2019 STATE OF THE ENVIRONMENT

ORANGE COUNTY
NORTH CAROLINA

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INTRODUCTION

Since the **Commission for the Environment (CfE)** began publishing these reports in 2000, Orange County's commitment to a healthy environment and functioning natural systems has grown and remains strong. Examples of the County's environmental commitments include:

- reducing carbon emissions 26% by 2025, and to transition to 100% renewable energy county wide by 2050;
- maintaining a Rural Buffer planning zone to limit urban sprawl for over 30 years;
- supporting the Economic Development program that actively supports local, sustainable agriculture;
- reaching the goal of conserving 10% of the County's land;
- working directly with landowners to make improvements in the agriculture and natural resources on farm land throughout the County through programs such as Cooperative Extension and Soil and Water Conservation.

This report marks the 6th publication of a State of the Environment for Orange County. The State of the Environment is an opportunity to reflect on and recognize the County's environmental achievements, review environmental indicators, discover knowledge gaps, and think creatively on policies and actions for the future. In 2020, the population of Orange County may top 150,000 residents. More people means more pressure on our natural systems, which, along with global threats like climate change, will test the County's resilience and responsiveness to environmental change.

In this edition, the CfE researched key issues organized by land, water, and air/energy resources and recommended actions for the Board of County Commissioners (BOCC) and County residents for each issue. Highlights of our recommendations for the BOCC and other decision makers include:

- developing a tree policy across all County-owned property;
- expediting efforts to reduce the County's carbon footprint;
- setting new goals for land protection;
- considering a conservation land acquisition bond to expand the Lands Legacy program.

How will Orange County and residents ensure a safe, healthy environment? How will we address the global biodiversity and climate crises that undoubtedly have causes and consequences within our county? Moreover, how will we meet these challenges in a just and equitable way? This report certainly has not answered these questions, but the CfE hopes we have informed the conversation and sparked ideas.

Towards a better world,

Bradley Saul, Chair

B Saul

Orange County Commission for the Environment

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LAND RESOURCES

State of the Local Birds

Long-running local study of bird populations highlights changes to our local environment and illustrates the global connectedness of the natural world.

Each spring, a group of volunteers travel the roads of Orange County to listen for birds who have chosen to make a nest in our neighborhood. The mini-bird breeding survey (MBBS), a regional version of the long-running national survey, has tracked local bird populations since 1999. Such systematically collected data make it possible to examine trends in bird biodiversity on a local scale.

Local Declines; Global Connections

The MBBS documents declines of over 50% over the last 20 years in iconic specialist species such as the Wood Thrush. Anyone who has enjoyed a summer hike in one of our local parks will certainly recognize the Wood Thrush's fluty song. Loss and fragmentation of local deciduous forests have certainly contributed to Wood Thrush decline. However, like all migratory birds, its winter range and travel routes are equally important, and land use changes in other regions may be the primary driver of some declines. Changes to a local ecosystem can indeed have global consequences.

Ecological Government

From backyard plantings to new development to urban sprawl, changes in land use at multiple scales drives loss of habitat and biodiversity. As a primary policy maker regarding land use at a county level, the Orange County government can have tremendous influence on biodiversity. Orange County's 2030 comprehensive land use plan adopted in 2008 includes a biodiversity-related goal of "a balanced and healthy diversity of native plant and animal populations." While work toward some of the objectives, such as the conservation of high-priority natural areas, is ongoing (see also land use topic), the status of other objectives is unclear.

Common Name	1999-2018 Trend	Annual Rate of Change
Wood Thrush		-0.055
Chimney Swift		-0.043
Eastern Bluebird		-0.012
Eastern Meadowlark		-0.004
Field Sparrow		0.003
Brown-headed Nuthatch		0.019

One objective is to develop "way to measure the 'state of biodiversity' in Orange County." The MBBS provides some clues about a particular aspect of biodiversity, but a full picture is lacking. Another objective calls for a "detailed and consistent methodology for monitoring changes in forest cover throughout the County." For the State of the Environment report, we used a simple methodology to measure tree cover, but the method misses important metrics such as hardwood forest extent. In the coming years, the Board of County Commissioners and the Commission for the Environment should revisit the objectives in the Natural & Cultural Systems Goal and plan for how to achieve biodiversity goals.

Ecological Citizens

At the individual level, land owners can enhance or diminish wildlife habitat through their landscaping practices. Native plants tend to have more wildlife value than introduced species–even those that appear to be good for wildlife. For example, Butterfly Bush (Buddleja davidii) is a popular shrub whose abundant nectar attracts swarms of butterflies in the summer. Its foliage, however, is a food desert for caterpillars, which are a critical food during the breeding season for many bird species. Native herbaceous forbs such as Joe-Pye Weed and shrubs like Mapleleaf Viburnum are both aesthetically pleasing and adapted to our climate and local food web.

Joe-Pye Weed

Eastern Bluebird

Recommendations

For the BOCC and other decision makers

- Consider hosting a forum for local governments, developers, landscape architects and related professionals on sustainable landscape practices and certifications such as the US Green Building Council's SITES program.
- Consider requiring measures that prevent bird-window collisions on all new County buildings.
- Continue the ongoing invasive species management efforts of Orange County staff.
- Free-roaming and feral cats are a predation threat to ground and shrub nesting birds such as Eastern Meadowlarks and Wood Thrush, two species in decline locally. The charge of the Free Roaming Cats Task Force included wildlife protection. The BOCC should continue to support the Animal Services Board in working on this problem.

For residents

- Monitor your local environment and contribute to science through citizen science projects such as ebird and inaturalist.
- Replace landscaping plants with native species. The NC Cooperative Extension Going Native site and the NC Botanical Gardens are excellent resources for planting ideas.
- Maximize the wildlife habitat potential of your own property. Take advantage of expert help from the NC Wildlife Resources Commission and the NC Forest Service. Contact the District 11 Office of the Forest Service to get started.

LAND RESOURCES

Growing a Healthy Environment with Sustainable Agriculture

Orange County has a long agricultural history and a commitment to preserving agricultural land and fostering farm businesses. But environmentally, agriculture can be a double-edged sword. Best practices can enhance the land and sustain natural systems; poor practices can degrade soil and water. The County should continue to advance working lands conservation approaches that simultaneously target promoting biodiversity, enhancing ecosystem services, and increasing farmer yields and profit.

According the 2017 USDA Agricultural Census[1], 69,908 acres (27.4%) of Orange County is part of a farm operation for crops, timber, or pasture. The number of farms increased from 577 in 1997 to 686 in 2017, while the total area of farm operations decreased by about 4% from 72,673 to 69,908 acres. **Figure 1** shows the change in farm acreage by size of area operated showing the shift towards more farms operating on smaller amounts of land.

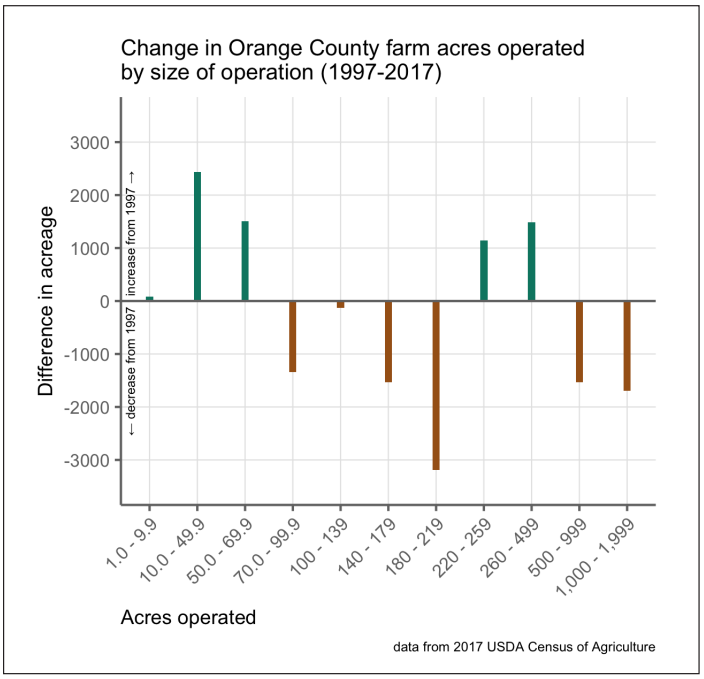

Figure 1

Figure 2 shows another major trend in Orange County agriculture over the past 20 years: dramatic increases in pasture as (largely) farmers shift cropland out of production. A transition from cropland to pasture tends to improve water quality[2] due to less erosion and less nutrient load from fertilizer inputs. Plant biodiversity may also increase as land transitions from arable to pasture[3]. On the other hand, the shift begs the question of why farmers are changing their business model, the answers to which are surely multifaceted but beyond the scope of this article.

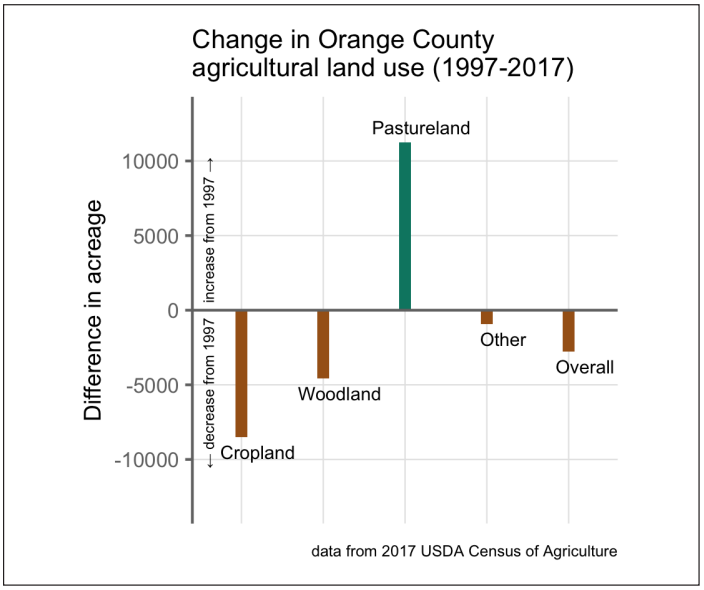

Figure 2

Orange County offers or supports several outstanding agricultural programs including agricultural development grants, the Breeze farm incubator, the Piedmont Food and Agricultural Processing

Center, the Lands Legacy program, and the many Soil and Water Conservation District programs. Staff within these programs and the farmers who are appointed to serve on the Agricultural Preservation Board engage directly with landowners to make improvements in agriculture, farm products markets, and natural resources on farmland throughout the County. These improvements focus on water quality, air quality, reducing soil and sediment erosion, improving soil health, and improving animal health.

