that Orange County will be designated non-attainment for the newly-revised Federal national ambient air quality standard for ozone, as part of the Triangle area MSA -- that is, we will officially be in violation of this more protective standard, with a large number of other NC counties. Orange County should develop progressive and comprehensive strategies to assess our impacts on local and regional ozone levels, to contribute to the reduction of those ozone levels and to improve overall air quality.

Basis for recommendations

Orange County should develop the in-house capability to generate accurate and comprehensive air emission inventories for the county, particularly for area and mobile sources. Orange County should lobby the NC legislature and North Carolina Department of Environment and Natural Resources to install an ozone monitor in Orange County. Ozone monitors are critical tools that enable counties to validate estimates of ozone levels and develop planning initiatives to reduce ozone levels. In the interim while Orange County does not have an ozone monitor, Orange County should coordinate with Universities, research institutes, and other organizations with capabilities of periodically testing and characterizing ambient ozone levels, short of having an “official” monitoring station. This will enable Orange County to immediately assess the adequacy of relying on monitors from surrounding counties to determine current ozone levels within Orange County. Orange County should allocate staff resources necessary to support the development and assessment of County strategies for improving ambient air quality, generate air emission inventories, compile human health data indicators to gauge trends in air quality in Orange County, and coordinate with Triangle counties and the State to improve ambient air quality.

Figure 7: Trends in Ozone Exceedance Days at Sites Surrounding Orange County, 1995-2002

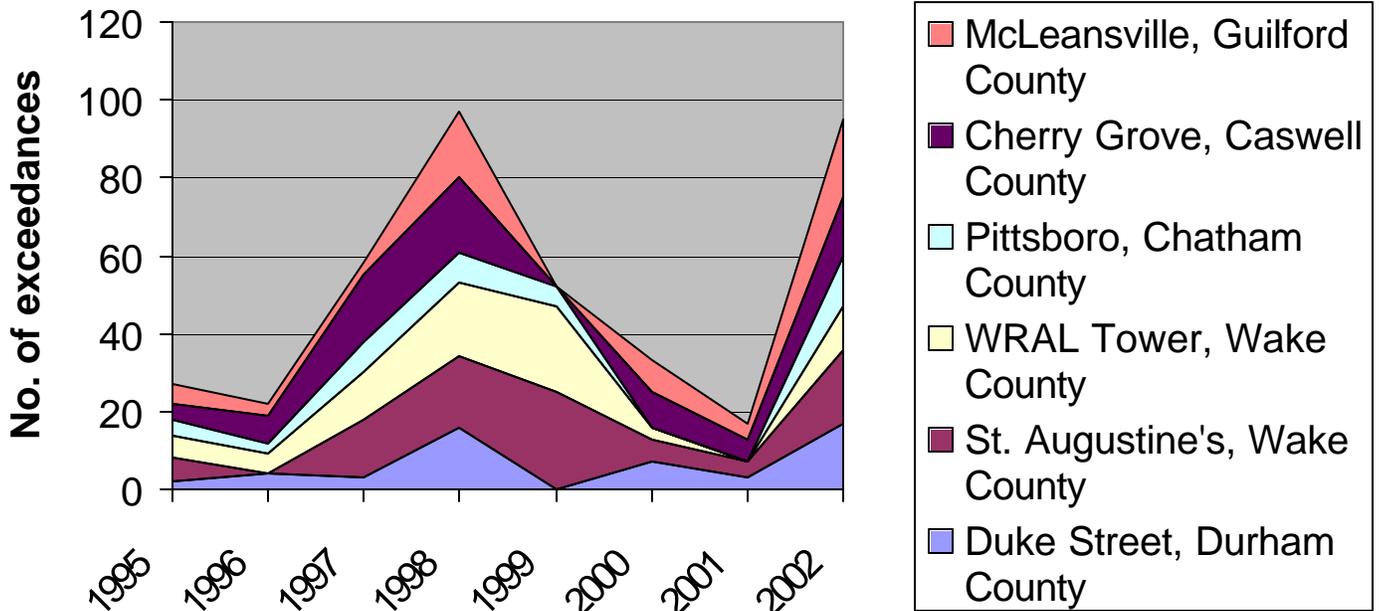


Table 6: Number of Ozone Exceedance Days at Sites Surrounding Orange County, 1995-2002

Site	Number of Exceedance Days							
	1995	1996	1997	1998	1999	2000	2001	2002
Duke Street, Durham County	2	4	3	16	0	7	3	17
St. Augustine's, Wake County	6	0	15	18	25	6	4	19
WRAL Tower, Wake County	6	5	12	19	22	3	0	11
Pittsboro, Chatham County	4	3	8	8	5	0	0	13
Cherry Grove, Caswell County	4	7	17	19	0	9	6	15
McLeansville, Guilford County	5	3	3	17	0	8	4	20
Triangle - Based on nine monitors	16	19	26	40	29	13	9	29

AIR RESOURCES

Transportation modes

Why the indicator was selected

The use of the automobile is directly related to air quality since motor vehicle exhaust is the main contributor to criteria pollutants and a significant source of hazardous air pollutants. Therefore it is important for the County and other local governments and businesses to encourage alternatives to the single-occupancy automobile, currently the dominant mode of transportation to work and other destinations, and for this and other indicators to be used in tracking and assessing our success in encouraging these alternatives. In particular, there are a number of unique aspects of Orange County's employment base, population distribution and commuting/movement patterns that may offer opportunities for further, innovative possibilities in this critical area.

How the indicator was measured

The statistic presented here represents the journey-to-work of Orange County residents, including out-commuters; to get a more complete picture of vehicle occupancy and further opportunities for mode shifts in the County, the modes used by in-commuters and modes used in non-work trips need to be assessed also. The U.S. Census Bureau provided means of transportation to work data gathered from a sample survey administered during the 1990 and 2000 census. These data are very useful in determining the long-term results of policies that promote transit and pedestrian activity. These data can be used to gauge the success of these policies and determine the proportion of non-automobile mode use.

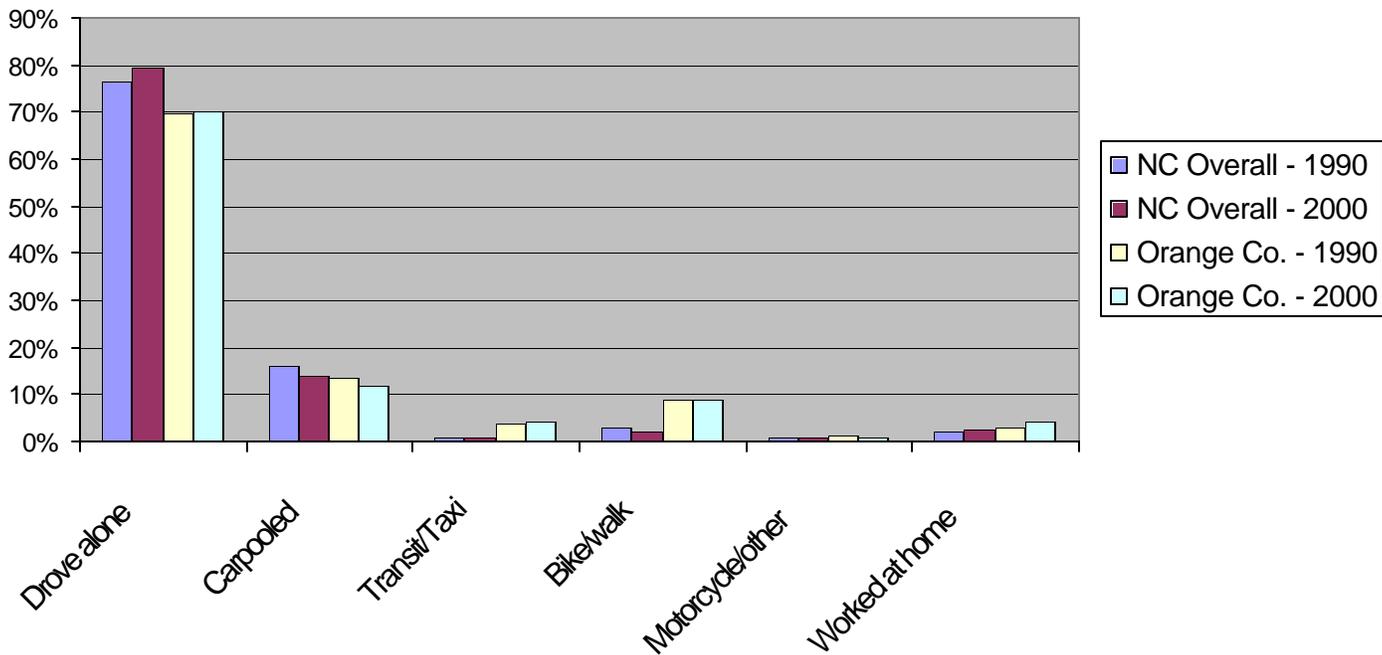
The trend in Orange County

As is the case in the automobile-dominated areas of the U.S., the single-occupancy automobile is by far the dominant mode of transportation to work for Orange County citizens. However, the comparison of the data presented for Orange County and North Carolina as a whole indicates some interesting things about our County. The percentage of workers driving alone AND the number of carpoolers is lower in Orange County than in NC as a whole, while the number of those using transit, walking/biking and working at home is significantly higher than the state average (while still a small part of the total commuting trips). Further investigation is necessary to determine the extent to which Chapel Hill's transit system, the dominance of the University, and other factors affect these measures (for example, is a student walking to class considered a commuter?). However, these data may also indicate that there may be further opportunities for reducing single-occupant travel in the area.

Basis for recommendations

Orange County, its constituent municipalities and the University should continue to investigate ways to shift our transportation use to more efficient and less-polluting modes, as well as to reduce vehicle trips altogether by increasing telecommuting, co-location of jobs and employment, development of walkable and bike-able community structure including pedestrian- and bike-friendly roads and separate-mode paths.

**Figure 8: Percentage of Means of Transportation to Work,
NC Overall and Orange County, 1990-2000**



AIR RESOURCES

Daily vehicle miles traveled

Why the indicator was selected

Daily vehicle miles traveled (DVMT) includes the amount that both County and non-County residents use their vehicles on public roads in Orange County. As discussed under the emissions inventory indicator, the analysis of this data over time is a critical factor in how much vehicles contribute to the degradation of air quality within the County.

How the indicator was measured

NC Department of Motor Vehicles collects traffic count data and uses them to estimate statistics such as the VMT shown for 1990 and 2000. Vehicle miles are divided into rural and urban, which is used to specify the geographic area of the County in which the mileage is occurring. Within these large categories the mileage is broken down into the type of road driven on. Per capita daily vehicle miles traveled is calculated by dividing the total miles driven by the population during that year. The VMT projections for 2007 and 2015 were made available by NC Division of Air Quality, generated by future-based Travel Demand Models.

The trend in Orange County

VMT is increasing in Orange County. There was a 53% increase in the number of miles driven from 1990 to 2000. This is a dramatic increase. This increase in DVMT, coupled with projected significant population growth in Orange County forecast an unhealthy trend for Orange County's air quality. In 1990 there were 23.7 miles driven per person per day and in 2000 there were 28.9 miles driven per person per day - a 21.5% increase. There are a number of aspects of these data that require further assessment. The dramatic change between 1990 and 2000 was driven in large part by a very large increase in the "rural interstate" category, which probably represents the opening of the last section of Interstate 40 in Orange County in 1988 and the progressive increases of traffic on I40 since then. The future projections indicate that, based on past trends and expected population and job growth, development patterns, etc., there will be ongoing large increases in VMT in the County, unless comprehensive measures are enacted to reduce, prevent and divert these mostly single-occupant trips to other modes. A large part of this increasing VMT is thru-traffic and in- and out-commuting on the two Interstates in Orange County, which presents an additional level of complication. If major additional road-building is not undertaken, the resulting congestion will produce greater emissions, more fuel use and a lowered quality of life for all County residents. On the other hand, additional road-building has many environmental and fiscal costs and can lead to further VMT generation by making longer commutes possible. The apparent increase in per-capita daily VMT, from 24 to 29 miles per day, is most likely a product of several factors, including increased travel out of the County for work and other purposes, as well as increased local vehicle usage in general; however, there is likely also some substantial amount of this increase that is due to the heavy through-County travel on the interstates as well as in-commuting by folks who don't live in Orange County, making the use of this rough figure based on County population questionable without further refinement. The same complications apply to assessing the implications of the projected VMT per capita figures. However, careful assessment of more detailed data of this type is clearly important for development of possible options and strategies the County might be able to implement to reduce the distances and time our citizens have to travel to work and other destinations.

Basis for recommendations

Orange County needs to develop the in-house capability to assess the issues raised by these VMT statistics and projections, and to develop a comprehensive program and innovative strategies to address these issues. One key component of this capability is to cooperate with other local authorities, NC DOT and NC DAQ to develop and refine an integrated transportation-impacts model (transportation demand model/emissions model combination) which can be used to investigate the possible impacts of trip-reduction measures, road-building and development proposals, transit improvements, increases in employment at the University and other local employers, and other factors that will come into play over the next decades.

**Figure 9: Daily Vehicle Miles Traveled (VMT)
for Orange County, 1990-2015**

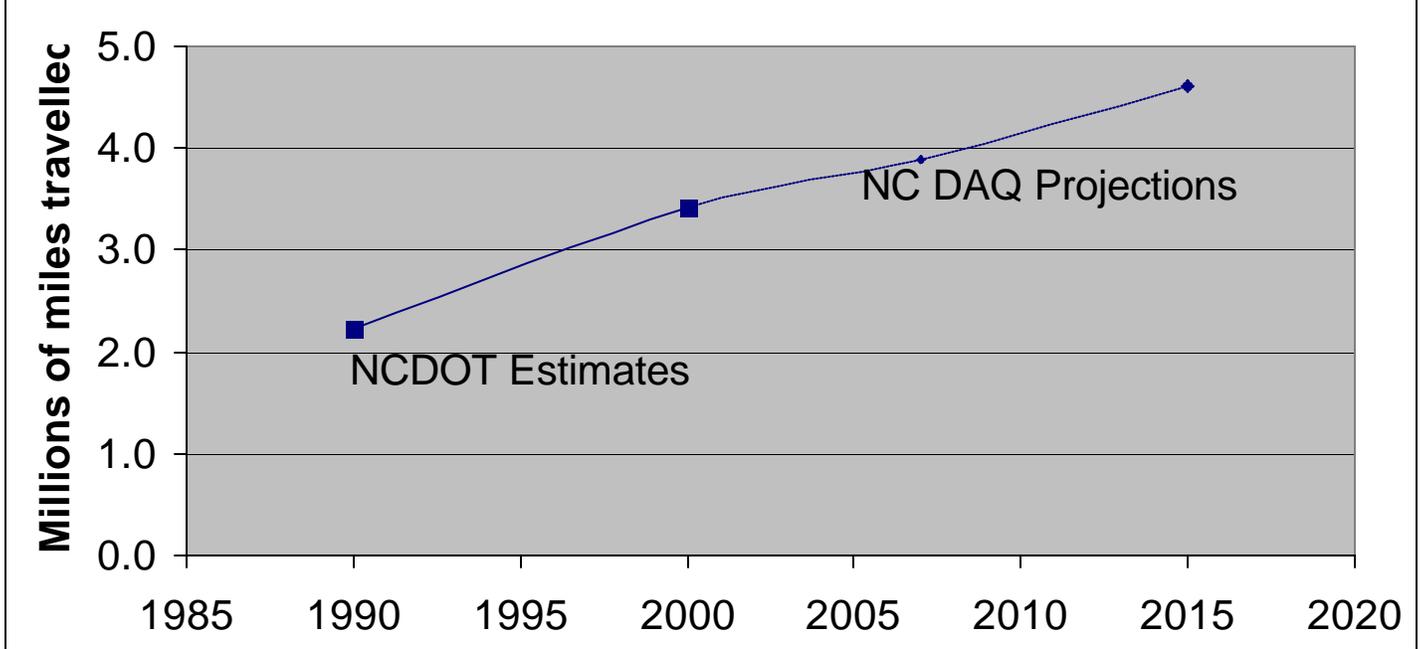


Table 7: Daily Vehicle Miles Traveled (DVMT), 1990-2015

	Measured		Projected	
	1990	2000	2007	2015
Rural				
Interstate	745,550	1,417,590	1,676,749	2,027,478
Arterial	75,700	196,100	215,570	259,073
Collector	569,300	647,630	627,013	741,156
Local	111,300	148,980	270,210	330,388
Total	1,501,850	2,410,300	2,791,549	3,360,110
Urban and small urban				
Interstate	21,070	114,320	3,423	4,258
Freeway	53,660	57,420	77,763	97,489
Arterial	558,040	754,080	748,163	836,717
Collector	35,890	41,500	59,827	79,315
Local	57,620	34,080	215,437	237,920
Total	726,280	1,001,400	1,104,613	1,255,699
Grand Total	2,228,130	3,411,700	3,896,162	4,615,809
% of Grand Total Interstate and Freeway	36.8%	46.6%	45.1%	46.1%
Per Capita DVMT	23.7	28.9	29.0	30.6

AIR RESOURCES

In commuting / out commuting

Why the indicator was selected

One method of decreasing the amount that people drive is to reduce commuting distance. The “in commuting” and “out commuting” statistics help reveal the proportion of residents who are working outside the County or the proportion of workers who are living outside the County. In most cases, the people who are not working or living in the same County are driving more to get to work. These people could be crossing County lines from personal choice or from an inability to pay Orange County housing prices or find a job within the County.

How the indicator was measured

The U.S. Census Bureau provided this information in workers 16 and older from a sample survey administered during the 1990 and 2000 census. The out commuting chart shows the number of residents who are driving outside the County to get to their work. The in commuting chart shows the number of Orange County workers who reside outside the County and are driving outside the County to get to and from home and work.

The trend in Orange County

Orange County contains a large and rapidly increasing proportion of residents who are working outside the County. This proportion increased 16% from 1990 to 2000. As shown in Table 9, in 1990 there was a large proportion of people who traveled from homes outside the County to a place of work in Orange County.

Basis for recommendations

Orange County should identify and evaluate commuting patterns in Orange County and develop strategies to improve commuting patterns. The County should also encourage and offer incentives for regional employers to promote telecommuting to reduce vehicle miles traveled.

Figure 10: Out commuting: Percent of Workers Residing in Orange County Who Work Outside County, 1990-2000

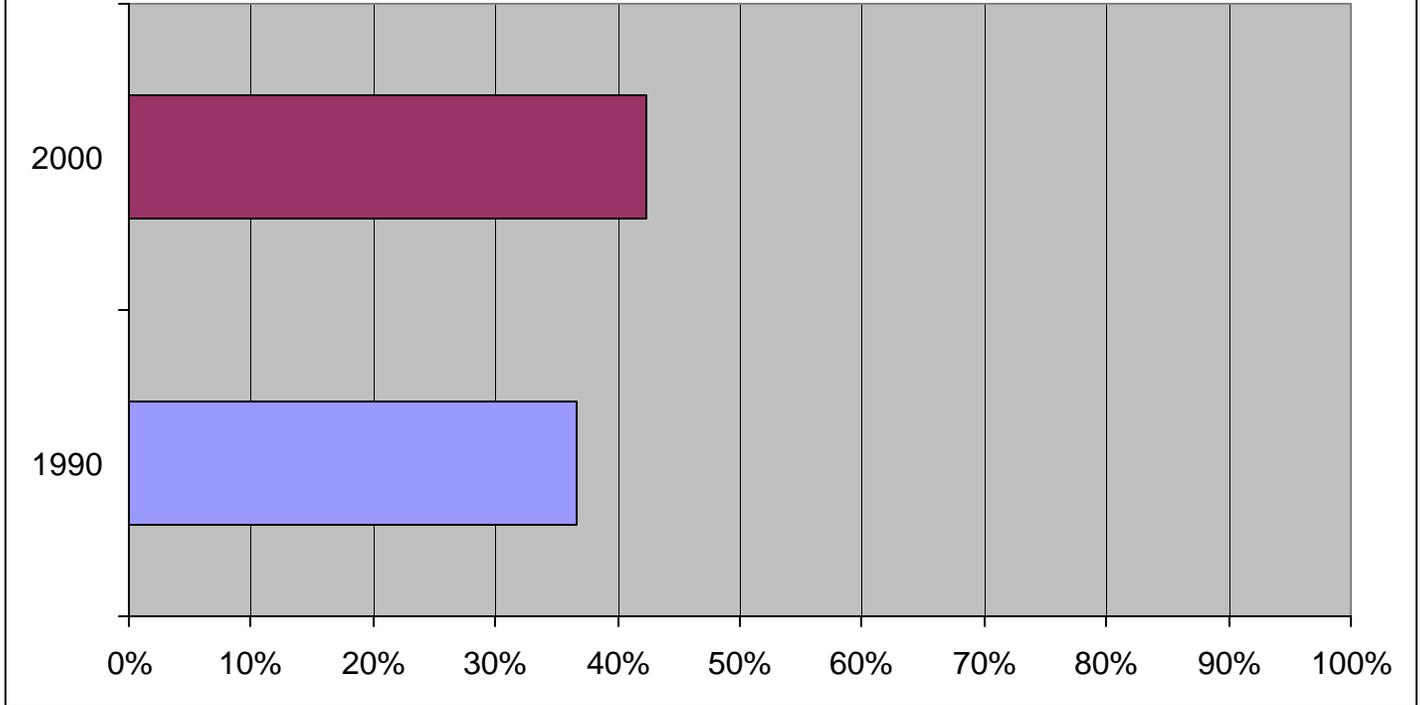


Table 8: Out commuting, 1990-2000

	1990	2000	% change '90-'00
Number of workers residing in Orange County	49,915	65,009	30.2%
Number of workers residing in Orange County, but working outside County	18,324	27,563	50.4%
Percent of workers residing in Orange County, but working outside County	36.7%	42.4%	15.5%

Table 9: In commuting, 1990

	1990
Number of workers working in Orange County	48,621
Number of workers working in Orange County, but residing outside Orange County	17,030
Percent of workers working in Orange County, but residing outside Orange County	35.0%

AIR RESOURCES

Travel time to work

Why the indicator was selected

The amount of time that people spend traveling to work correlates directly to air emissions. Since the dominant mode of transportation is the single occupancy vehicle, statistics on travel time can indicate how much time vehicles are being driven and are emitting dangerous air pollutants.

How the indicator was measured

The U.S. Census Bureau provided this information gathered from a sample survey administered during the last three censuses. The elapsed time includes time spent waiting in traffic, waiting for public transportation, time spent picking up passengers in carpools, and time spent in other activities related to getting to work.

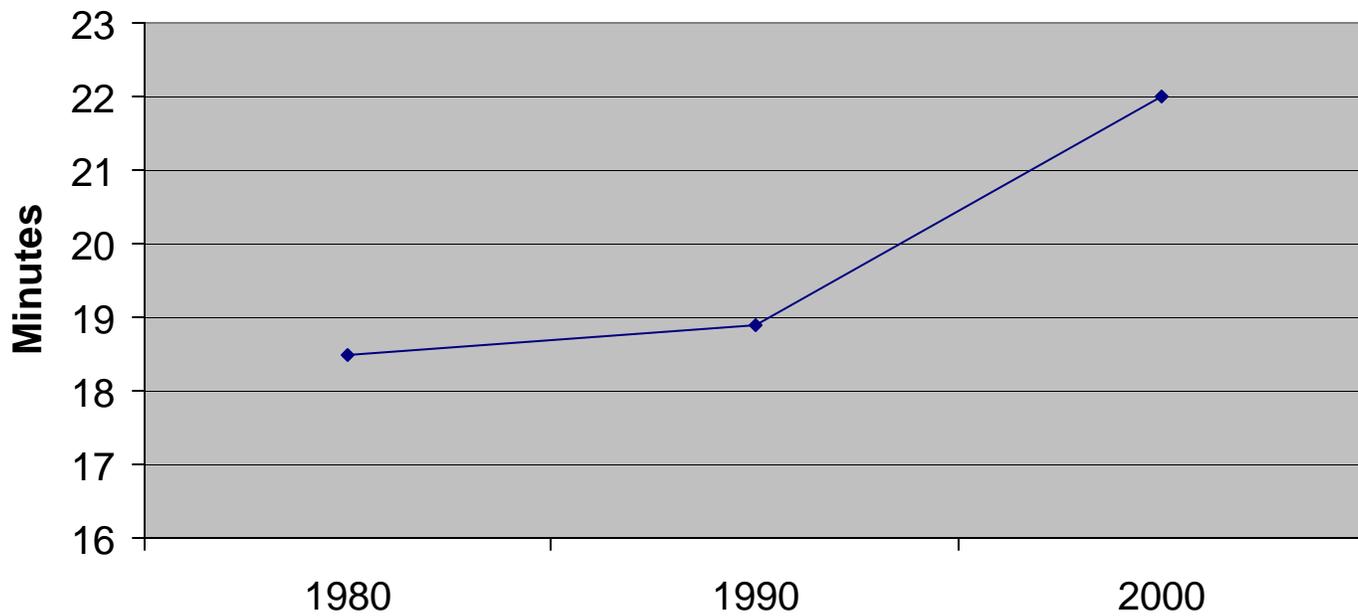
The trend in Orange County

The amount of time Orange County residents spend traveling to work has greatly increased. In just over the ten years from 1990 to 2000, this indicator has increased by 16%. Since the majority of people are using single occupancy vehicles to get to work (70% in 2000), commuters are either driving farther or sitting in traffic for more extended periods of time.

Basis for recommendations

Orange County should identify and evaluate commuting patterns in Orange County and develop strategies to improve commuting patterns. The County should create opportunities for its residents to work in the County to minimize commute times.

**Figure 11: Mean Travel Time to Work (minutes),
1980-2000**



* The percentage increase over 20 year period from 1980 to 2000 is 19%.

AIR RESOURCES

Miles of state maintained road lanes

Why the indicator was selected

The number of miles of road lanes in the County is an important indicator of the overall capacity and built-environment aspects of the transportation system. Additional lane-miles can result in additional VMT, which can add vehicle emissions, but may also reduce emissions if they allow freer flow of traffic instead of creating even more congestion. Historically, many roads have initially made it possible for more drivers to reach new, more distant destinations more quickly (more VMT, maybe less emissions). Then as demand escalated, these roads became congested and resulted in higher VMT, more commuter time on the road, higher emissions due to lower speeds and more time on the road, and reduced energy efficiency.

How the indicator was measured

This indicator is compiled by the NC Division of Transportation based on the total mileage of state-maintained roads, which include all the highways, arterial routes and major urban roads as well as all rural roads but excludes local streets in municipalities. "Lane miles" count a mile of four-lane road as four miles, and the statistic includes widening of existing roads as new lane miles. However, this statistic is not broken down by road type, thus a new lane of I-40 is counted the same as a new State Road in a rural area.

The trend in Orange County

This indicator confirms that the overall lane-mileage of our local road system grew steadily over the last 15 years, but always at a rate that averaged less than one percent a year. However, comparison of this information to the Vehicle Miles Traveled indicator reveals a very cautionary combination – while the amount of actual pavement grew very gradually in that period, the VMT escalated at a much greater rate. Between 1990 and 2000, lane-miles grew by only 4.2 percent, while the estimated VMT grew by over 50 percent! There are many factors that need to be considered in assessing the real importance of what appears to be a recipe for congestion and increased emissions. A large amount of that dramatic increase in VMT that has occurred on a very small number of new lane miles of Interstate highways which have developed very high traffic volumes in a short period of time.

Basis for recommendations

This measure should be tracked along with other transportation-related parameters to provide a comprehensive picture of the impacts of transportation on air quality, land and water resources, and the overall environment of Orange County. Use of lane-miles for specific road types would reveal further detail in comparisons with similar VMT statistics. However, even these more specific measures of system capacity will be inadequate to fully characterize system/VMT interactions, and to assess the immediate and longer-term impact of new roads on total VMT, traffic flow and other parameters that are critical to understanding their air quality impacts. Development of an integrated traffic/air quality modeling program and associated data is the first step to this improved capability.