As highlighted in the Triangle Farms for Food report[4], our County has many assets that create opportunities for the future of agriculture. For the County's objective[5] for "long-term productivity of farms and timberlands through best land-use management practice," the Commission for the Environment encourages the BOCC to continue to prioritize local, sustainable agriculture as a core component of Orange County's land use. Furthermore, we recommend that the success of agricultural programs should include ecosystem functioning metrics and explicitly target biodiversity.[6]

Recommendations

For the BOCC and other decision makers

- Continue to fund and support Agriculture Economic Development and certifications such as GAP (Good Agricultural Practices) and grant funding for farm infrastructure and growth.
- Continue to support and fund the Breeze Farm Incubator, especially as the operation transitions to County oversight.
- Continue to support and fund the Voluntary Farmland Preservation Program (and Voluntary Agricultural District Program) to encourage farmers to conserve, preserve, and maintain their agricultural lands as working farms in Orange County and include the Agricultural Preservation Board, in discussions on agricultural related issues.
- Consider renewing the County's commitment to the NC 10% campaign.
- Research the activity of local farmers' markets as a way to better understand the scale of local farming.
- Identify tools and protocols that could be used to understand the carbon sequestration potential for various farming practices.

For residents

- Shop Local! Attend Farmers' Markets and support local agriculture events such as the Piedmont Farm Tour.
- Get involved with local food issues with the Orange County Food Council.

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[1] USDA. 2017 Census of Agriculture, Accessed May 11, 2019.

[2] Egan, J. F. and D. A. Mortensen. A comparison of land-sharing and land-sparing strategies for plant richness conservation in agricultural landscapes. Ecological Applications, 22(2), 2012.

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[5] Orange County Board of Commissioners. 2030 Comprehensive Plan Chapter 6 Cultural and Natural Systems Element. Accessed July 21, 2019.

[6] Kremen, C. and A. M. Merenlender. Landscapes that work for biodiversity and people. Science, 362(6412):eaau6020, Oct 2018.

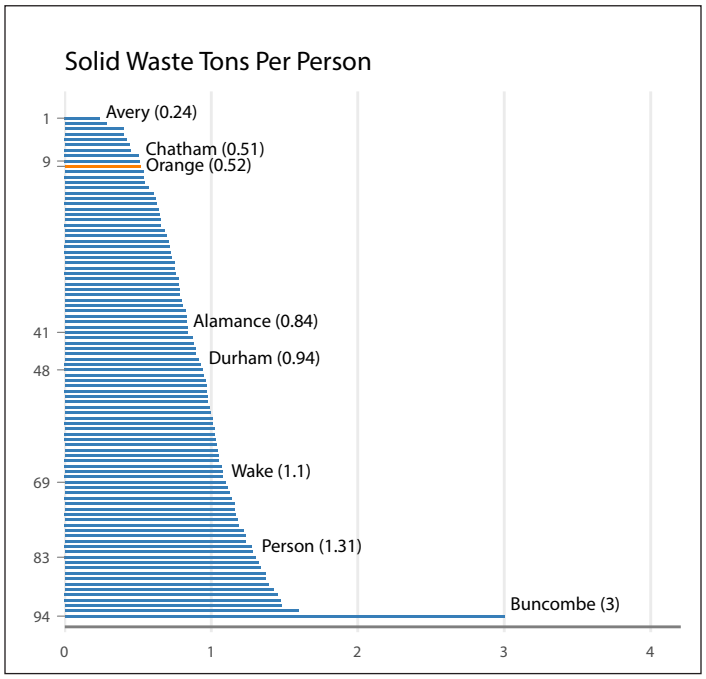
LAND RESOURCES

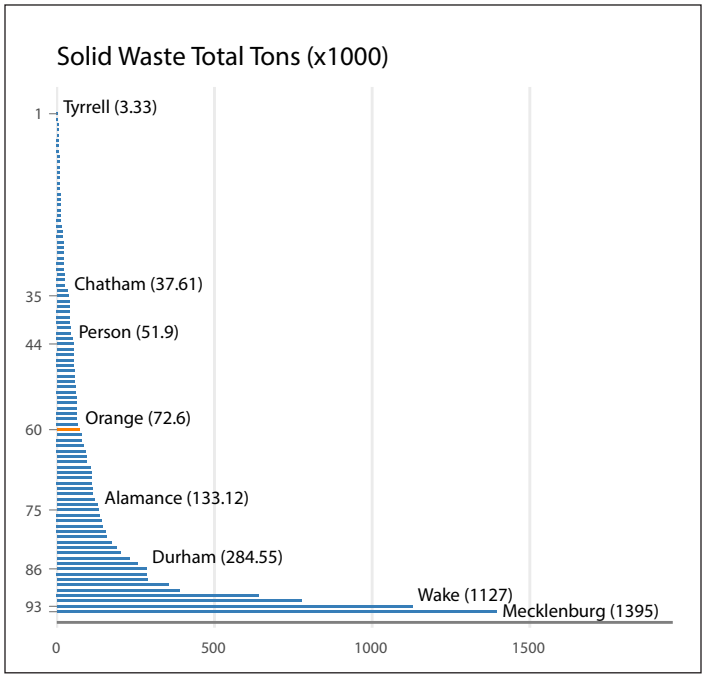
From Waste to Opportunity

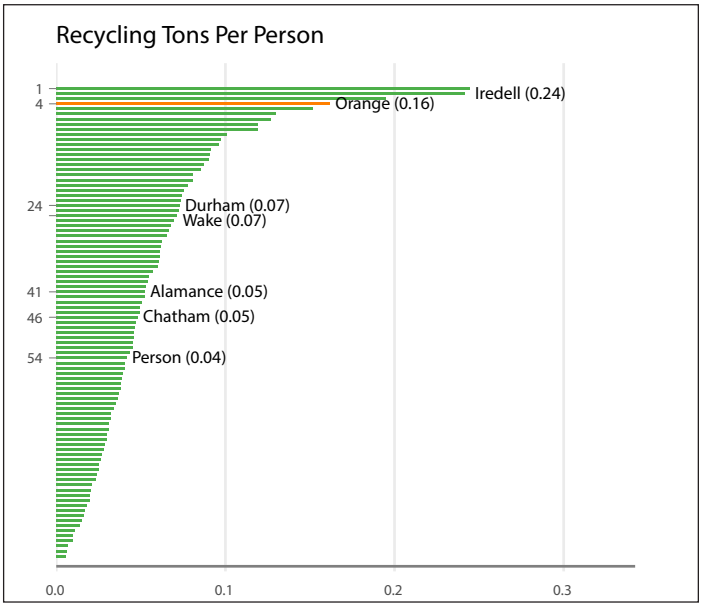
Orange County has one of the highest per capita recycling rates and one of the lowest rates of municipal solid waste generation in North Carolina. Still, County residents and leaders have many opportunities to further reduce waste and diminish impacts of human industry.

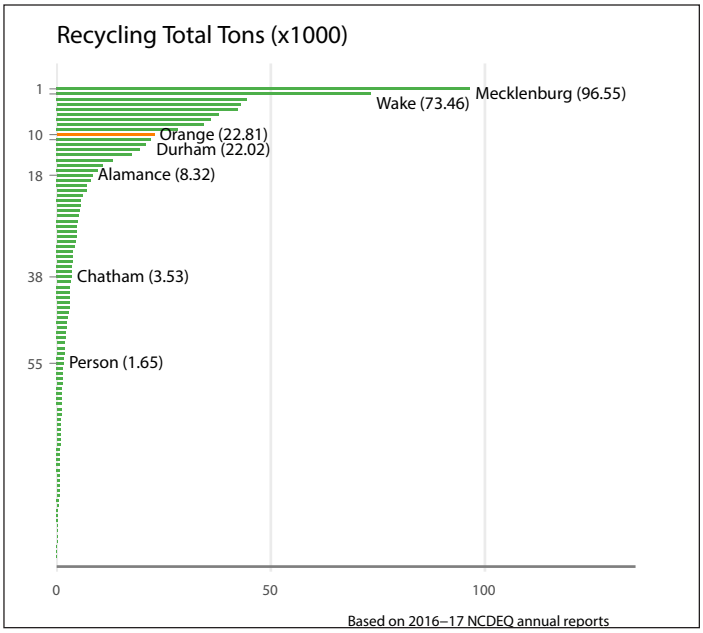
Industrial life cycles can be framed as existing on a spectrum from the ubiquitous cradle-to-grave one-way path to the aspirational cradle-to-cradle loop. In the former, raw materials are extracted from natural resources (the "cradle"), converted into products for human use, then disposed of as waste (the "grave"). In a cradle-to-cradle model, products and processes are designed so that materials are never downcycled–a product's lifecycle is a closed loop without a stop in a landfill. We live in a cradle-to-grave, factory to landfill (perhaps after getting recycled) world, and a cradle-to-cradle circular economy is undoubtedly a lofty goal. While a fully circular economy may seem out of reach, the goal can serve as a guide, sparking innovation that drives local, sustainable economic development, while shrinking our human footprint.

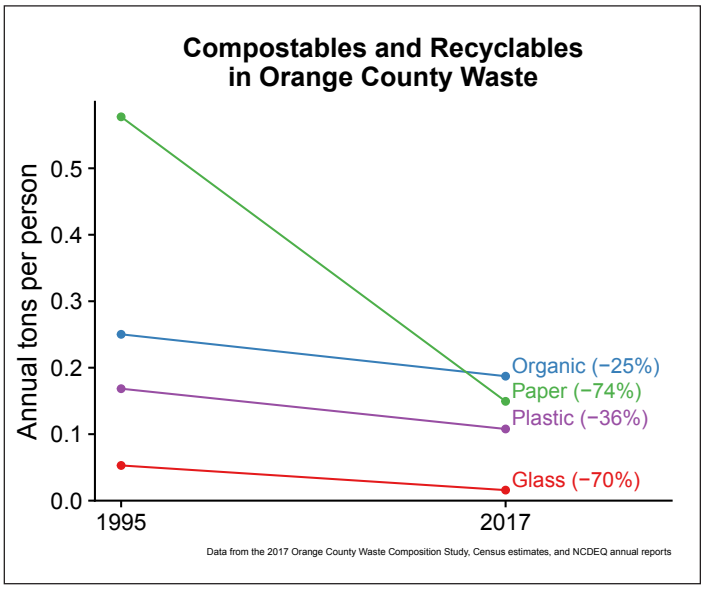
In a cradle-to-grave model, the three Rs–reduce, reuse, recycle–are proven ways to limit the pace of landfill accretion. Orange County Solid Waste Management has been a leader in strategies to implement the three Rs, especially recycling. The graphic to the right shows the tonnage of municipal solid waste, construction and demolition waste, and recycling for all NC counties according to the 2017 Department of Environmental Quality reports on recycling and solid waste. In that year, Orange County reported 0.52 tons of waste per person and 0.16 tons of recycling per person. Recycling accounted for 24% of all reported waste and recycling in Orange County. Out of all NC counties, Orange ranked 4th highest in per capita recycling rates and 10th lowest in waste rates.