Figure 12: Total State Maintained Road Lane Miles, 1985-2000

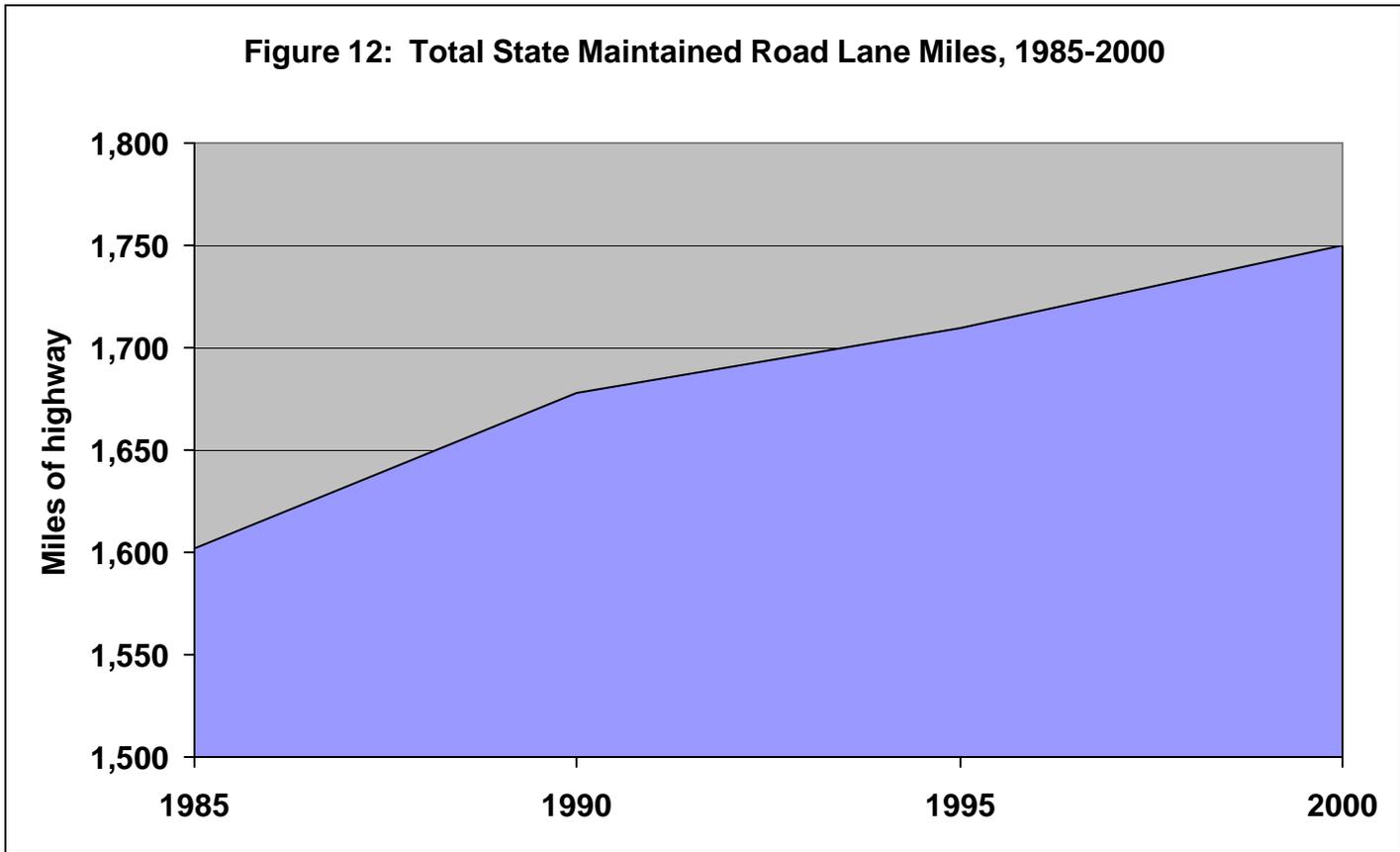


Table 10: State Maintained Road Lane Miles, 1985-2000

Year	Highway Mileage	Percent Change	
1985	1,602	1985-1990	4.7%
1990	1,678	1990-1995	1.9%
1995	1,710	1995-2000	2.3%
2000	1,750	1985-2000	9.2%

* The lane miles shown are defined as the center line mileage times the number of lanes.
 Ex. 1.23miles x 3 lanes=3.69 miles.

* These mileage totals are for all state maintained roads in Orange county.
 (Interstate, US, NC, and SR)

BIOLOGICAL RESOURCES

County land cover

Why the indicator was selected

“Land cover” refers to both the natural state of the land and the human uses of the land. All land in the County can be categorized as covered either by “natural” vegetation (e.g., “Forestland” in Figure 13) or by the human use to which the land has been altered (e.g., “Urban” in Figure 13). Analysis of the relative amounts of land cover is a key element in planning on many levels. By tracking changes in land cover, we can gauge how well the County has integrated the protection of natural land and resources into its planning.

How the indicator was measured

The U.S. Department of Agriculture’s Natural Resource Inventory (NRI) compiles these data from remote sensing (mainly low-level aerial photography) every five years. This inventory gives us a general idea of the land cover across the State, but contains a high margin of error, as indicated in Table 11. However, the changes in these data over time still provide a relevant picture of how land use and land cover in our region and County are changing.

The trend in Orange County

Figure 13 shows the rapid urbanization that occurred in Orange County from 1982 to 1997 - a trend that is substantiated by other studies for the larger Triangle region. Urban land cover and rural roads have both increased dramatically, and these increases are directly related to the decrease in farmland, forestland, and other types of open space. Table 11 gives actual acreage for the same categories of land cover over this 15-year period.

Basis for recommendations

Orange County has adopted specific goals and objectives to preserve the County’s rural character, including farmland preservation, preserving watersheds, preserving identified natural areas and wildlife habitats, and integrating principles of sustainability into the County’s decision-making, policy and planning processes. These goals and objectives are implemented through such programs as the Lands Legacy Program. They are also implemented through the County’s zoning and subdivision ordinances, however, further amendments to those ordinances are needed to slow or halt the loss of biological resources represented by conversion of land from natural and agricultural to urban land uses.

Table 11: Land Cover, 1982-1997

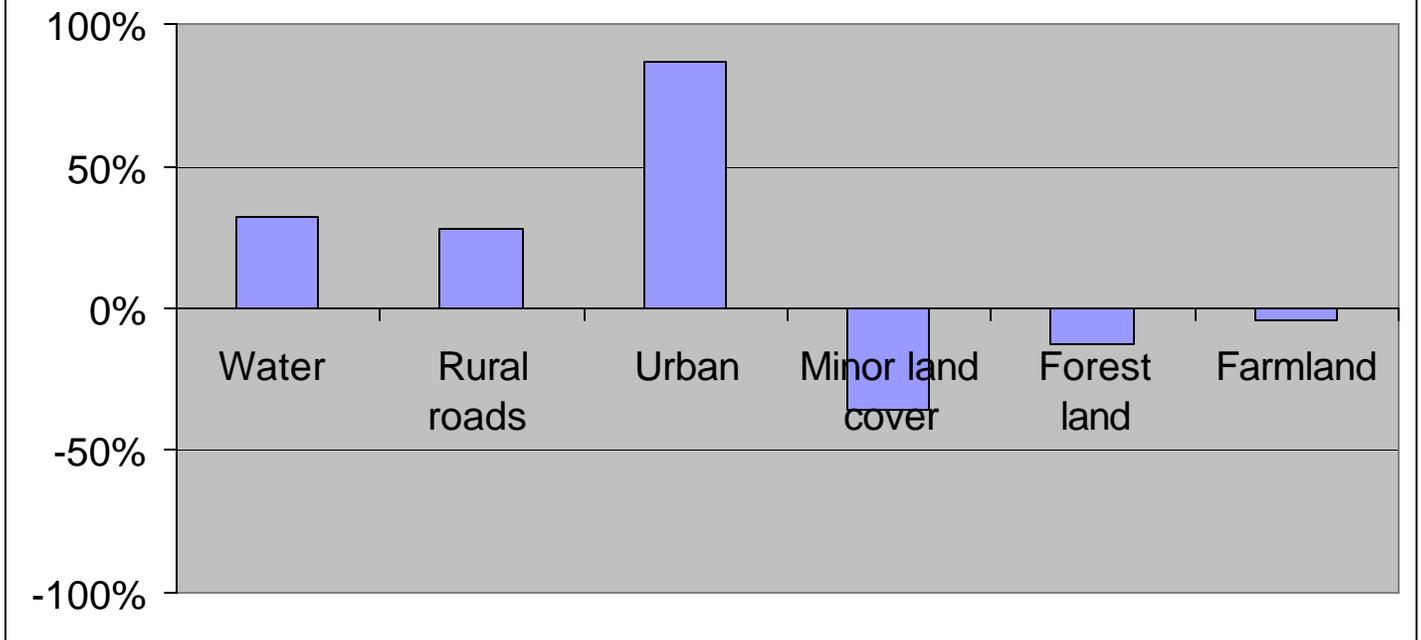
Land Cover Categories ¹	1982	1987	1992	1997	% Change 1982-1997
Farmland	78,900	79,700	74,100	75,500	-4%
Forest land	140,400	135,400	129,500	122,200	-13%
Minor land cover ²	5,300	5,300	3,200	3,400	-36%
Urban	24,400	28,000	40,500	45,600	87%
Rural roads and railroads	4,900	4,900	6,000	6,300	29%
Water	2,800	3,400	3,400	3,700	32%
Total Land in County	256,800	256,800	256,800	256,800	0%

1 Each land cover category contains a standard error of the estimate which averages 17%

2 Minor land cover = all other land uses that are not included in the specified land cover categories

Source: USDA NRI

Figure 13: Percent Change of Land Cover, 1982-1997



BIOLOGICAL RESOURCES

Acres of protected land

Why the indicator was selected

Land that is protected for conservation purposes (i.e., not to be used for development) is an important natural resource. The most effective method for protecting land is to purchase it for conservation purposes or to limit future development activities using conservation easements. A conservation easement is an agreement that allows the land owner to continue to own, and in some cases live on, the land but all rights to develop the property. These actions can ensure long-term protection of the natural habitats found on the land, although restoration activities or buffering from neighboring developed land may be needed. Easements can also be used to protect other community benefits such as scenic or recreational values.

How the indicator was measured

The Orange County Environment and Resource Conservation Department (ERCD) maintains a database of the protected natural and cultural resources within the County. Figure 14 shows the acreage of land placed in permanent or partially protected status in each of three time periods (1980 and prior, 1981–1990, and 1991–2000). Figure 15 shows the percentages of total Orange County land area in two categories, permanently protected and partially protected, as of December 2002. “Permanently protected” land includes land owned by a conservation entity (e.g., government, nonprofit organization, etc.) that is to be permanently left in a natural state, and land for which a conservation easement limits development. “Partially protected” land is land that is intended to remain in a natural state, but is not bound by a legal contract for permanent protection. Table 12 gives details on conservation land holders in Orange County.

The trend in Orange County

Orange County governments, residents, and non-profit organizations continue to work hard at protecting the most important natural resources while providing recreational parks and open space for the public. These groups have worked together to place over 16,000 acres under some form of protection. Although this is a significant amount of land, only 8,000 acres or 3% of the County’s total land is fully protected, and many sensitive areas are threatened by development.

Basis for recommendations

Orange County supports the efforts of various resource protection entities (land trusts, universities, State of NC, OWASA and others) and private landowners to protect important resource lands, including Duke Forest, Eno River State Park, Cane Creek Reservoir watershed, Mason Farm Biological Reserve, the New Hope Creek corridor, and the Ayr Mount and Moorefields historic properties. Those efforts also include the several hundred acres of prime farmland on active farms protected by conservation easements. With the adoption of the Lands Legacy Program in April 2000, Orange County became a full partner in protecting important natural and cultural resources. Orange County ERCD monitors land protection activities and looks for opportunities for collaboration. The County’s goal should be to achieve permanent protection status for at least 10% of Orange County land by 2010.

Figure 14: Amount of Land Protected during Three Time Periods (not cumulative), 1980-2000

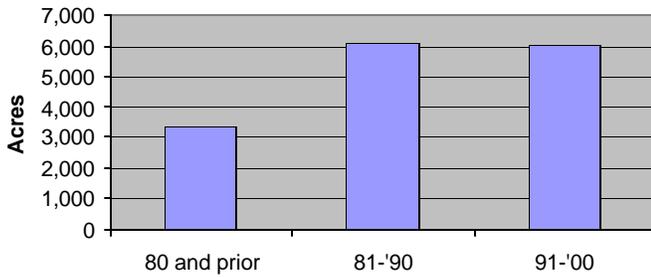


Figure 15: Percent of Total Land that is Protected, 2002

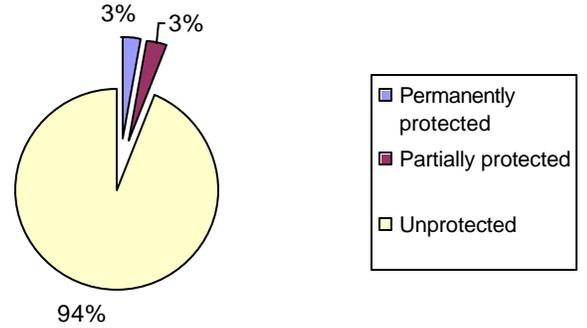


Table 12: Acres of Protected Land, 2002

Owner or Easement Grantee	Date Purchased				Total
	1980 & prior	1981-90	1991-00	2001-02	
Permanently Protected					
Conservation Trust for NC					0
Conservation Easements			143	35	178
Eno River Association			17	17	34
Conservation Easements					0
Draper Savage Memorial Foundation - (Moorefields)		85			85
Conservation Easements					0
The Nature Conservancy		10			10
Conservation Easements					0
Botanical Garden Foundation		17	77		94
Conservation Easements			23		23
Orange County			63	135	198
Conservation Easements			8	119	127
Orange Water and Sewer Authority	73	1,983	1,300		3,356
Conservation Easements			152	354	506
State of North Carolina					
Occoneechee Mountain			74		74
Eno River State Park	800	800	374	178	2,152
Conservation Easements ¹			(32)	(57)	(89)
Triangle Land Conservancy		5	428	35	468
Conservation Easements		9	348	261	618
US Army Corps of Engineers (New Hope Gamelands)	98				98
Conservation Easements					0
U.S. Fish and Wildlife Service					0
Conservation Easements		51			51
Subtotal	971	2,960	3,007	1,134	8,072
Partially Protected					
Town of Carrboro		28	67	1	96
Town of Chapel Hill	131	152	133	22	438
Town of Hillsborough		28			28
City of Durham			11		11
Orange County	331	33	38	244	646
Duke University (Duke Forest)	2,419	397	2,175		4,991
Private Homeowner's Associations	70	239	562	224	1,095
Classical American Homes Pres. Trust			263		263
University of North Carolina	200	1,093	90		1,383
Subtotal	3,151	1,937	3,339	491	8,951
TOTAL	4,122	4,897	6,346	1,625	17,023

¹ Conservation easements held on land already accounted for as protected.

BIOLOGICAL RESOURCES

Acres of protected recognized natural areas

Why the indicator was selected

Recognized natural areas include the County's remaining unique and exemplary natural ecosystems, rare species habitats, special wildlife habitats, and scenic areas. These areas are critical for the sustenance of populations of rare animals, plants and ecosystems. They also provide educational opportunities, recreational enjoyment, and scenic beauty.

How the indicator was measured

Sixty-four natural areas were identified in the 1988 "Inventory of the Natural Areas and Wildlife Habitats of Orange County, North Carolina." The Environment and Resource Conservation Department (ERCD) continues to track the status of these natural areas and works to protect them. Figure 16 shows the acreage of land placed in permanent or partially protected status in each of three time periods (1980 and prior, 1981–1990, and 1991–2000). Figure 17 shows the percentages of total Orange County recognized natural areas in two categories: permanently protected and partially protected, as of 2002. "Permanently protected" areas include land owned by a conservation entity (government, nonprofit organization, etc.) that is intended to be permanently left in a natural state, or land for which a conservation easement limits development. "Partially protected" areas are on land that is intended to remain in a natural state but which is not bound within a legal contract to remain permanently protected. Table 13 gives details on owner, date purchased, and type of legal arrangement for the conservation land holders in Orange County.

The trend in Orange County

A substantial portion of the natural area acreage inventoried in 1988 was found on land already protected by Duke University and the State of North Carolina. Those lands were more accessible for inspection and hence more readily included. The 1980s saw large amounts of land placed under protection, but conservation efforts have not continued at the same pace. This is unfortunate since 4,572 acres of vulnerable natural areas remain unprotected and could be degraded through development.

Basis for recommendations

Orange County is fortunate to have conservation partners (land trusts, universities, State of NC, private landowners, and others) that work to protect the most important natural areas. More than half of the identified natural areas remain unprotected, however, including large sections of Oconeechee Mountain, Pickards Mountain, Laurel Hill Ridge, Crabtree Creek Monadnock Ridge, and Southern Shagbark Hickory Forest. Orange County, through its Lands Legacy Program and in consultation with the Commission for the Environment (CfE), continues to make headway in protecting these areas, in collaboration with other conservation partners. County zoning and subdivision regulations help guide new development out of natural areas, but further refinements to those regulations are needed to effectuate long-term protection. An update to the 1988 inventory of Orange County natural areas will be completed in 2003. That effort will result in changes to the original list of 64 sites. The County should develop a process whereby the status of these sites and their rare species populations are monitored on a regular basis.

Figure 16: Amount of Recognized Natural Area Land that has been Protected during Three Time Periods (non-cumulative), 1980-2000

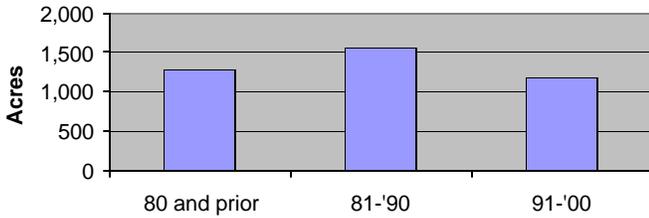


Figure 17: Percent of Acres of Total Recognized Natural Areas that are Protected, 2002

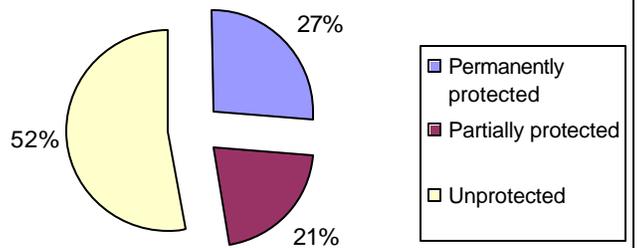
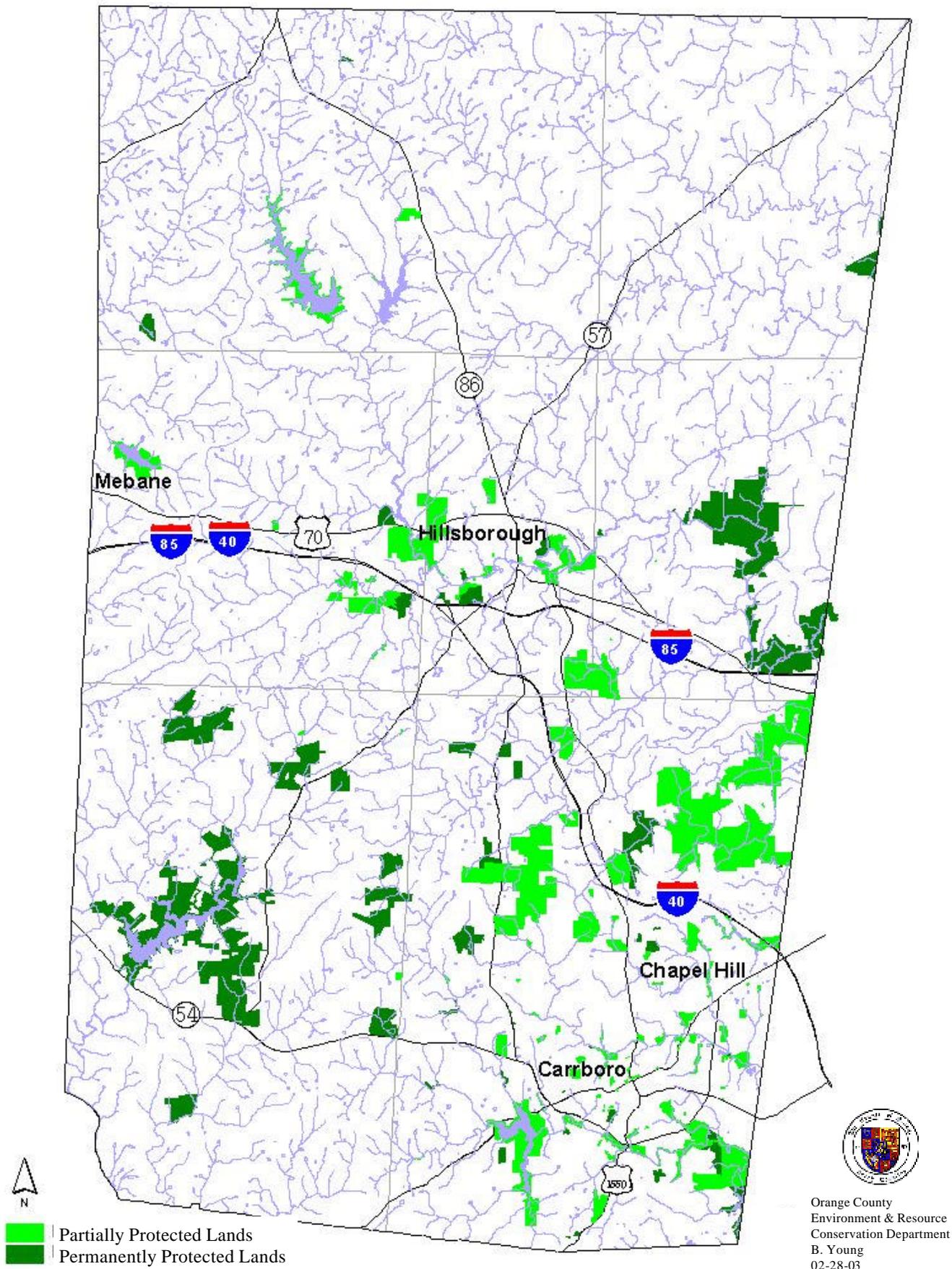


Table 13: Acres of Protected Recognized Natural Areas, 2002

Owner	Date Purchased				Total
	1980 & prior	1981-90	1991-00	2001-02	
Permanently Protected					
Conservation Easements (various)	10	28	197	11	246
Eno River Association			0.5		0.5
Orange Water and Sewer Authority	29	491	196		716
State of North Carolina	457	202	331		990
The Nature Conservancy		6			6
Triangle Land Conservancy		5	85		90
US Army Corps of Engineers (New Hope Gamelands)	78				78
Subtotal	574	732	810	11	2,127
Partially Protected					
Classical American Homes Preservation Trust			46		46
Duke University (Duke Forest)	584	113	332		1,029
Orange County	124			49	173
Town of Chapel Hill	1				1
Town of Hillsborough		28			28
University of North Carolina		685			685
Subtotal	709	826	378	49	1,962
TOTAL	1,283	1,558	1,188	60	4,089
Unprotected	7,377	5,819	4,632	4,572	4,572

Figure 18: Protected Lands in Orange County 2002





Morgan Creek headwater stream below Pickards Mountain.
Protected by conservation easement.

BIOLOGICAL RESOURCES

Acres of prime forest

Why the indicator was selected

Forests were prominent in the pre-European settlement landscape of Orange County, and in this role they provided and still provide habitat for most of the plants and animals native to this area. These plants and animals constitute our indigenous biodiversity. Forests also provide certain ecosystem services to the human community—for instance, they are a source of clean water and they provide flood control services. From the “Land Cover” indicator (described on page 30), we already know that acreage of generalized “forestland” is decreasing in Orange County.

How the indicator was measured

“Prime Forest” is here defined as it was in the report, “A Landscape with Wildlife for Orange County, Parts 1 and 2” (Triangle Land Conservancy, 1997 and 1999): tracts of hardwood forest 10 acres or more in size and tracts of mixed hardwood-pine forest, 40 acres or more in size that are undisturbed or only slightly disturbed. Many of the native plants and animals of Orange County remain restricted to hardwood forests and need forest interior habitat. Others, such as white-tailed deer, raccoons, crows, and mockingbirds, have adapted to human created disturbances to the forest in the form of clearings for houses, buildings, and roads. Acres and distribution of prime forest were obtained for the TLC report by analyzing 1988 aerial photographs. Changes to these data as of 1996 were estimated by analyzing building permits issued between 1988 and 1996. The digitized data are on file at the ERCD and are shown in Figure 18. Orange County does not yet have an updated analysis of prime forest cover, though it could be obtained by examining 1998 aerial photographs. This indicator does not include forests lost to timber harvesting since 1988.

The trend in Orange County

In 1988, Orange County had about 71,000 acres of prime forest (28% of Orange County). About 25,000 acres of this (10% of County) was “undisturbed hardwood forest” (as defined in the TLC report). Most of these tracts were small—more than half were no more than 100 acres in size. Based on building permit data from 1988 to 1996, 9,000 acres of prime forest (10% of the total noted on 1988 aerial photos) lie within parcels affected by the building permits. Still other areas—not yet quantified—have been affected by timber harvesting that is not associated with building permits. Ten percent loss in less than a decade is a rapid rate of deforestation.

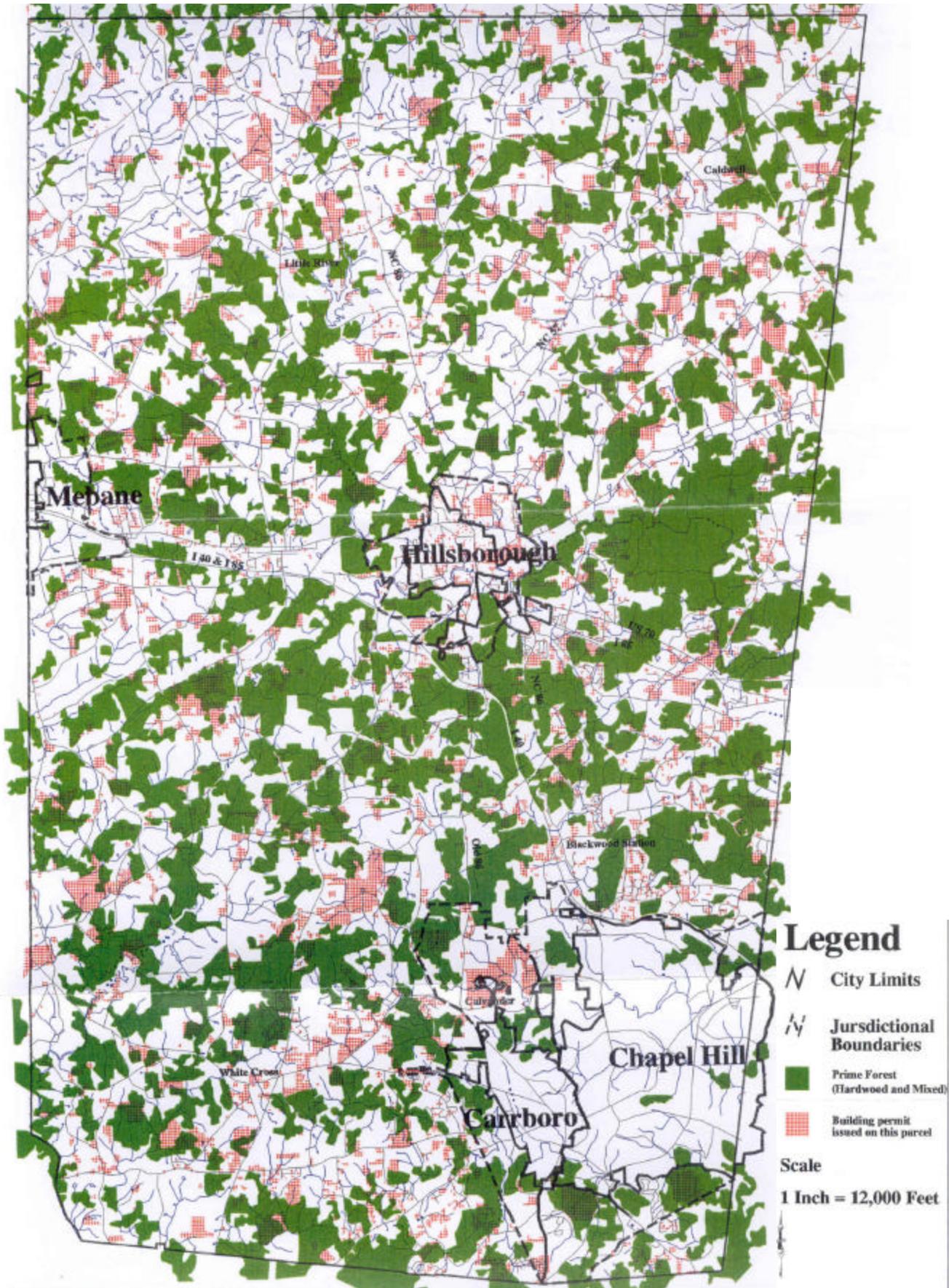
Table 14: Acres of Prime Forests, 1988

Hardwood	24,567
Mixed hardwood-pine	46,814
Total	71,381

Basis for recommendations

Orange County funded the “Landscape with Wildlife for Orange County” reports (Parts I and II) in order to identify these important forest resources. These data are used by the Environment and Resource Conservation Department (ERCD) to identify priority resource lands to protect through the Lands Legacy Program. The County needs to update the prime forest data using 1998 orthophotographic data and present the 10-year change (1988-1998) in the next SOE report. Orange County must intensify its own efforts to achieve permanent protection for remaining large hardwood and mixed hardwood-pine forests. Primary ways to achieve this goal are to purchase forestlands through the Lands Legacy Program, and to purchase or otherwise acquire working forest easements. Connectivity between protected forest tracts and buffering from disturbance-generating activities (e.g., encroachment by invasive species) should be major considerations in these efforts.

Figure 19: Disruption of Prime Forest by Development, 1988-1996



BIOLOGICAL RESOURCES

Acres within the present use value program

Why the indicator was selected

North Carolina General Statutes authorize local governments to reduce tax values for individually owned property used for agricultural, horticultural, or forestry management (NCGS 105-277.2 et seq.). Eligibility requirements for the Present Use Value Program are different for each use category. By basing the tax rate on the current use instead of potential development uses, the program helps protect farms and forest from development pressure and speculation. Since Orange County will continue to experience strong development pressure, the program will enable farmers and owners of forestland to continue providing essential crops to the community and will remain another important mechanism for helping protect wildlife habitat.

How the indicator was measured

The Present Use Value Program is administered in Orange County by the Tax Assessor's Office. Lands that are removed from eligibility in the program may be subject to deferred taxes based on the property's full market value.

The trend in Orange County

As shown in Figure 19, 42% of the land in Orange County is enrolled in the Present Use Value Program. By encouraging landowners to keep their land free from development, the program is a valuable tool to preserving open space, and its utilization will continue to provide a benchmark to the County's success in this area. When the lands withheld from development are nonagricultural, they also contribute to maintaining biodiversity in the County. It should be noted, however, that agricultural lands do not contribute significantly to this goal.