The largest proportion of landfill-bound waste in Orange County is refuse that could be a renewable asset. The figure to the left shows the change in per capita rates of recyclable and compostable waste categories (by weight) between 1995 and 2017.

Though the trend for organics is in the right direction, a goal should be negligible food waste ending in the landfill. There is still much room for improvement. Concerted efforts of the past 30 years to divert recyclable materials have seen success. Could similar efforts on organic waste see similar gains? State laws prohibiting more aggressive and innovative campaigns on solid waste may make it difficult to improve the situation in the short term.

Recommendations

For the BOCC and other decision makers

- Bolster efforts to divert commercial and restaurant compostables while expanding composting programs to single-family and multi-family residences.
- Consider partnering with groups such as Audubon or Xerces Society on a "leave the leaves" marketing campaign to convert yard waste to a yard asset.
- Continue to work with the Solid Waste Advisory Group in finding ways to locally handle local waste.
- Advocate as part of the County's legislative agenda to allow local governments to regulate solid waste streams such as plastic bags.

For residents

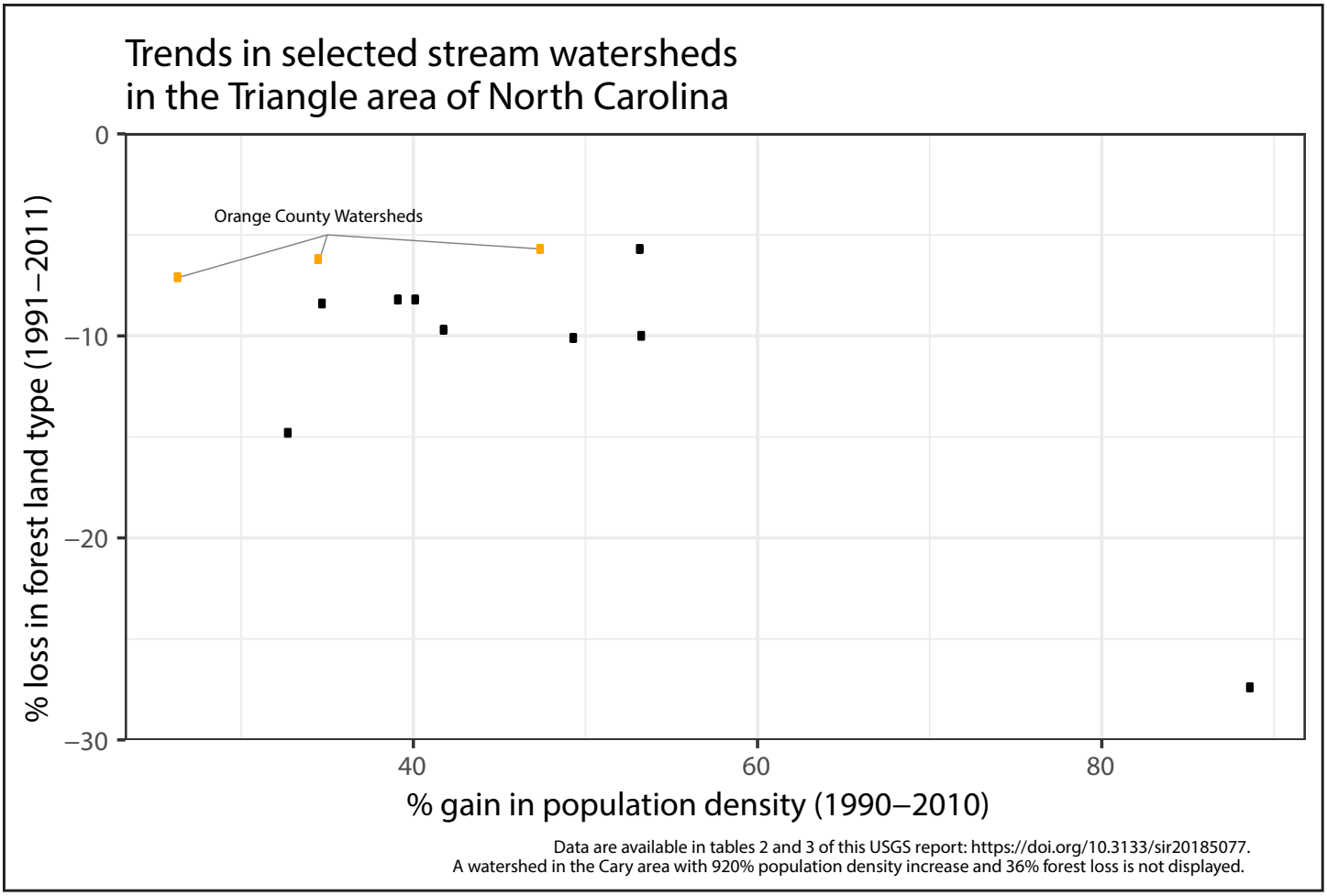
- Start composting at home or sign up with a composting services provider.
- Volunteer with the Solid Waste Management to promote composting and recycling right.
- Stay up-to-date on the acceptable materials list for recycling and look for ways to upcycle or reuse items before putting them in the trash.
- Retire your rake, convert your leaf blower to a confetti machine, and leave the leaves.
- Join the #SkipthestrawOCNC movement.

LAND RESOURCES

Trees for the Forest: Tree cover increases; Forest protection uncertain

Trees and intact forests in particular provide many ecosystem services such as clean water, stormwater mitigation, carbon sequestration and wildlife habitat. A Commission for the Environment study shows an increase in tree cover between 2008 and 2017 in Orange County. Whether this change met a County environmental goal is uncertain.

In 2005, the BOCC adopted an environmental responsibility goal to see "no net loss of woodlands" on County-owned properties. To assess the success of reaching this goal, the Commission for the Environment's Land Resources committee measured the change in tree cover between 2008 and 2017, years when high resolution imagery is available. The spatial extent of the study included the entire County but focused on County-owned lands and the rural buffer zoning district. The study design, data, and methodology



Data are available in tables 2 and 3 of this USGS report: https://doi.org/10.3133/sir20185077.
A watershed in the Cary area with 920% population density increase and 36% forest loss is not displayed.

are available online[1]. The following table shows the estimated percent change in tree cover from 2008 to 2017, showing an increasing tree cover in all areas.

Study Area	Estimated % change in tree cover 2008-2017 (95% confidence interval)
Orange County owned property	3.0 (2.94, 3.01)
Rural buffer	4.0 (3.97, 4.06)
County excluding rural buffer and County-owned property	3.2 (3.13, 3.25)

Our results may suggest a shift in a longer term trend. A recent USGS report provided changes in land use and population density from 1991 to 2011 for selected triangle area watersheds[2]. Over that time period, forest land type declined in all watersheds. However, the figure below shows the Orange County watersheds included in the study tended to have lower relative forest loss even compared to watersheds outside Orange County with similar increases in population density.

Of our three study areas, tree cover increased the most within the rural buffer from 2008 to 2017. The rural buffer also had the greatest proportion of trees in any study area (~77% compared to roughly 60% outside the rural buffer). Further analysis is needed to assess specific effects of the rural buffer land use policy on tree cover.

While our study does suggest tree cover increased on County-owned lands since 2008, the 2005 no-net-loss goal is not specific about a frame of reference. Hence we cannot determine whether the goal was met[3], nor how County policies may have affected tree cover. The research reported here also did not measure the health or quality of the forests.

Recommendations

For the BOCC and other decision makers

- Adopt a tree policy for all development projects on all County-owned lands. The Commission for the Environment has reviewed a current policy for tree protection in Orange County parks and Lands Legacy lands, and is working with County staff to expand the policy to cover other County-owned lands and to align goals with other agencies in the region.
- Forest type is relevant to biodiversity and carbon storage, and the County should assess methods for measuring forest health at a landscape scale on a more frequent basis than provided by Federal products such as LANDFIRE.

For residents

- Orange County and the towns of Chapel Hill, Carrboro, and Hillsborough have programs and policies for tree protection. Interested residents in Chapel Hill and Hillsborough can apply for their town's tree committee.
- Plant a tree! Organizations such as Trees for the Triangle, The Arbor Day Foundation and the NC Forest Service donate or sell trees or seedlings.
- County landowners with more than 20 acres of woodland may qualify for the present use value tax exemption with a forest management plan from a registered forester.

References

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LAND RESOURCES

Protected Lands in Orange County

The 2014 State of the Environment stated a goal to protect 25,000 acres of land in Orange County. This goal was achieved in 2018, but many important natural heritage areas remain unprotected. We propose to expand the County's land conservation targets with an emphasis on natural heritage sites, wildlife corridors, and stream buffer protection.

Means for land protection used in Orange County include (a) fee-simple (owned) land such as parks and preserves or conservation lands owned by institutional landowners such as Duke University or OWASA and (b) conservation easements held by governments or land trusts on land owned by another entity. Of Orange County's 256,595 acres, 25,471 acres (9.9%) have some form of protection (see **Figure 1**).

The County's Lands Legacy Program continues to be an important program for the County government itself to conserve land. Since 2000, the County has largely used the program to contract easements rather than purchase land (**Figure 2**). This trend has environmental justice implications worthy of further consideration. While easements increase the amount of protected land, easements tend to more directly benefit more affluent landowners and their neighbors through tax breaks and limited development. Easements can indirectly benefit other citizens to the degree that, for example, the easements protect water quality[1].

Stream buffers are an important tool in protecting water quality and wildlife corridors. However, a recently enacted NC law restricts a local government's ability to set riparian buffers that exceed the State's standards. Hence, Orange County should consider its development and conservation priorities and creatively find combinations of regulation, education, and land conservation programs that protect biodiversity and water quality. Ongoing conservation projects in the County include the Eno-New Hope Conservation Collaborative which establishes a long-term plan for protecting wildlife and landscape corridors.