Basis for recommendations

The Present Use Value Program provides farm and forest landowners with significant financial incentives to maintain the productivity and rural nature of important resource lands. In 2002, Orange County supported legislation that allows farm and forest lands that have been placed under conservation easement to remain eligible for the program. The Commission for the Environment (CfE) recommends that the County now support new legislation proposed by the NC Smart Growth Commission that would enlarge a low-impact conservation option for forestry (Smart Growth Commission 2001).

Figure 20: Percentage of Total County Land that is in Present Use Value Program, 2002

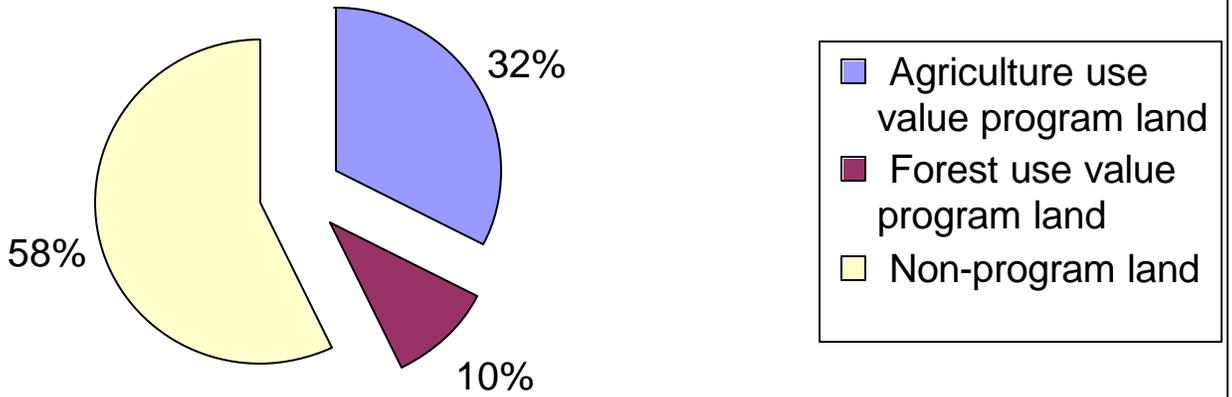


Table 15: Present Use Value Program, 2002

	No. of parcels	Acreage
Agriculture use value	2,415	83,267
Forest use value	815	26,398
Total land in use value	3,230	109,665
Total land in Orange County	49,616	256,800

BIOLOGICAL RESOURCES

Status of rare plants and animals

Why the indicator was selected

Why do rare species matter? Within an ecosystem, the loss of one species can severely impact the livelihood of other species, as each species depends upon the other to operate as a community. When one species becomes “historic” or extirpated in a region, there is a loss of natural biological diversity (“biodiversity”) – a loss in the number and type of genes, species, and ecosystems in that region.

How the indicator was measured

The 2002 Orange County rare species list (Table 18) was compiled by the N.C. Natural Heritage Program and the Orange County Environment and Resource Conservation Department (ERCD). State status (endangered, threatened, special concern, etc.) is determined by the State Plant Conservation Program and the Endangered Wildlife Program of the N.C. Wildlife Resources Commission. The designation of “historic” (presence not documented in the past 20 years) within the County was verified by field biologists with local knowledge of Orange County.

The trend in Orange County

As Table 17 suggests, Orange County continues to experience the loss of native species populations. Since habitat loss is considered one of the leading causes of endangerment and extirpation of plant and animal populations, the loss of species could be directly related to the increased rate of conversion of natural land to urban/suburban uses and the related degradation of stream and other aquatic habitats.

Table 16: Last Occurrence of Historic Species

	Pre 1940	1940 - 1959	1960-1980	Total
Bird			1	1
Crustacean		1		1
Insect		1	1	2
Mollusk			1	1
Moss			1	1
Vascular plant	6	7	8	21
Total	6	9	12	27

Basis for recommendations

Orange County ERCD works with the NC Natural Heritage Program to monitor and update the list of rare plants and animals for the County. Changes to the list will be made as a result of an update to the 1988 inventory of natural areas, to be completed in 2003. To address the apparent loss of species (though some of these may have always been rare), the County should be aware that loss of habitat and the establishment and spread of invasive species are the major causes of native species extirpation and local extinction. Setting aside land that will remain in its natural state, providing for wildlife corridors, and promoting the use of native species for landscaping are actions that the County can use to influence this trend. The County should also consider developing a way to monitor non-rare indicator species as a way to measure the “state of biodiversity” in Orange County.

State of the Environment - 2002
Orange County, NC

Table 17: STATUS OF ORANGE COUNTY'S RARE PLANTS AND ANIMALS

	Common Name	Scientific Name	Federal Status	State Status				County Status
				Endangered	Threatened	Special Concern	Significantly Rare	
Vertebrates								
Fishes								
	Roanoke Bass	<i>Ambloplites cavifrons</i>					X	Current
	Carolina Darter	<i>Etheostoma collis pop</i>	Species of Concern			X		Current
	Pinewoods Shiner	<i>Lythrurus matutinus</i>	Species of Concern				X	Current
Amphibians								
	Four-toed Salamander	<i>Hemidactylium scutatum</i>				X		Current
	Neuse River Waterdog	<i>Necturus lewisi</i>				X		Current
Birds								
	Sharp-shinned Hawk	<i>Accipiter striatus</i>					X	Current
	Bald Eagle	<i>Haliaeetus leucocephalus</i>	Threatened		X			Current
	Red-cockaded Woodpecker	<i>Picoides borealis</i>	Endangered	X				Historic
	Warbling Vireo	<i>Vireo gilvus</i>					X	Current
Invertebrates								
Crustacean								
	Carolina Well Diacyclops	<i>Diacyclops jeanneli putei</i>					X	Historic
Insect								
	Golden Banded-skipper	<i>Autochton cellus</i>					X	Historic
	Northern Oak Hairstreak	<i>Fixsenia favonius ontario</i>					X	Current
	Giant Swallowtail	<i>Papilio cresphontes</i>					X	Historic
Mollusk								
	Dwarf Wedgemussel	<i>Alasmidonta heterodon</i>	Endangered	X				Current
	Triangle Floater	<i>Alasmidonta undulata</i>			X			Current
	Brook Floater	<i>Alasmidonta varicosa</i>	Endangered	X				Current
	Alewife Floater	<i>Anodonta implicata</i>			X			Historic
	Atlantic Pigtoe	<i>Fusconaia masoni</i>	Endangered	X				Current
	Yellow Lampmussel	<i>Lampsilis cariosa</i>	Endangered	X				Current
	Eastern Lampmussel	<i>Lampsilis radiata</i>			X			Current
	Green Floater	<i>Lasmigona subviridis</i>	Endangered	X				Current
	Squawfoot	<i>Strophitus undulatus</i>			X			Current
	Savannah Lilliput	<i>Toxolasma pullus</i>	Endangered		X			Current
	Notched Rainbow	<i>Villosa constricta</i>				X		Current
Vascular Plants								
	Southern Anemone	<i>Anemone berlandieri</i>					X	Current
	Bradley's Spleenwort	<i>Asplenium bradleyi</i>					X	Current
	Prairie Blue Wild Indigo	<i>Baptisia minor</i>			X			Current
	American Barberry	<i>Berberis canadensis</i>					X	Historic
	American Bluehearts	<i>Buchnera americana</i>					X	Historic
	Douglass's Bittercress	<i>Cardamine douglassii</i>					X	Current
	Bush's Sedge	<i>Carex bushii</i>					X	Current
	Wood's Sedge	<i>Carex woodii</i>					X	Historic
	Piedmont Horsebalm	<i>Collinsonia tuberosa</i>					X	Historic
	Creamy Tick-trefoil	<i>Desmodium ochroleucum</i>					X	Historic
	Eastern Shooting Star	<i>Dodecatheon meadia var meadia</i>					X	Historic
	Smooth Coneflower	<i>Echinacea laevigata</i>	Endangered	X				Historic
	Eastern Isopyrum	<i>Enemion biternatum</i>					X	Historic
	Godfrey's Thoroughwort	<i>Eupatorium godfreyanum</i>					X	Historic
	Large Witch-alder	<i>Fothergilla major</i>					X	Current
	Heller's Rabbit Tobacco	<i>Gnaphalium helleri var helleri</i>					X	Historic
	Crested Coralroot	<i>Hexaletris spicata</i>					X	Current
	Lewis's Heartleaf	<i>Hexastylis lewisii</i>					X	Current
	Small Whorled Pogonia	<i>Isotria medeoloides</i>	Endangered	X				Current
	Earle's Blazing Star	<i>Liatris squarulosa</i>					X	Historic
	Glade Milkvine	<i>Matelea decipiens</i>					X	Historic
	Sweet Pinesap	<i>Monotropsis odorata</i>	Species of Concern				X	Current
	Wiry Panic Grass	<i>Panicum flexile</i>					X	Historic
	Glade Wilde Quinine	<i>Parthenium auriculatum</i>					X	Historic
	Purple Fringeless Orchid	<i>Platanthera peramoena</i>					X	Current
	Indian Physic	<i>Porteranthus stipulatus</i>					X	Historic
	Torrey's Mountain-mint	<i>Pycnanthemum torrei</i>					X	Current
	Water-plantain Spearwort	<i>Ranunculus ambigens</i>					X	Historic
	Michaux's Sumac	<i>Rhus michauxii</i>	Endangered	X				Historic
	Pursh's Wild-petunia	<i>Reullia purshiana</i>					X	Historic
	Southern Skullcap	<i>Scutellaria australis</i>					X	Historic
	Shale-barren Skullcap	<i>Scutellaria leonardii</i>					X	Current
	Appalachian Golden-banner	<i>Thermopsis mollis sensu stricto</i>					X	Historic
	Glade Bluecurls	<i>Trichostema brachiatum</i>					X	Historic
Nonvascular Plants								
Moss								
	Closter's Brook-hypnum	<i>Hygrohypnum closteri</i>					X	Historic

WATER RESOURCES

Water demand

Why the indicator was selected

Water is a finite resource that we all depend upon. This resource is vital for public health, agricultural production, and economic growth. To continue to provide a healthy and affordable living environment along with sustainable growth in agriculture and industry, Orange County must carefully plan and manage the use of its water resources.

How the indicator was measured

The data were provided by NC DENR, Division of Water Resources and U.S. Geological Survey. Table 19 shows the amount of water used within the County over a 15-year period in million gallons per day (mgd). It separates the usage by the source of water: ground or surface. Table 20 presents the demand for 1985 to 2000 to identify the average amount of water used per person, which is measured in units of gallons per capita per day (gcd). For this table, gcd is calculated by dividing the total average amount of water used per day by the population.

The trend in Orange County

As the urban areas within the County continue to grow, more and more people are relying on municipal and community supplies. The vast majority of this water supply is from surface waters. However, a significant proportion of the domestic water supply still comes from individual wells. The data on per capita demand reveal that the amount of water being used per person increased from 124 gcd in 1985 to 142 gcd in 2000, a 15% increase. This increase would be higher if Flint Fabrics, which used 1 million gpd, would have not closed.

Basis for recommendations

The demand for water from the three utilities in Orange County that serve its largely urban population of approximately 120,000 people, of an estimated 180,000 County population, will amount to about 18 million gallons per day (mgd), based upon a per capita demand of about 150 gallons per capita per day (gcd). The present safe yield is about 15 mgd. Surface water resources in the region are extremely limited. Wastewater reclamation and reuse for nonpotable purposes holds the promise of meeting the future demand for water for the urban population. Implementation of changes in development pattern need to be taken well before the reclaimed water is available.

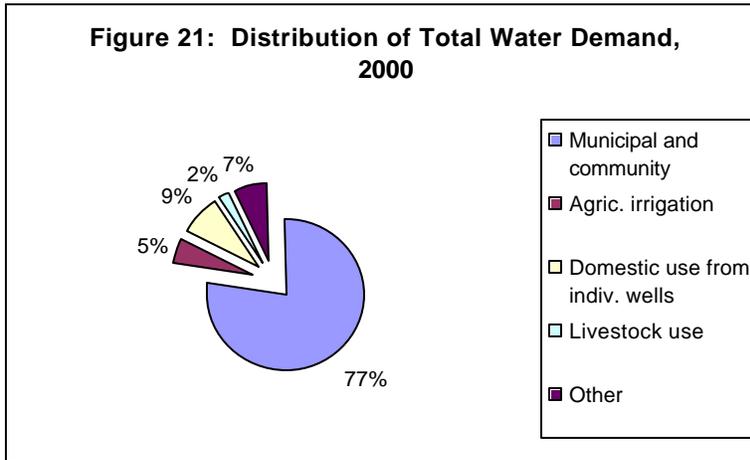


Table 18: Water Usage (mgd), 1985-2000

	1985			1990			1995			2000*		
	Ground	Surface	Total	Ground	Surface	Total	Ground	Surface	Total	Ground	Surface	Total
Municipal and community		7.52	7.52		9.49	9.49	0.25	10.5	10.75	0.52	12.44	12.96
Self supplied industry	0.01		0.01			0			0			0
Agric. irrigation		0.8	0.8	0.08	0.74	0.82	0.76	2.28	3.04	0.22	0.59	0.81
Domestic use from indiv. wells	1.2		1.2	0.71		0.71	1.72		1.72	1.52		1.52
Livestock use	0.35	0.06	0.41	0.36	0.06	0.42	0.35	0.13	0.48	0.24	0.06	0.3
Other	0.15	0.24	0.39	0.12	0.3	0.42	0.03		0.03	0.3	0.88	1.18
TOTAL USE	1.71	8.62	10.33	1.27	10.59	11.86	3.11	12.91	16.02	2.8	13.97	16.77

* Preliminary data subject to revision

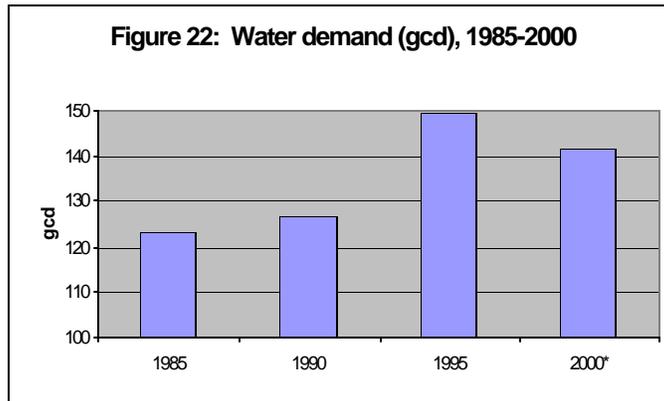


Table 19: Percent Change in Demand (gcd), 1985-2000

	1985	1990	1995	2000* ¹	% change '85-'90	% change '90-'95	% change '95-'00	% change '85-'00
MGD	10.3	11.9	16.0	16.8	14.8%	35.1%	4.7%	62.3%
Population	83,581	93,851	107,352	118,227	12.3%	14.4%	10.1%	41.5%
GCD	124	126	149	142	2.2%	18.1%	-4.9%	14.8%

* Preliminary data subject to revision

¹ The decrease in 2000 demand is heavily attributed to the closing of Flint Fabrics in 2000, which used 1 million gpd. If Flint Fabrics had remained open and used the same amount of water the gcd would be 150 and the upward trend would have continued.