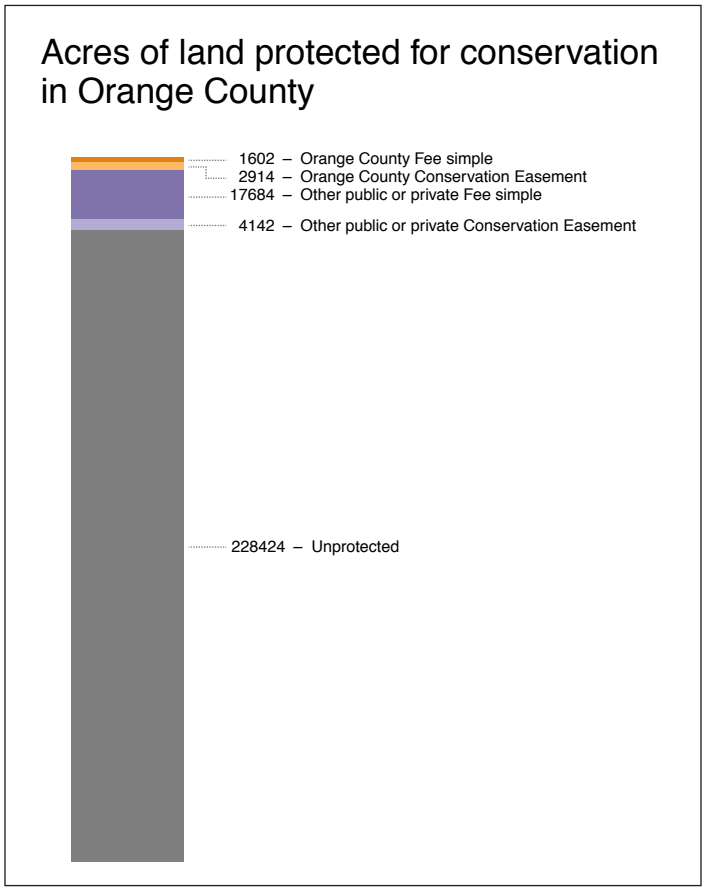


Figure 1

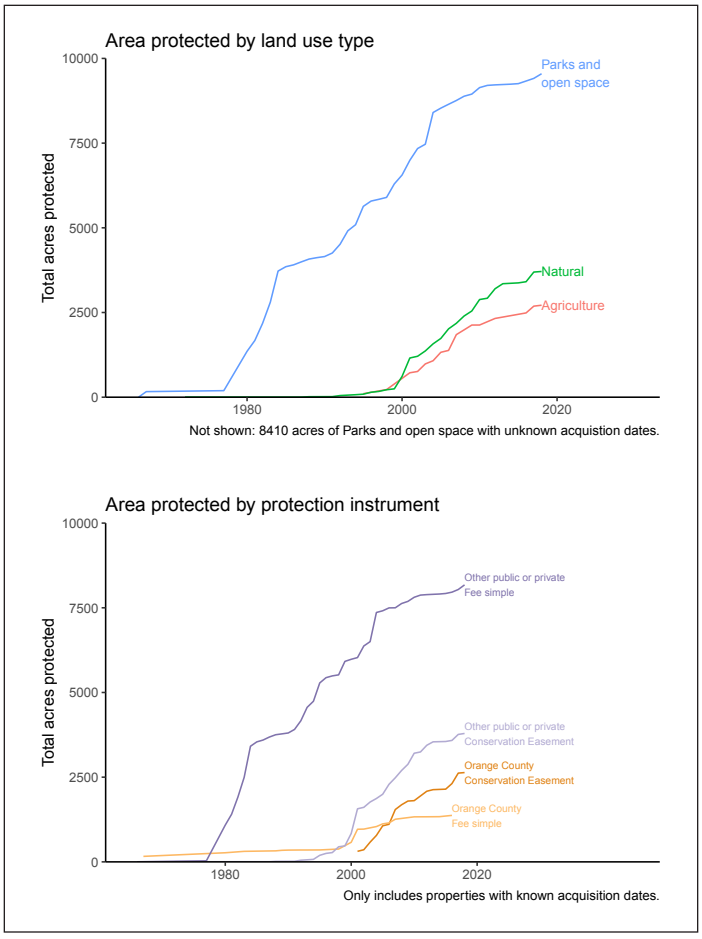


Figure 2

Recommendations

For the BOCC and other decision makers

- Continue to support the Lands Legacy Program and consider issuing a conservation land acquisition bond in the near future.
- Ask relevant County staff to assess possibilities and prioritize land conservation investments to maximize additional co-benefits such as flood risk reduction.
- Develop new land conservation targets that focus on Natural Heritage sites and continue to work with local conservation partners to protect the County's most environmentally valuable lands.
- Ask relevant County staff and/or Advisory Boards to review and offer comment on the Eno-New Hope Landscape Corridor Plan and recommend any changes to Orange County's land use and environmental plans to the BOCC for it to initiate the process.
- Continue to advocate as part of the County's legislative agenda to permit local governments to set riparian buffer requirements that may exceed state-level requirements.
- Continue to encourage the development of higher density living spaces in Orange County in areas already served by water and sewer, public transit, and pedestrian/bike infrastructure. This will focus growth in the areas best equipped to accommodate it while continuing to protect sensitive lands and biodiversity.

For residents

- Talk to your elected officials about the importance of sustainable development and protection of natural heritage sites.
- Volunteer or donate to local land conservancy trusts including Orange County Community Giving Fund, the Eno River Association, Triangle Land Conservancy, and the NC Botanical Gardens Foundation.
- Consider land protection options, such as conservation easements, for your property or farm.

References

[1] Pidot, J. 2005. Reinventing conservation easements: A critical examination and ideas for reform. Technical report, Lincoln Institute of Land Policy.

The Effects of Land Use and Climate Change on Water Resources

How are land use policies and climate change affecting water resources in Orange County? This is not an easy question to answer.

We know from global monitoring and climate modeling that air and sea-surface temperatures are increasing, polar ice caps and alpine glaciers are melting, sea levels are rising, and that storms, floods and droughts are becoming more intense and more frequent. But do we have evidence to show how climate change is affecting water resources, particularly streamflow, in Orange County? This is not an easy question to answer.

A number of natural and anthropogenic factors affect streamflow:

- Precipitation naturally varies spatially and temporally.
- As population grows, water use increases and more water is withdrawn from rivers and aquifers. More wastewater is also returned to rivers and aquifers. Dams may be built on rivers to control flooding or to provide a water supply reservoir.
- As we alter more forested land through development, we pave surfaces so that more precipitation runs quickly into stormwater drains instead of naturally percolating into the soil and underlying rock.

To determine if our changing climate is changing the amount of streamflow in Orange County, we would need to parse out the effects of each of these natural and anthropogenic causes and determine if there is a resulting trend due to global warming.

The Fourth National Climate Assessment for the Southeastern United States[1], a Congressionally mandated report issued by the U.S. Global Change Research Program, indicates that regional data show both variability and long-term trends in precipitation, where the change, an increase in precipitation events in excess of 3 inches, is attributed to the hydrologic effects of climate change (**Figure 1**). But the question remains — has increased storm and precipitation intensity affected streamflow in Orange County?

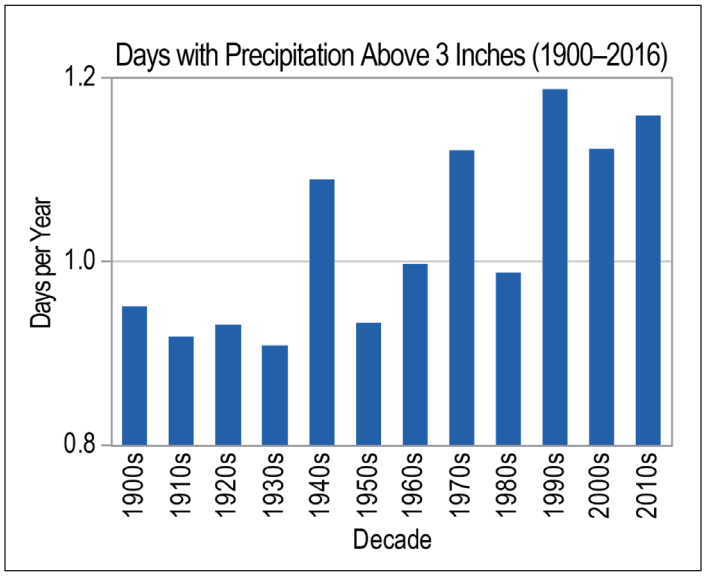
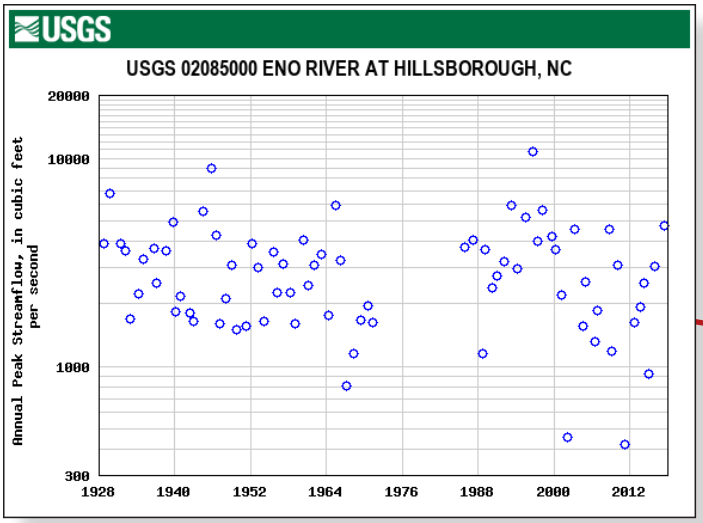
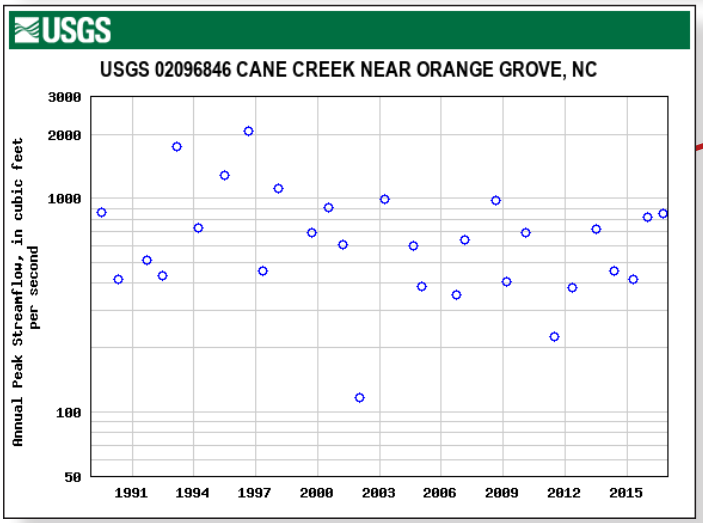
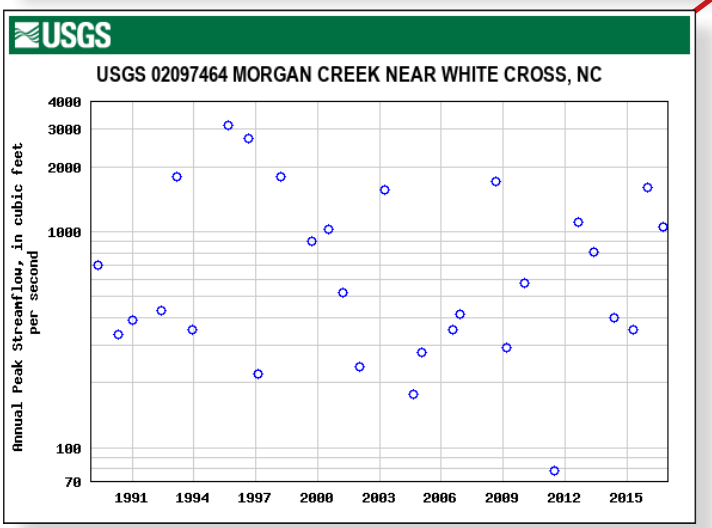


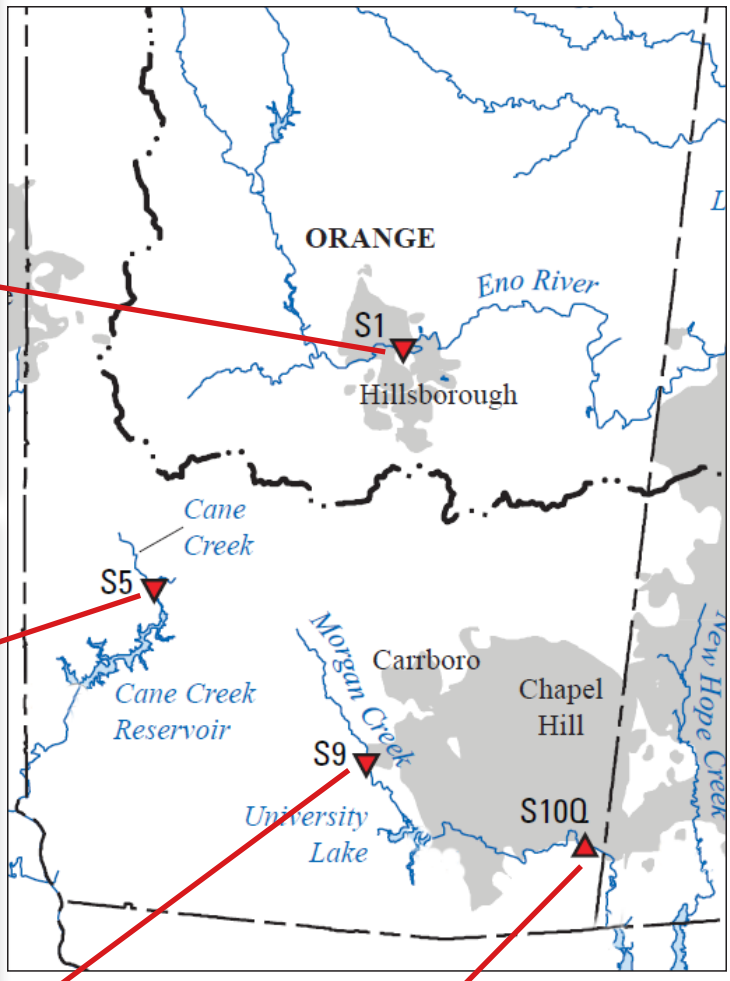
Figure 1. Figure showing variability and change in the annual number of days with precipitation greater than 3 inches (1900–2016) averaged over the Southeast (Virginia, North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, Arkansas, Tennessee, West Virginia) by decade. Sources: NOAA NCEI and CICS-NC. [Taken from Carter and others, 2018; figure 19.3]

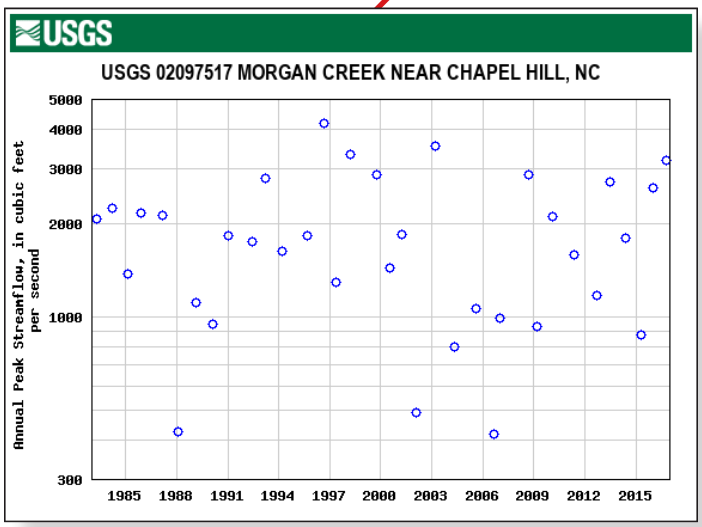
Fortunately, local agencies, including both Orange County and the Orange Water and Sewer Authority, have had the foresight to partner with a federal earth, hydrologic, land use and climate change science agency to monitor and evaluate water resources in the Research Triangle area for more than 25 years. The U.S. Geological Survey, in partnership with local agencies, has monitored and evaluated drinking water quantity and quality in the Triangle area since 1989[2]. This recent USGS investigation identified considerable changes in population, land cover,











Base map from digital files of
U.S. Geological Survey, 1:100,000-scale hydrography
U.S. Department of Commerce, Bureau of Census, 2016
TIGER/Line Files- Political Boundaries
North Carolina Department of Transportation Municipal Boundaries

EXPLANATION

- Basin boundary
- S13 — Water-quality stream site and number
- L4 — Water-quality lake site and number
- S10Q — Streamflow site and number
- Precipitation station

Figure 2 (left).Annual peak streamflow graph for 4 long-term, continuous streamgages in Orange County. Peak flow is defined as the instantaneous maximum flow that occurs each year and is measured in cubic feet per second. A) Map showing locations of streamgages. [Modified from Giorgino and others, 2018, Figure 1.] B) S1, Eno River at Hillsborough, NC, has minor regulation or diurnal fluctuation caused by permitted discharges, water-supply diversions, and/or small impoundments upstream from the station. C) S5, Cane Creek near Orange Grove, NC, has unregulated flow. D) S9, Morgan Creek near White Cross, NC, has unregulated flow. E) S10Q, Morgan Creek near Chapel Hill, NC, has regulated flow. [Figures B, C, D, and E were accessed on July 25, 2019 from U.S. Geological Survey website https://waterdata.usgs.gov for streamgage stations 02085000, 02096846, 02097464, 02097517 .]

Continued from page 15

streamflow, and selected water-quality characteristics in the Triangle area over the 25-year period from 1989 to 2013. But this report did not have sufficient data to clearly distinguish the effects of development and land use change from the hydrologic effects of climate change[2] (see **Figure 1** and **Table 4**).

Since the intensity of precipitation has increased, as shown in Figure 1, we might expect that annual peak streamflow in Orange County has also increased, but for several reasons this is not the case, as shown in **Figure 2**:

- Streamflow may be unregulated, regulated, or affected by other factors, including upstream diversions.
- Precipitation is measured at one point on the landscape, but streamflow reflects conditions over an entire watershed; that is, precipitation and land use vary within a watershed.
- Because the hydrologic cycle is naturally variable, many years of streamflow data are necessary in order to observe a significant trend in hydrologic extremes such as annual peak flow events.

What can we do to improve our understanding of the effects of climate change on our water resources? Because water quantity and quality are influenced by multiple, often confounding, factors, long-term monitoring is critical for tracking these trends and ensuring resiliency of water supplies for the future. Results from continued monitoring and analysis of streamflow in Orange County will contribute to the understanding of water resources response to climate change, a growing population, and land-cover changes. Analysis of these continuous and long-term data will assist decision makers in Orange County as they plan for the future.

Recommendations

For the BOCC and other decision makers

- The BOCC should continue to support long-term,continuous water resource monitoring and analysis, including the Triangle Area Water Supply Monitoring Project, of which Orange County has been a partner since 1988.
- Continue to support land use ordinances that moderate peak stream flows and manage stormwater runoff such as preserving natural infrastructure like wetlands.

For residents

- Local property owners can adopt simple methods of reducing the amount of stormwater runoff leaving their property, such as installing and maintaining a rain garden or bioswale, or by using rain barrels to store precipitation. For more information visit the Orange County's information page about rain gardens.

References

[1] Carter, L., A. Terando, K. Dow, K. Hiers, K.E. Kunkel, A. Lascurain, D. Marcy, M. Osland, and P. Schramm, 2018: Southeast. In Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II [Reidmiller, D.R., C.W. Avery, D.R. Easterling, K.E. Kunkel, K.L.M. Lewis, T.K. Maycock, and B.C. Stewart (eds.)]. U.S. Global Change Research Program, Washington, DC, USA, pp. 743–808. https://doi.org/10.7930/NCA4.2018.CH19

[2] Giorgino, M.J., T.F. Cuffney, S.L. Harden, and T.D. Feaster, 2018, Trends in water quality of selected streams and reservoirs used for water supply in the Triangle area of North Carolina, 1989–2013: U.S. Geological Survey Scientific Investigations Report 2018-5077, 67 p., https://doi.org/10.3133/sir20185077

Status of Drinking Water Resources

Many residents of Orange County are served by one of the five drinking water utilities that serve the County, while nearly 40% of the population of the County relies on their own domestic well, using groundwater for their water supply. Water from utilities is subject to ongoing testing for a range of contaminants whereas the testing of individuals' well water is the responsibility of the owner.

Sources of Drinking Water

The five water utilities in Orange County are the Orange Water and Sewer Authority (OWASA), Orange-Alamance Water System (OAWS), Town of Hillsborough, City of Mebane, and City of Durham. These utilities obtain nearly all their water from surficial reservoirs. **Figure 1** illustrates the growth in population served by four of the water utilities serving Orange County, as well as the overall decrease in per capita water usage by their customers since 1997. Significant droughts in this area in 2002 and 2007 dramatically raised citizen awareness concerning water resources and reduced the per capita rate of water consumption.