WATER RESOURCES

Public water system safe yields

Why the indicator was selected

A twenty year safe yield is the amount of water that a system can withdraw on a continuous basis. This implies that if a system's average daily demand is roughly equal to the safe yield then once every 20 years the source will be inadequate. On the average, 19 years out of every 20 years, 95% of the time, the source will be sufficient. This statistic is a useful gauge for determining the resource that is needed within a water system.

How the indicator was measured

The indicator includes only the largest systems in Orange County since smaller water service providers are not required to identify or report their safe yields. The safe yield information for the three largest Orange County systems was gathered from local water supply plans for 1992 and 1997, as submitted to the NC DENR Division of Water Resources (table data compiled by Triangle J Council of Governments, TJCOG). Data for 2001 were provided by the water service provider, through TJCOG. Since one-third of Orange-Alamance Water System customers are in Orange County, the reported numbers for the system were multiplied by one-third to distinguish Orange County trends. It should be noted that Hillsborough bought finished water from Durham during extended periods over the past several years. Orange-Alamance Water System has also bought water from Graham-Mebane and Hillsborough. Those supplemental supply sources are not factored into the safe yields, since the purchase arrangements are not permanent in nature and can be discontinued at any time by the party selling the water. Table 22 reveals the average day and maximum day demands on the water systems. Maximum day is the maximum daily amount demanded in one year.

The trend in Orange County

Within the last four years, all three water systems have increased their capacity to accommodate future demands on the system. As shown, Orange Water and Sewer Authority has significantly larger sources than Hillsborough and Orange-Alamance. The low safe yields reveal that the Hillsborough and Orange-Alamance systems have been dependent on purchasing water from other public water systems.

Basis for recommendations

The demand for water from the three utilities in Orange County that serve its largely urban population of approximately 120,000 people, of an estimated 180,000 County population, will amount to about 18 million gallons per day (mgd), based upon a per capita demand of about 150 gallons per capita per day (gcd). The present safe yield is about 15 mgd. Surface water resources in the region are extremely limited. Wastewater reclamation and reuse for nonpotable purposes holds the promise of meeting the future demand for water for the urban population. Implementation of changes in development pattern need to be taken well before the reclaimed water is available.

Table 20: Safe Yield, 1992-2001

	1992	1997	2001
OWASA (mgd)	13.50	13.50	15.10
Hillsborough (mgd)	0.68	0.68	2.58 ¹
Orange-Alamance (Orange) (mgd)	0.12	0.12	0.12 ²

1 Equals 1.9 for W. Fork of Eno plus 0.68 for Lake Ben Johnston

2 Plus three wells at 95, 667 gpd specifically for Orange County

Hillsborough's safe yield is adjusted by Eno River Capacity Agreement

Table 21: Average Day and Maximum Day Demand, 1992-2001

	1992	1997	2001
OWASA			
Avg. Day (mgd)	7.14	8.98	10.17
Max Day (mgd)	12.00	14.34	13.75
Hillsborough			
Avg. Day (mgd)	1.46	1.82	1.23
Max Day (mgd)	2.04	2.65	1.87
Orange-Alamance (Orange)			
Avg. Day (mgd)	0.24	0.36	0.29
Max Day (mgd)	0.34	0.44	0.39

* The large decrease in Hillsborough is due to the closing of Flint Fabrics in 2000 which used 1 mgd

Figure 23: Water and Sewer Management Planning and Boundary Agreement, 2001

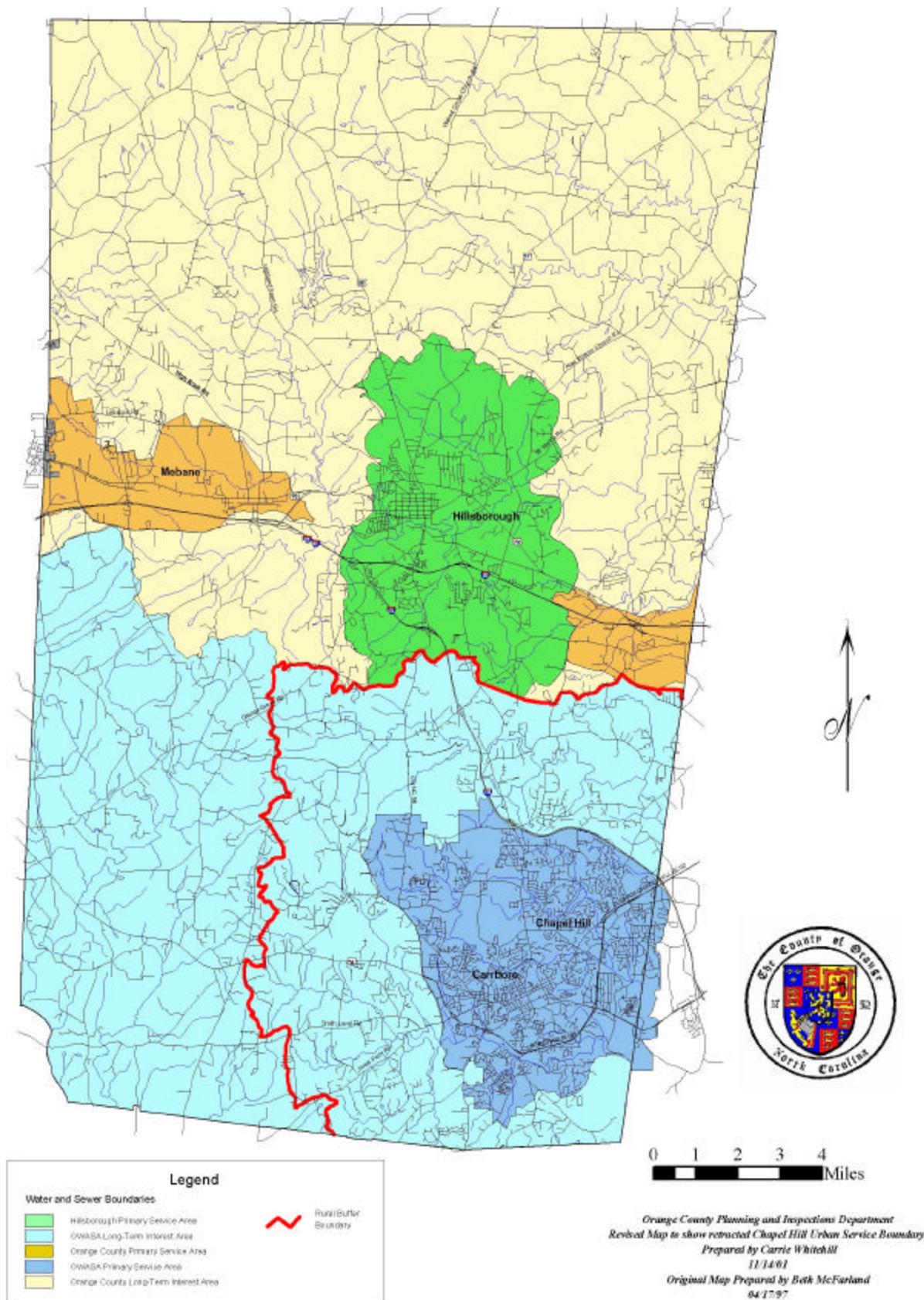
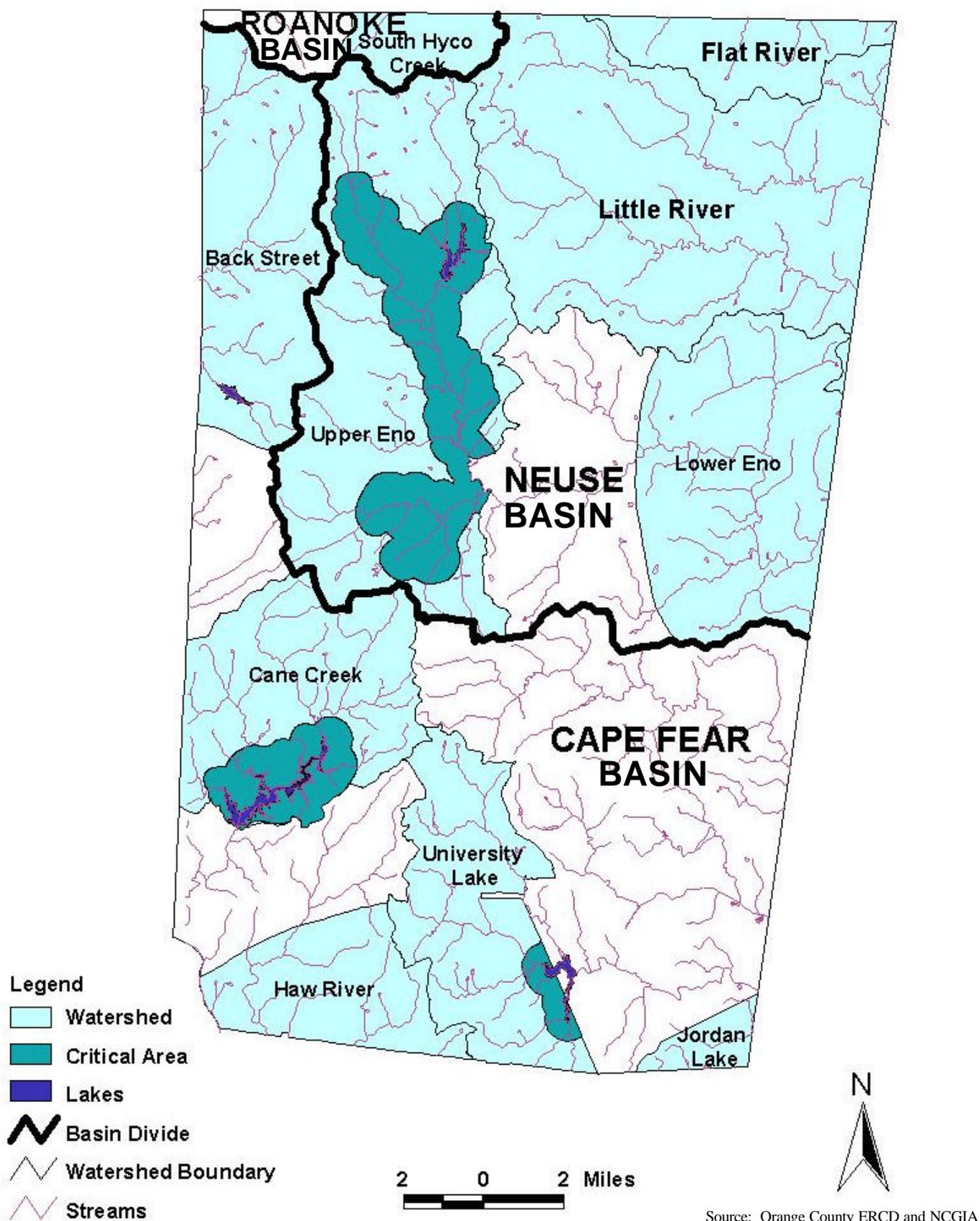


Figure 24: Protected Watersheds in Orange County



WATER RESOURCES

Household source of water

Why the indicator was selected

In order to effectively plan now for the provision of clean and affordable water in the future without exhausting the resource, the County must have information on how residents obtain water today.

How the indicator was measured

The U.S. Census Bureau provided this information through a sample survey administered during the decennial census. Table 23 shows the percentage of households that used well water, public water, or water from another source.

The trend in Orange County

Approximately, one third of County residents (predominantly in the unincorporated areas) rely on a non-public source of water. This percentage has remained fairly constant over the last 30 years. Thus a large proportion of the County relies on a water source that is only slightly, if at all, monitored. The size of this cohort provides an incentive for the County to better monitor and protect the quantity and quality of water for residents relying on non-public water sources.

Basis for recommendations

Groundwater contamination reports are filed with the State from many sources. No one, however, follows these reports to ensure that groundwater users in the vicinity of ground contamination check their wells. There currently is a wellhead protection program in the County. The County tracks the location of new wells, but no one currently is compiling the location of older existing wells.



Lake Ben Johnson: Water supply intake for the Town of Hillsborough.

Table 22: Household source of water, 1990

Source	% of total
Well Water	28.7%
Public Water	70.7%
Other Water	0.6%

WATER RESOURCES

Groundwater contamination incidents

Why the indicator was selected

Ground contamination incidents can contaminate groundwater and soils and therefore can severely damage plants, animals, and groundwater quality. The number of incidents is one of many indicators which describe how critically our daily activities are impacting the natural environment surrounding us. The complete remediation of these incidents is vital for protecting water quality. The term “closed out” refers to incidents that have been successfully restored to their natural state.

How the indicator was measured

The NC DENR, Division of Waste Management—Underground Storage Tank Section manages the Pollution Incident Response Form (PIRF) Management Database. The database provides detailed information on the type, date, amount and status of ground contamination incidents.

The trend in Orange County

Over the past fifteen years, there has been a significant increase in the number of ground contamination incidents. There were 28 incidents from 1986-1990 and 98 incidents from 1996-2001. The percentage of incidents that have been “closed out” also signals a poor trend. During the previous time periods 46% and 50% of the cases were “closed out” while only 43% were “closed out” in the latest period.

Basis for recommendations

Groundwater contamination reports are filed with the State from many sources. No one, however, follows these reports to ensure that groundwater users in the vicinity of ground contamination check their wells. There currently is a wellhead protection program in the County. The County tracks the location of new wells, but no one currently is compiling the location of older existing wells.