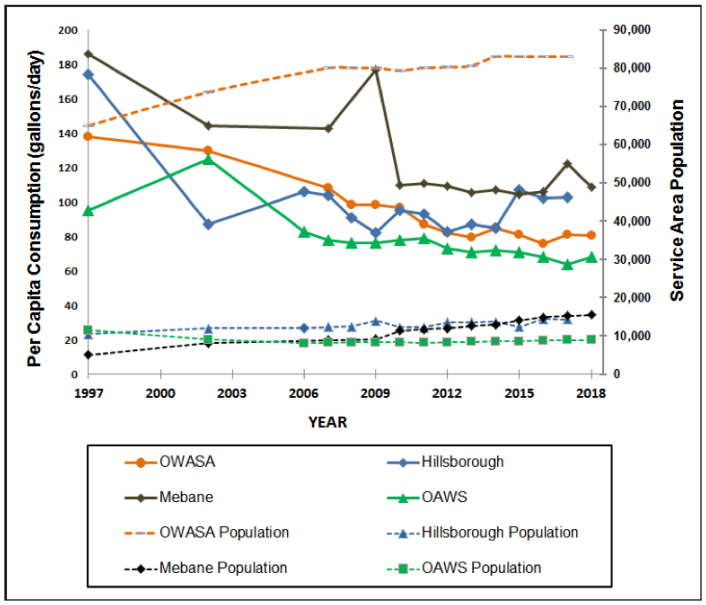


Figure 1

Since wells in nearly all of Orange County utilize water that is present in a system of bedrock fractures (**Figure 2**), the yield of wells varies greatly from one location to another, depending on how many fractures the well intersects, how those fractures are connected to a larger system of fractures, and how much groundwater is draining into those fractures. The more bedrock fractures a well intersects, the greater the amount of groundwater that will likely be available for use from that well.

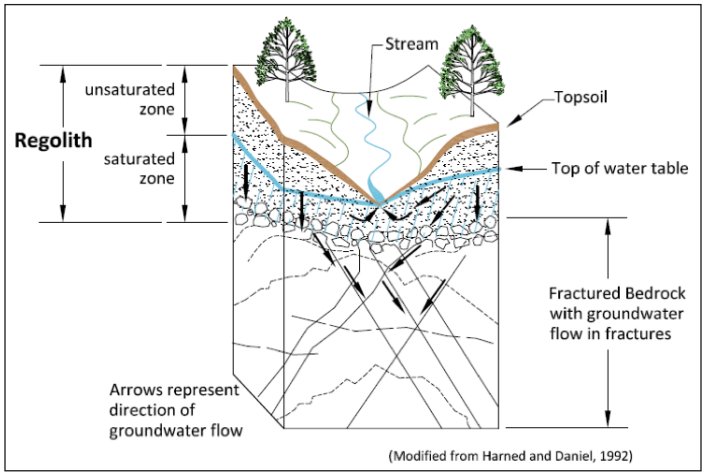
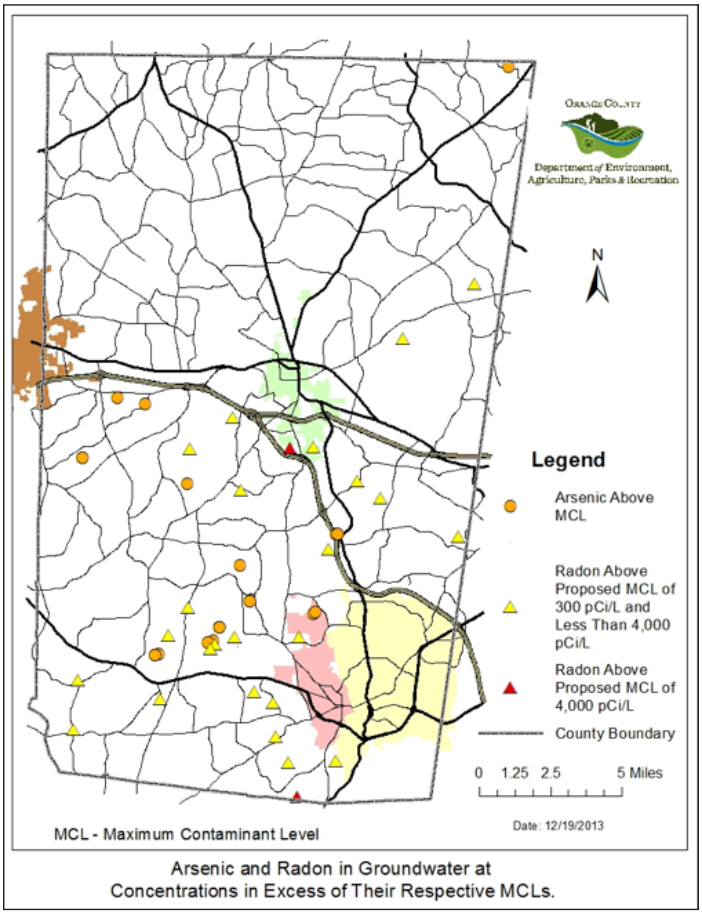


Figure 2

Groundwater can naturally contain elevated concentrations of some dissolved minerals simply from being in contact with bedrock. In Orange County these typically include iron

and manganese, and may also contain elevated arsenic and radon (**Figure 3**). In addition, if septic fields or other sources of biological contamination are located too close to a well, pathogenic bacteria can spread and cause the water in the well to be unsafe for consumption. Other potential contaminants, such as gasoline, pesticides, and fertilizer, can be released at the land surface and percolate downward, contaminating the groundwater which is drawn into the well. Older indoor plumbing can also introduce lead into a domestic water supply, depending on the solder that was used to join the piping and the corrosiveness of the water in the system.



Arsenic and Radon in Groundwater at Concentrations in Excess of Their Respective MCLs.

Figure 3

Monitoring Drinking Water Quality

Under the federal Safe Drinking Water Act, all community water systems are required to produce an annual water quality report providing details on the source(s) and the quality of their drinking water. These reports may be accessed from the utilities' respective websites. The Orange County Environmental Health Division samples groundwater in newly installed wells, and will sample groundwater in established wells at the request of the property owner for a selected range of parameters. Orange County residents and visitors are also served by small public water supplies in rural areas, such as water supplies provided to mobile home parks. The U.S. Environmental Protection Agency regulates these small public water supplies.

Recommendations

For the BOCC and other decision makers

- Continue to employ an Orange County staff hydrologist to monitor the quantity and quality of groundwater in the County and to answer questions from Orange County residents using domestic wells.
- Continue to support the observation well network.
- Work with local water providers and Triangle J Council of Governments to track any emerging contaminants or other regional concerns. Specific to the emerging concerns around PFAS chemicals such as GenX, ask staff to track the findings of the NC PFAS Testing Network.
- Encourage and/or partner with water utilities to conserve additional land in water supply watersheds to further protect drinking water resources.

For residents

- Educate yourself and your family about the source of your water and your watershed. Understanding your connections to the natural environment increases your understanding of how changes and developments in the area affect you, and can make you a more savvy consumer. If your water supply is groundwater, contact Orange County Environmental Health for possible well construction and sampling records. Test your well water regularly for potability. Maintain disinfection and treatment systems that are necessary.
- Evaluate your surroundings and property maintenance habits – particularly your actions that affect the application of potential contaminants at land surface–and determine if improvements can be made to protect local water resources.

WATER RESOURCES

The Health and Vulnerability of Our Watersheds

Water quality and aquatic ecosystem health have been a long-standing priority for Orange County. The BOCC, County staff, and residents should consider designing and implementing alternative solutions for protecting County watersheds.

Orange County is a headwaters area located primarily in the Neuse River Basin and the Cape Fear River Basin with a small portion of the Roanoke River Basin (**Figure 1, page 22**). The health of our watersheds affects our drinking water quality and our outdoor recreational opportunities, and to a large extent defines our success or failure as stewards of our environment. Protecting watersheds, especially water quality and aquatic ecosystem health, has been a long-standing priority for Orange County residents, elected officials, and non-governmental organizations. For example:

- Rainfall onto paved roads, parking lots, and buildings and other impervious surfaces does not infiltrate into soil and contribute to groundwater resources, but rather contributes to stormwater runoff that contains atmospheric dry fall pollutants, for example, from vehicle exhaust. Impervious surface limits for watersheds are included in Orange County's Unified Development Ordinance.
- The County has implemented Critical Watershed Protection Overlay Districts as part of its regulations.
- The County has a Water and Sewer Management, Planning and Boundary Agreement with neighboring governments that restricts the expansion of water and sewer service and helps to limit geographic expansion of dense urban and periurban development. Such urban expansion would increase polluted runoff in protected watersheds.
- In addition to land conservation efforts, open-space preservation has been established for almost all new subdivisions, with a focus on preserving environmentally sensitive areas.

Even with these protective policies and practices, some County watersheds are healthier than others, and each watershed is in some degree vulnerable to environmental degradation. In 2017, the U.S. Environmental Protection Agency (USEPA) published a preliminary national evaluation of watershed health and vulnerability[1]. The Watershed Health Index is an integrated measure of watershed condition that combines landscape condition, hydrology, geomorphology, habitat, water quality, and biological condition scores. Higher scores correspond to greater potential for a watershed to have the structure and function in place to support healthy aquatic ecosystems. The Watershed Vulnerability Index characterizes the vulnerability of aquatic ecosystems in a watershed to future alteration based on land use change, changes in demand for water supply, and vulnerability to wildfire. Higher scores correspond to greater potential vulnerability of aquatic ecosystems to future degradation.

Watershed health and vulnerability indices are intended for use by state and local partners to identify healthy watersheds that require protection. The results of this USEPA assessment are presented in **Figure 1** for Orange County.