Figure 25: "Closed Out" Ground Contamination Incidents, '86-'00

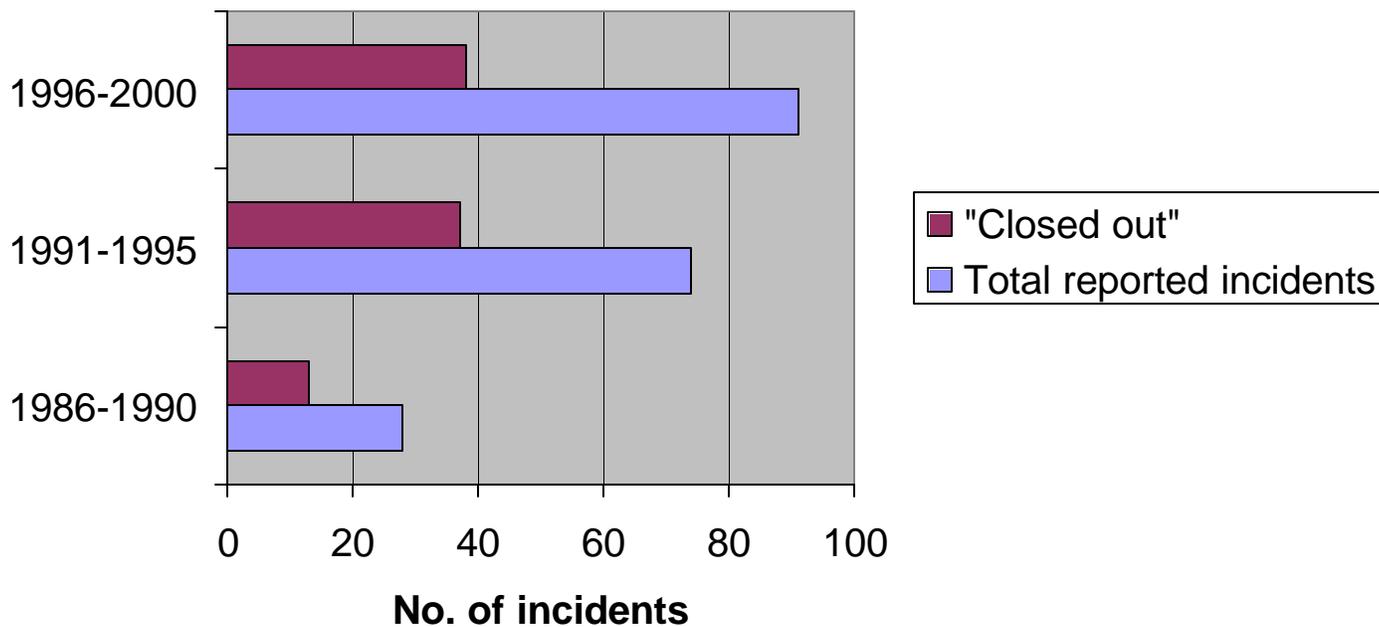


Table 23: Ground Contamination Incidents, 1986-2000

	1986-1990	1991-1995	1996-2000	Total
Total reported incidents	28	74	91	193
"Closed out"	13	37	38	88
% that are "Closed Out"	46.4%	50.0%	41.8%	45.6%

WATER RESOURCES

Type and size of water service providers

Why the indicator was selected

Policy makers should be aware that there are many water providers within the County. The institutional capacity of these small providers is an ongoing policy concern.

How the indicator was measured

The indicator data were provided by NC DENR, Division of Environmental Health - Public Water Supply Section. Table 25 shows the names of the 53 water providers within the County, the type of provider they are, the number of connections they serve, the average number of gallons per day that they provide, and the amount of water that is from ground water or surface water.

The trend in Orange County

Although the majority of the water is provided by three public water providers: Orange Water and Sewer Authority, Town of Hillsborough, and Orange-Alamance Water System, County residents rely on many other providers. These other providers obtain their water from wells or purchase it from larger providers.

Table 24: Type and Size of Water Providers: 2002

System Name	Type1	Number of Connections	Daily Flow Requirements (gpd)	Ground Water Amount (gpd)	Surface Water Amount (gpd)
ORANGE WATER & SEWER AUTHORITY	CS		8,800,000		8,800,000
HILLSBOROUGH, TOWN OF	CS		1,800,000		1,800,000
ORANGE-ALAMANCE WATER SYSTEM (Orange)	CS		330,000	70,000	260,000
STONERIDGE MASTER	CG	271	108,400	108,400	
STONEGATE MHP	CG	29	72,300	72,300	
BIRCHWOOD S/D	CG	107	42,800	42,800	
ROBINSWOOD S/D	CG	99	39,600	39,600	
THE TRAILS S/D	CG	94	37,600	37,600	
MAPLE RIDGE PARK	CG	86	21,500	21,500	
COLONIAL PARK WATER ASSOC	CG	51	20,400	20,400	
BINGHAM WOODS	CG	72	18,000	18,000	
WHISPERING PINES	CG	71	17,700	17,700	
WILDCAT CREEK S/D	CG	44	17,600	17,600	
NORTHWOOD S/D	CG	40	16,000	16,000	
RIDGEWOOD MHP	CG	60	15,000	15,000	
SPRING HILL MHP	CG	55	13,700	13,700	
HEARTWOOD S/D	CG	26	10,400	10,400	
OAK GROVE MHP	CG	38	9,500	9,500	
WOODLAND PARK	CG	23	9,200	9,200	
ORANGE MHP	CG	35	8,800	8,800	
HOMESTEAD MHP	CG	35	8,700	8,700	
HILL TOP MHP	CG	33	8,300	8,300	
EUGLENA JUNCTION	CG	31	7,800	7,800	
COUNTRY SQUIRE MHP	CG	31	7,700	7,700	
BAILEY'S MOBILE VILLA	CG	27	6,800	6,800	
ARBOR HILL MHP	CG	27	6,800	6,800	
STURBRIDGE S/D	CG	17	6,800	6,800	
CAROLANTIC PARK	CG	27	6,700	6,700	
RILEY'S MHP	CG	25	6,200	6,200	
THE RANCH MHP	CG	24	6,000	6,000	
CAROLINA FRIENDS SCHOOL	P		6,000	6,000	
WOOD'S MHP	CG	22	5,500	5,500	
TIMBERIDGE MHP	CG	22	5,500	5,500	
FOXBORO ESTATES	CG	20	5,000	5,000	
NORTH ORANGE HUMAN SERVICES	P		5,000	5,000	
OLDE FARM MOBILE COURT	CG	19	4,800	4,800	
MCFARLAND MHP	CG	19	4,700	4,700	
CRAWFORD'S MHP	CG	18	4,500	4,500	
MORRIS GROVE HEIGHTS	CG	13	3,300	3,300	
EMERSON WALDORF GRADE SCHOOL	P		3,200	3,200	
SUNRISE CHURCH	P		3,000	3,000	
UPS	P		2,500	2,500	
KANTNER SCHOOL	P		2,100	2,100	
MAJOR BUSINESS SYSTEMS	P		1,900	1,900	
CAMP NEW HOPE	R		1,100	1,100	
EMERSON WALDORF KINDERGARTEN	P		700	700	
MT HERMON BAPTIST CHURCH DAYCA	P		500	500	
DOMINION RAMSGATE APTS	S		Purchase2		
HIGHLAND HILLS APTS	S		Purchase2		
POPLAR PLACE	S		Purchase2		
BRADFORD PLACE	S		Purchase2		
AUTUMN WOODS APTS	S		Purchase2		
NOTTING HILL APTS	S		Purchase2		
Total			11,540,000	680,000	10,860,000

Type1 = System Types: CG - Community Ground Well, CS - Community Surface, P - Non-Transient Non-Community, S - Sub-metered Apartment, R - Campground
Purchase2 = system purchases water from another supplier (ie. a city) and then retails to households.

WATER RESOURCES

Wastewater permit violations and spill collection

Why the indicator was selected

Wastewater treatment is an essential element of the infrastructure of towns and cities. The quality of that service can be evaluated by observing the number and volume of spills and determining by analysis the amount of pollutant that reaches surface waters.

How the indicator was measured

NC DENR, Division of Water Quality provided the data for this indicator. Table 26 includes the number and volume of spills and the amount that reached surface waters. Table 27 states the number of violations within the County and the total amount of penalties charged for those penalties.

The trend in Orange County

Wastewater treatment plants have done an excellent job of decreasing the number of spills. Since 1998, they have decreased the number by 99%. As shown in Figure 27, the wastewater permit violation data reveals a significant problem in 2000 with a large decrease in violations in 2001.

Figure 26: Total Volume of Wastewater Spills, 1998-2001

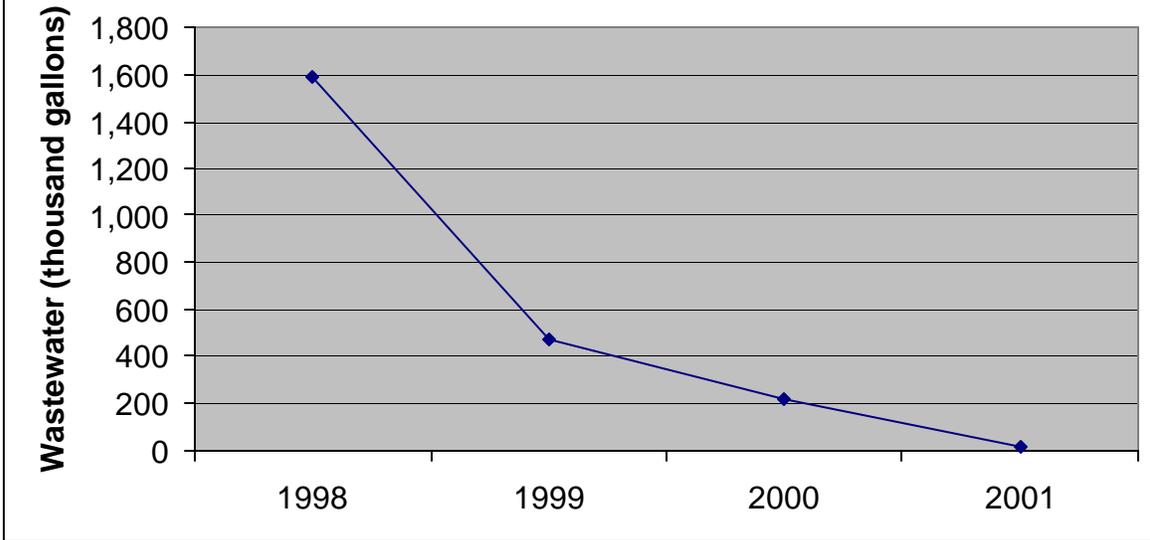


Table 25: Wastewater Spills, 1998-2001

	1998	1999	2000	2001	% change '98-'01
Number of spills	62	55	26	10	-83.9%
Total volume of spills	1,592,970	467,035	215,595	18,305	-98.9%
Total volume reaching surface waters	1,539,495	461,739	196,237	17,495	-98.9%

Figure 27: Wastewater Permit Violations, 1998-2001

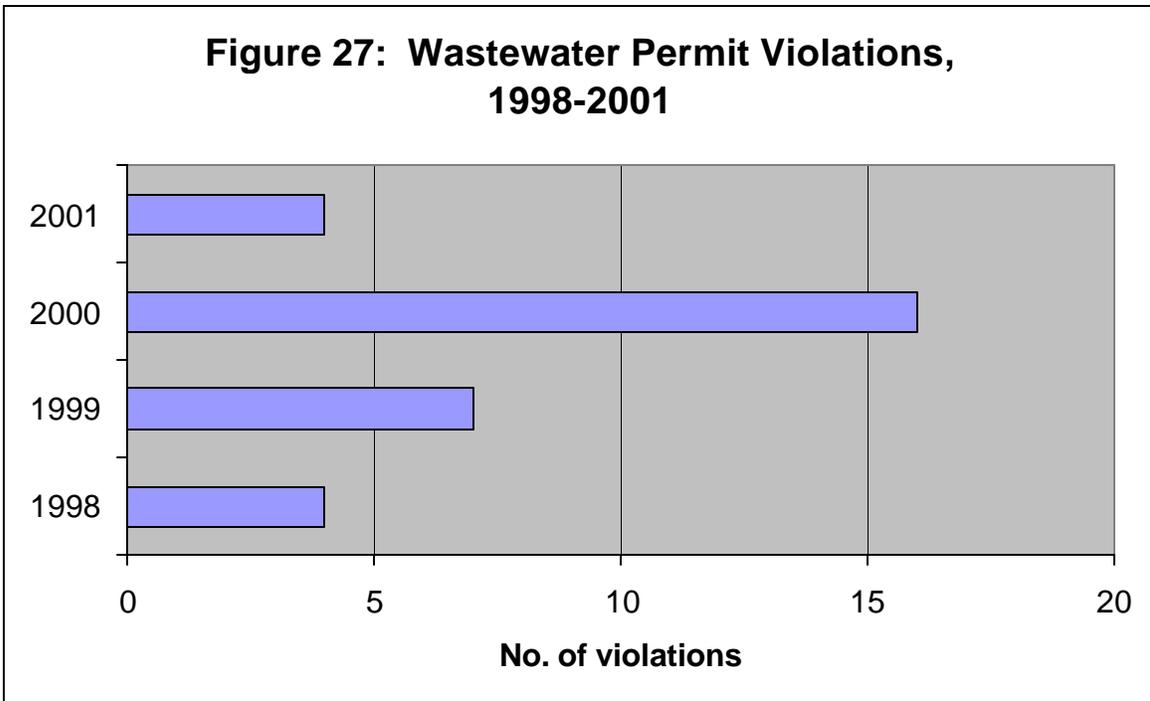


Table 26: Wastewater Permit Violations, 1998-2001

	1998	1999	2000	2001
Number of violations	4	7	16	4
Total penalties assessed	\$5,425	\$10,425	\$24,836	\$3,500

WATER RESOURCES

Streams not meeting classified uses

Why the indicator was selected

Since plants, animals, and humans rely on clean surface water, it is critical that local and state governments plan and protect this sensitive resource. One method that state governments use to ensure clean and safe surface water is applying specific federal standards that water bodies must meet. The State compiles a list of all water bodies that do not meet water quality standards. The numbers in Table 28 represent the length in miles of water bodies in Orange County that do not meet water quality standards. The impairment in these water bodies may be due to an individual pollutant, multiple pollutants, pollution, or an unknown cause.

How the indicator was measured

NC DENR, Division of Water Quality compiles a list of impaired water bodies. The indicator was measured through a GIS database provided by Triangle J Council of Governments, TJCOG. The mapping and calculations were performed by Orange County Environment and Resource Conservation Department (ERCD). The list rates sections of major streams and rivers as either “fully supporting” their designated use, “partially supporting” their use, or “not supporting”. “Partially supporting” or “non supporting” implies that the stream or river has been damaged by pollutant(s) or by an unknown cause.

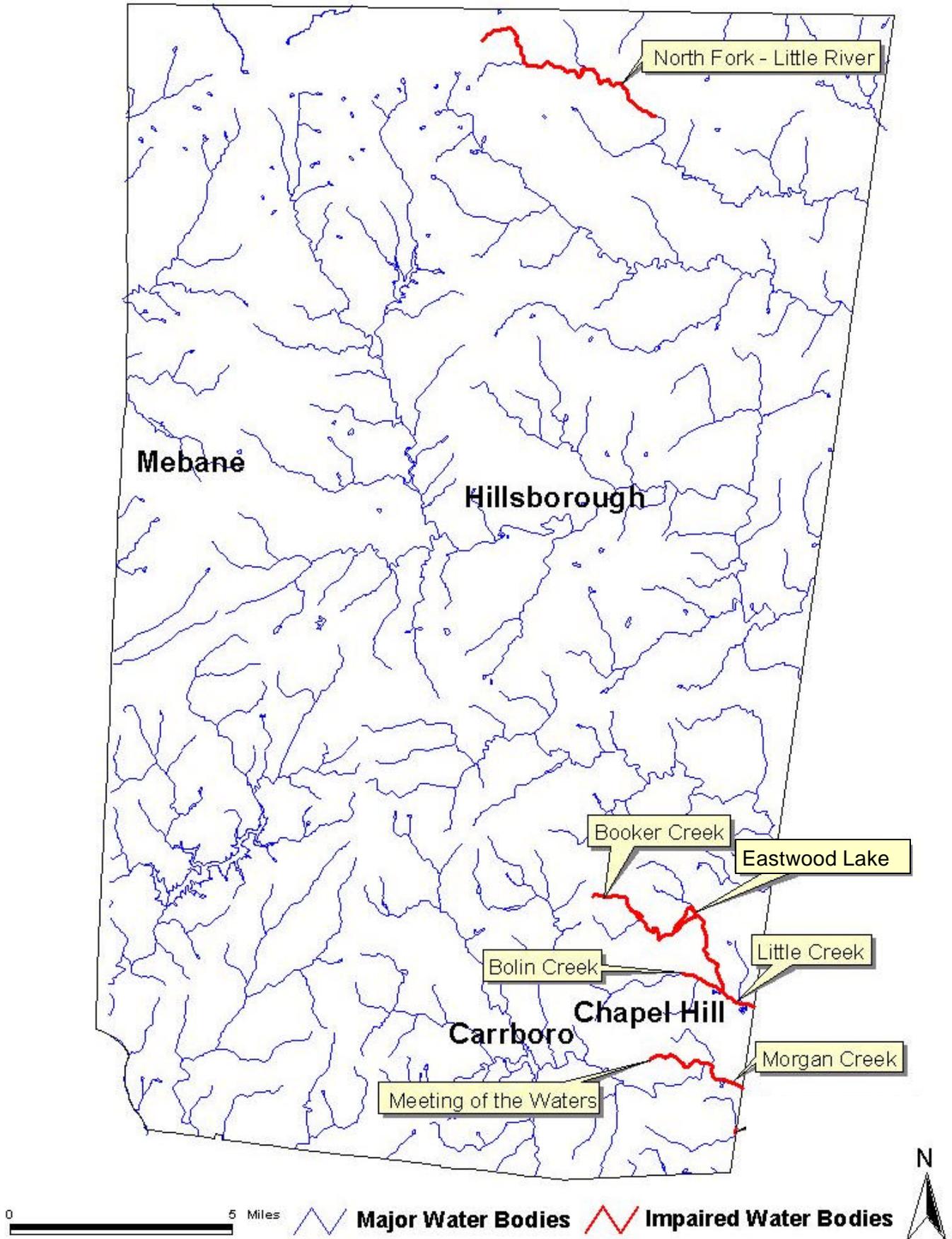
The trend in Orange County

Of the major streams and rivers that NC DWQ have tested in Orange County, approximately 5% are impaired. This percentage only relates to the streams that have been tested and is not a complete representation of all streams or rivers in the County. Furthermore, this indicator only reports the length of the water body and is not necessarily related to quantity.

Table 27: Streams Not Meeting Classified Uses, 2000

Rated stream length	322
Rated "not supporting" or "partially supporting"	17
Percent of rated that are "not-supporting" or "partially supporting"	5.3%

Figure 28: Impaired Water Bodies, 2000



WATER RESOURCES

Percent of benthos site tests that are good or excellent

Why the indicator was selected

Benthos site tests are used to monitor water quality within rivers or streams. Benthic macroinvertebrates, or benthos, are organisms that live in and on the bottom substrates of rivers and streams. In freshwater, these organisms are primarily aquatic insect larvae. The use of benthos data has proven to be a reliable monitoring tool, as benthic macroinvertebrates are sensitive to subtle changes in water quality. The benthic community also integrates the effects of a wide array of potential pollutant mixtures.

How the indicator was measured

The NC DENR, Division of Water Quality administers tests of stream quality and manages the database created by the results. Using criteria that have been developed for freshwater, the Agency assigns to each benthic sample a bioclassification that primarily reflects the influence of chemical pollutants. These bioclassifications range from Poor to Excellent and may be based on one of two ratings: (a) the number of taxa present in the intolerant groups Ephemeroptera, Plecoptera, and Trichoptera (EPT S) with higher taxa richness values associated with better water quality, or (b) a Biotic index that summarizes tolerance data for all taxa in each collection. The two rankings are given equal weight in final site classifications for qualitative samples. Taxa richness alone is used to assign bioclassifications for EPT samples but provides a poor assessment for sediment, the major physical pollutant.

The trend in Orange County

Orange County has made considerable improvement in stream quality over the last fifteen years. During the 1987-1994 time period only 26% of the streams tested were rated "good" or "excellent" while during the 1995-2002 time period 42% were rated "good" or "excellent". But despite this considerable improvement, more than half of the streams tested are in an unhealthy condition.

Figure 29: Biotic Tests Rated "Good or Excellent", 1987-2002

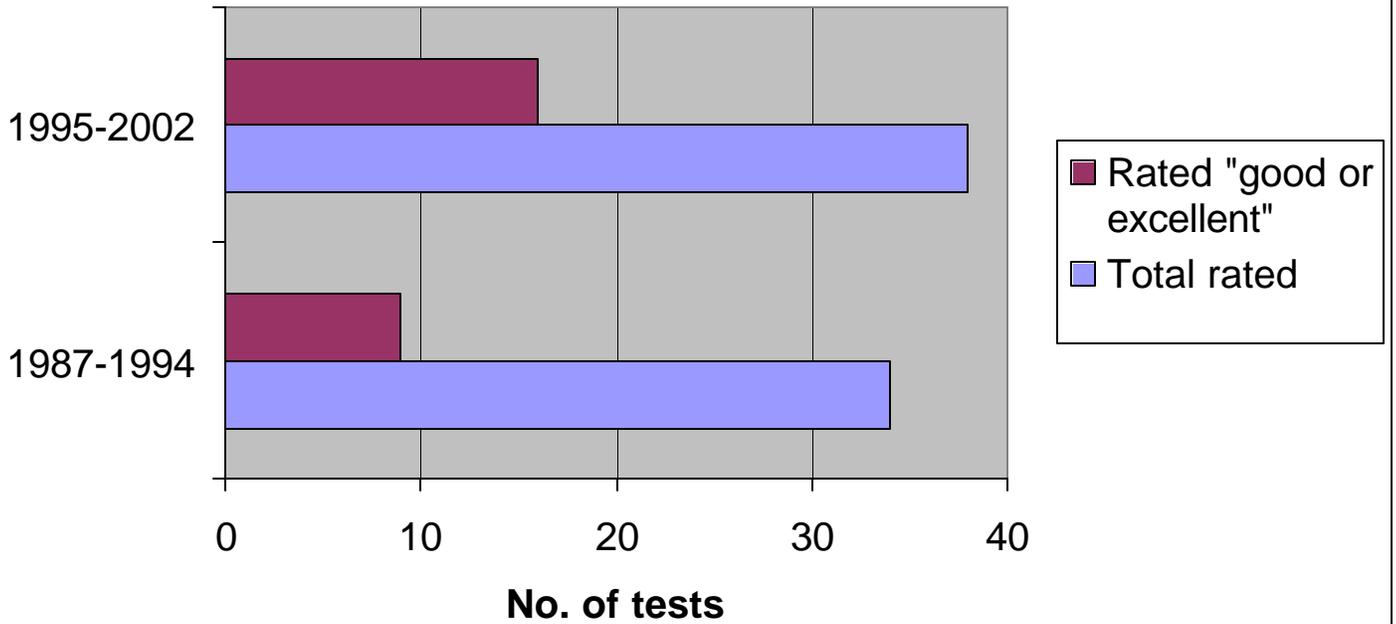


Table 28: Percent of Biotic Tests Rated "Good or Excellent", 1987-2002

	1987-1994			1995-2002		
	# rated	# rated "good or excellent"	% "good or excellent"	# rated	# rated "good or excellent"	% "good or excellent"
Bolin Creek	3	1	33%	14	3	21%
Booker Creek	No Data	No Data	No Data	1	0	0%
Cane Creek	3	1	33%	3	3	100%
Eno River	11	4	36%	5	4	80%
Little Creek	1	0	0%	2	0	0%
Morgan Creek	11	2	18%	6	4	67%
North Fork Little River	No Data	No Data	No Data	4	1	25%
New Hope Creek	1	1	100%	No Data	No Data	No Data
Pritchards Mill Creek	1	0	0%	No Data	No Data	No Data
South Fork Little River	No Data	No Data	No Data	1	0	0%
Sevenmile Creek	1	0	0%	2	1	50%
UT Collins Creek	2	0	0%	No Data	No Data	No Data
Total	34	9	26%	38	16	42%

WATER RESOURCES

Percentage of streams with at least a 50 ft. undisturbed buffer

Why the indicator was selected

Since there is a lack of data on surface water quality, data on riparian buffers is being used as a water quality indicator. Riparian buffers have a critical link to surface water quality and an overall healthy ecosystem. They have numerous important functions such as filtering out pollutants before they reach surface water, recharging ground water, providing habitat for plants and animals, and controlling flooding. For this reason, local governments must protect natural areas around streams by enforcing land use controls that prohibit disturbances in these areas.

How the indicator was measured

The Orange County Environment and Resource Conservation Department (ERCD) monitors the effects of land use on the County's natural environment. The Department is currently using GIS coverages to calculate the length of perennial streams with at least a 50 foot buffer. Due to the magnitude of this project, the analysis will be presented in the 2004 State of the Environment Report.

Data will be presented in future

WATER RESOURCES

Number of stream protection programs

Why the indicator was selected

Volunteer organizations play an important role in the protection and monitoring of our natural resources. Stream protection programs attempt to counteract the adverse impacts that development creates. These groups perform various tasks for the supervision and cleaning of the County streams.

How the indicator was measured

NC DENR, Division of Water Quality sponsors a stream watch program that identifies groups that conduct environmental work on streams. The Orange County Environment and Resource Conservation Department (ERCD) used the stream watch program participants as a base for determining the number of stream protection programs in the County. ERCD verified that the groups are still active and eliminated inactive groups from its database.

The trend in Orange County

Orange County contains eight volunteer groups that are actively working to protect the quality of our streams. These groups deserve recognition of their hard work. In the future, the number of groups should grow to cover every major stream and river in the County.

Table 29: Registered Stream Watch Programs, 2002

Organization	River / Stream	Contact	Email
1. Cedar Ridge High School	Sand Branch	Claire Garofolo	garafoc@cr.orange.k12.nc.us
2. Conservation and Outing Club	Little Creek / Jordan Lake		
3. Cub Scout Pack 820	Little Creek	Susan Murray	susan100m@aol.com
4. Duke Forest Friends	New Hope Creek	John Kent	jkent@tmug.org
5. Eno River Association	Eno River	Kathy Lee	katgirl@employees.org
6. Falls of the New Hope Stream Watch	New Hope Creek		
7. Frank Porter Graham School	Morgan Creek	Livy Ludington	lludington@chccs.k12.nc.us
8. Stoney Creek Ecorangers	Stoney Creek		

WATER RESOURCES

Wetland destruction

Why the indicator was selected

Wetlands have an essential function in our ecosystem. They are regarded as an invaluable resource and have been designated for protection by the Clean Water Act. However, projects that have small impact or no other economically feasible way to mitigate their impact may still fill in wetland areas if the developer obtains a 404 permit from the Army Corps of Engineers and the state issues a 401 Water Quality permit verifying that the project will not degrade the Waters of the State or otherwise violate water quality standards.

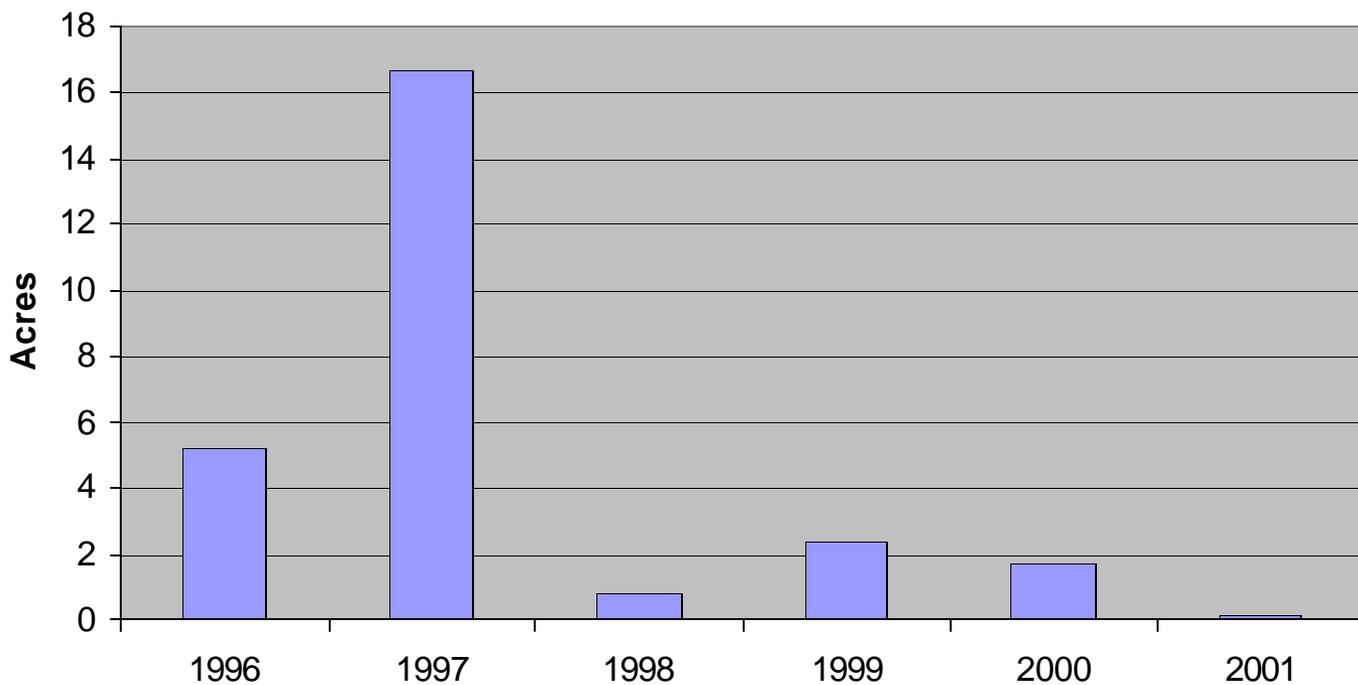
How the indicator was measured

NC DENR, Division of Water Quality - Wetlands Unit manages the 401 permitting process and records the number of wetland acres impacted by the permitting process. For years before 1998, impacted wetlands less than one acre were not reported. Since 1998 all impacts greater than 0.1 acre are reported except for utility, maintenance, and restoration impacts which are not included unless they impact one or more acres of wetlands.

The trend in Orange County

Over the past five years, the impacted wetland acreage in Orange County has decreased. The 1997 impacts from construction of Hillsborough's West Fork of the Eno Reservoir dominate the trend.

Figure 30: Approved 401 Wetland Impacts, 1996-2001



*The significant increase in 1997 is mainly due to the construction of Hillsborough's West Fork of the Eno Reservoir

Table 30: Impacted Wetlands, 1996-2001

Year	Impacted wetlands (acres)
1996	5.19
1997	16.68
1998	0.76
1999	2.35
2000	1.74
2001	0.10