In the County's urban areas, stream water quality and aquatic ecosystems are adversely affected by human activities such as our use of pesticides and fertilizers and modification of land surface such as paving and construction. In rural areas, stream water quality and aquatic ecosystems are vulnerable to increasing developmental pressures, our use of pesticides and fertilizers, increasing demand for water, and the potential for uncontrolled

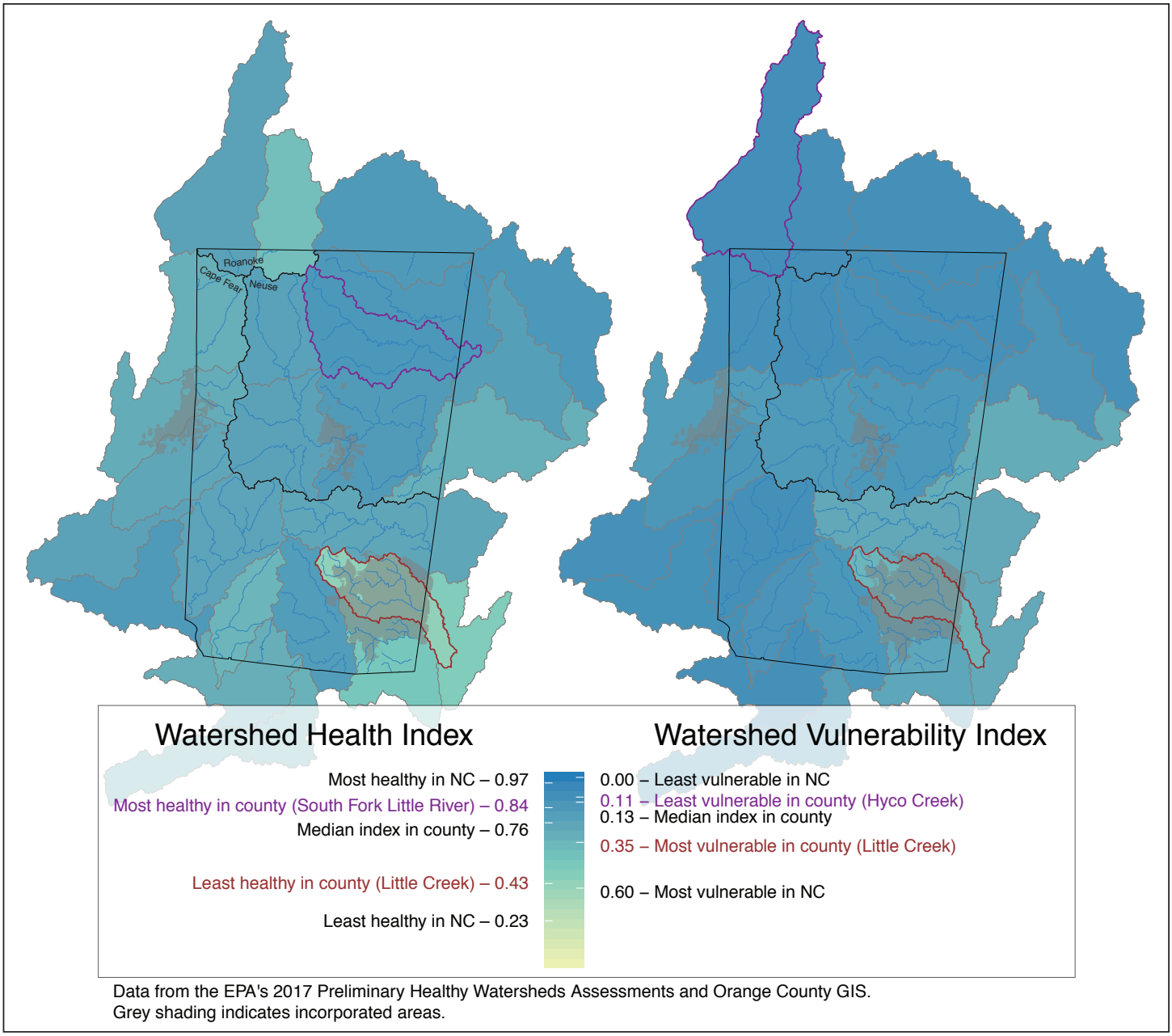


Figure 1

wildfire. With knowledge about watershed health and vulnerability, residents, elected officials, and non-governmental organizations can manage urban and rural areas in a wise manner so as to protect water quality and aquatic ecosystem health.

Recommendations

For the BOCC and other decision makers

- Continue to support open space preservation in Orange County, including the Land Legacy Program.
- Continue to support the Rural Buffer.
- Continue to support efforts to enact comprehensive nutrient management strategies in all water supply watersheds.
- Continue to enforce current impervious surface limits for new developments.
- Support staff efforts to continually monitor and address state efforts to reduce local watershed management authority.

For residents

- Get engaged with stream monitoring and cleanup efforts such as those organized by Chapel Hill, the Haw River Assembly, or the Eno River Association.
- Advocate for prescribed burns in rural watersheds where wildfire poses a risk to watershed health.
- Alterations to local streams require a permit. Before undertaking any stream alterations on your property, reach out to Orange County Soil and Water Conservation for resources on stream restoration.
- Learn more about how to protect your watershed by taking advantage of what nearby universities have to offer, such UNC's Institute for the Environment, NCSU's Center of Excellence for Watershed Management, and Duke University's Nicholas Institute for Environmental Policy Solutions.
- Properly dispose of oil, grease, pharmaceuticals, pet waste,and other household waste so these don't contaminate our water resources.

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US Environmental Protection Agency, 2017. Preliminary Healthy Watersheds Assessments. Published 13 Mar. 2017. Retrieved 13 Aug. 2019. https://www.epa.gov/hwp/download-2017-preliminary-healthy-watersheds-assessments.

Van Metre PC, Waite IR, Qi S, Mahler B, Terando A, et al. (2019) Projected urban growth in the southeastern USA puts small streams at risk. PLOS ONE 14(10): e0222714.https://doi.org/10.1371/journal.pone.0222714

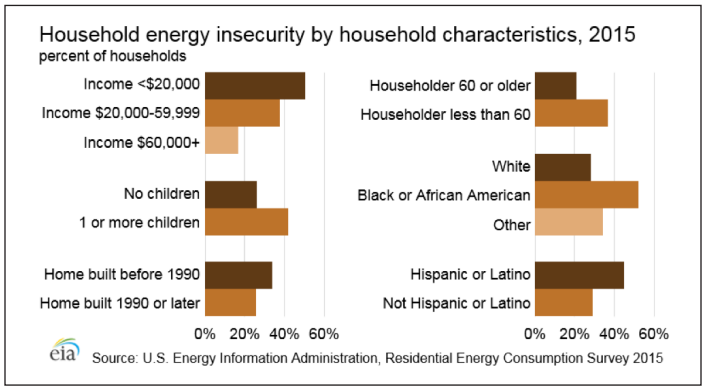
Energy Insecurity:
Energy Bills Are Part of Housing Affordability

A 2015 EPA survey found that over 30 percent of U.S. households face some form of energy insecurity. According to the NC Housing Coalition, Orange County renters who make below 50% of the area median income spend 12% of their budget each year (~$1,500) on energy bills.

Energy insecure households experience inadequate levels of essential energy services due to a combination of low household incomes and high energy bills due to older inefficient buildings and appliances. According to data from the US Department of Energy and the NC Housing Coalition, in 2015 Orange County households with an income below 50% of the area median spent 12%-14% of their total income on energy bills, which is twice the regional average for all households.

The 2015 US Energy Information Administration (EIA) Residential Energy Consumption Survey showed that about one in five households reported reducing or forgoing basic necessities like food and medicine to pay an energy bill and about 15% reported receiving a disconnection notice for energy service. While county-level data are not available, the EIA found that responses to their national survey were similar across the country and between urban and rural respondents. Income, race, the year a home was built, and the presence of children in the household were significant factors that predict energy insecurity.

Bringing together federal, state, and local resources the Orange County Housing and Community Development Department provides a spectrum of services to address housing needs in the county. These services include home repair and rehabilitation services to improve the health and efficiency of Orange County households as well as rental assistance to more than 600 low-income households across the county. The department's home



rehabilitation programs provide urgent repairs or comprehensive retrofits, depending on the needs of each household. The NC Housing Finance Agency estimates that for the statewide Urgent Repair Program, every $1 invested can save up to $19 in Medicaid/Medicare funding by keeping people in their homes and out of costly institutionalization.

Last year, Orange County's home rehabilitation program repaired 40 houses in addition to working with more than 200 landlords each year to maintain affordability and quality of life for Housing Choice Voucher recipients. Orange County also participates in two federal programs, the Crisis Intervention Program and the Low Income Energy Assistance Program, that assist eligible households in paying their energy utility bills.

Beyond county programs, the non-profit Central Piedmont Community Action receives support from the state Weatherization Assistance Program to directly improve the energy efficiency of low-income households in Orange County. They are part of a team of more than 7 organizations who have formed the Home Preservation Collaborative to coordinate necessary related services and increase the convenience of receiving assistance. Innovative programs such as this and those of other local

governments are working to create more enduring solutions to the energy burden across North Carolina.

Beyond increasing housing affordability, addressing energy insecurity also has the potential to bring indirect benefits for Orange County residents, including reducing chronic health burdens, better comfort and well-being, reductions in air pollution from lower energy consumption, and improved household resiliency in the event of an emergency.

Recommendations

For the BOCC and other decision makers

- Continue providing local financial support to Orange County Housing and Community Development's efforts to renovate energy insecure households to improve energy efficiency.
- Continue supporting partnerships with energy providers and non-profits who are already engaged in identifying energy insecure households in Orange County and implementing sustainable solutions to their energy issues.

For residents

- Add a small amount of your choosing to your monthly energy bill to support programs by your local utility that assist households in need. Examples include the Duke Energy Share the Warmth program and Piedmont Electric's Helping Hand Foundation which matches annual donations 1:1 up to $500,000 to assist households across the Carolinas.
- Volunteer for non-profits who are engaged in assisting energy insecure families, or those with more fundamental needs for housing. Examples include Habitat for Humanity, Inter-Faith Council for Social Services, Orange Congregations in Missions, and others.

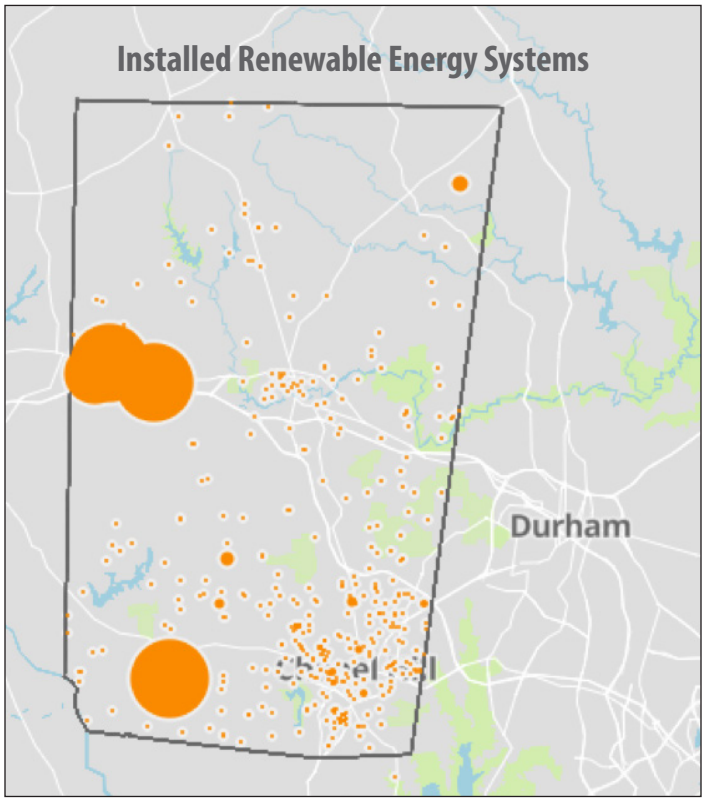
Renewable Electrical Energy Generation

To reduce greenhouse gas ("GHG") emissions, Orange County government, businesses, and residents all need to consider ways to obtain more energy from clean, renewable sources and reduce dependence on fossil fuels that contribute to climate change and pollution.

In 2005, the county set a goal of initiating policies and programs to increase the use of renewables, which led to the inclusion of solar energy goals and objectives in the county's 2030 Comprehensive Plan, as well as the county's 2015 "Resolution of Support for Small Solar." On September 5th 2017, the Board of Orange County Commissioners adopted a resolution to transition to a 100%, renewable energy based economy by 2050. The plan for how we transition and how far we've come will be addressed in the climate action plan.

Of the available sources of renewable energy in the US today, hydropower is one of the most powerful and reliable. There are major impacts when constructing additional dams, but more study should be conducted to determine the financial feasibility of small hydropower or hydrokinetic installations in Orange County[1].

While wind energy is a large source of renewable energy in the Midwest and some coastal areas, utility scale wind energy production in the Piedmont of North Carolina is difficult. With an annual average wind speed of <10mph at 33 feet, it is hard to generate enough electricity to create a payback, particularly with the costs and complexities of connecting to the electrical grid. As the cost of off-grid battery storage systems decline, there may be opportunities to use a combination of wind and batteries to power lighting, pumps, or other equipment in areas where connecting to the grid may be difficult. The rapid changes in these technologies underscore the value of periodic reviews of wind power feasibility, especially for off-grid applications.



The most readily available source of renewable energy in Orange County is the sun, and the growth in solar energy in Orange County has been rapid. Spurred on by the work of the 2014-15 "Solarize Orange" campaign and the state incentives for solar that were in place at that time, residents installed more than 723 kilowatts of capacity in over 135 homes. According to the NCSEA solar census, in June 2019 Orange County had 23.02 megawatts of solar across 407 systems. This is an increase of 37% (6.23 megawatts) in the county in just three years. In recognition of its

continuing efforts in reducing the barriers to appropriate local solar installations, Orange County was recently designated by the U.S. Department of Energy as a Silver Level "SolSmart" community.

Recommendations

For the BOCC and other decision makers

- As part of the Global Covenant of Mayors, continue to track and update the county's greenhouse gas emissions inventory every two years and complete, promote, and execute a countywide action plan for climate and renewable energy in 2020.
- Explore opportunities to upgrade existing county-owned facilities to include renewable energy production capability leveraging the Duke Energy solar incentive.
- Explore the adoption of policies to promote innovative financing mechanisms to aid the transition to renewable energy for commercial and residential customers, including property assessed clean energy (PACE) financing and "on-bill" financing.
- Continue progressing from the Silver to the Gold level in the SolSmart program, further increasing the clarity and speed of developing new solar energy installations.

For residents

- Explore opportunities to add solar to your property, whether purchased or leased, to supply energy or offset electricity demand.
- Consider community solar programs, such as those provided by organizations like Piedmont Electric Membership Cooperative and Arcadia Power, which allow users to support remote solar and wind energy installations.
- Explore geothermal heat pumps, which use the natural heat of the earth to make heating and cooling more efficient.
- Advocate at the state and federal level for practical energy policies to incentivize the speedier transition of electrical generation away from polluting and climate-impacting fossil fuels, as well as the creation of jobs and economic benefits through the growth of the clean energy industry.

References

[1] Sandt, Christopher J. and Martin Doyle. 2013. "Studying the Potential to Add Micro Hydropower in North Carolina". Retrieved 10/15/2013. https://www.hydroreview.com/2013/10/15/studying-the-potential-to-add-micro-hydropower-in-north-carolina/

AIR & ENERGY RESOURCES

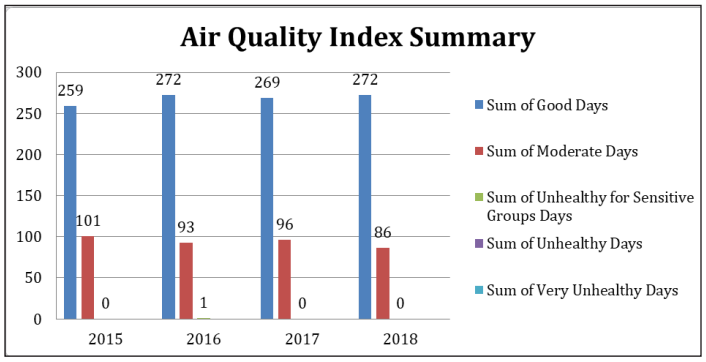
Trends in Local Air Quality

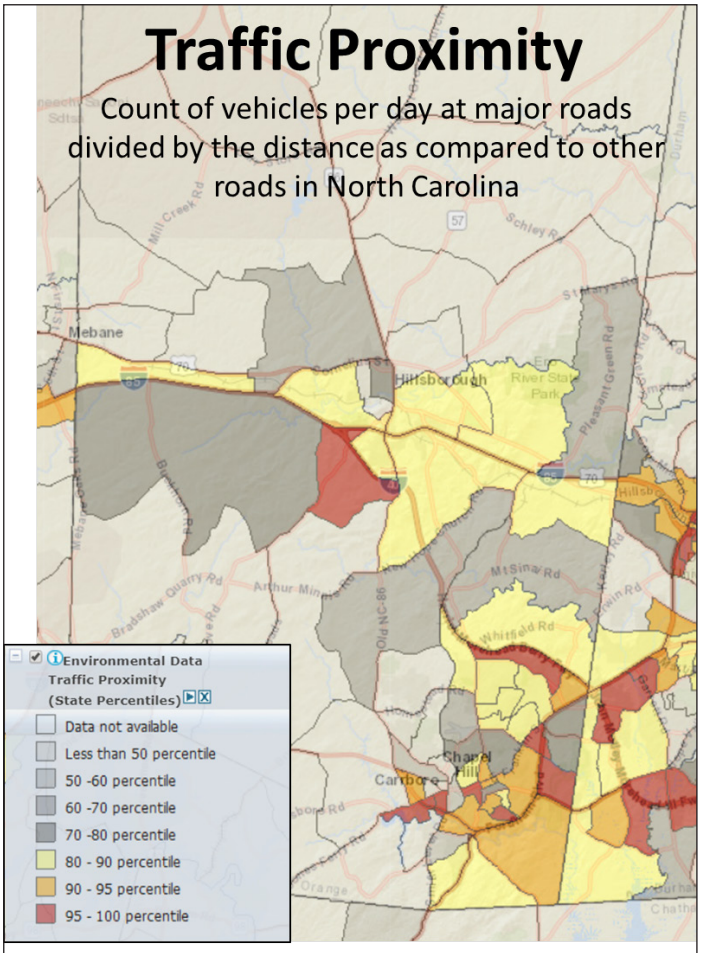
Tracking air pollutant emissions is critical to assessing and developing strategies to improve air quality. Reducing the amount of ground-level ozone and its health effects has been one of the greatest challenges facing Orange County and the entire Triangle region. Although a portion of the ozone impacting Orange County is the result of the transport of gases from other areas, a significant portion comes from local transportation and point-source emissions.

Ground-level ozone is formed in the atmosphere through a photochemical reaction involving a number of air pollutants. According to the NC Division of Occupational and Environmental Health, "when ozone is created at ground level, it can become a health problem, irritating the respiratory system, impairing breathing, and aggravating existing conditions such as asthma, allergies, emphysema or bronchitis."

The primary contributors to ground-level ozone are: 1) Nitrogen oxides (NOx), which are formed in significant amounts when vehicles or industrial facilities burn fossil fuels, and; 2) Volatile organic compounds (VOCs), which are hydrocarbons present in fuels and solvents.

Ground level ozone is one of the common air pollutants measured by the EPA's Air Quality Index (AQI). The EPA coordinates a network of air quality monitoring stations and produces a daily AQI score for the following common pollutants: ground-level ozone, particulate matter (PM 2.5 and PM 10), carbon monoxide, and sulfur dioxide. The highest of these AQI values is reported as the AQI value for that day. From 2015 through 2018 the nearest monitoring site at the Durham Armory has shown no Unhealthy or Very Unhealthy days, and only a single "Unhealthy Day for





Source: EJSCREEN: EPA's Environmental Justice Screening and Mapping Tool, ver 2018: https://ejscreen.epa.gov/mapper/

Sensitive Groups" in 2016. During this period there has been a slight decrease in the number of "Moderate" days, going from 101 to 86. If you look back further to 2010 which had 126 Moderate days and 8 days which were unhealthy for sensitive groups, you can see this is part of a longer term trend toward better air quality.

While the AQI gives a score that is relevant across all of Orange County, local concentrations of these air pollutants can be lower or higher based on how close you are to the source.

Proximity to high concentrations of vehicle traffic is one concern and another area of concern is vehicle idling, particularly around sensitive groups such as children. The county is already partnering with both school districts on a campaign to reduce vehicle idling at school pick up and drop off zones. The student Green Team from Phillips Middle School took on this issue and expanded this school idle reduction campaign significantly, creating their own branded campaign titled "Driving is Exhausting" with its own website and temporary yard signs highlighting student artwork.

While "point source" data are also collected from some industrial operations in Orange County, the number of those sources is less than 10 and not all of them report their emissions in any given year. This makes it hard to measure the overall impact of such sources for county residents. You can find out if you live close to one of these point sources by looking up Orange County in the North Carolina Point Source Emissions Report by the NC Division of Air Quality.

Recommendations

For the BOCC and other decision makers

- Work with the NC Division of Air Quality to add the first air quality monitoring station in Orange County or explore alternatives to collect more local air quality information.
- Continue working with school districts to assist parents in limiting their vehicle idling on school property and encourage the use of school buses.
- Work with the NC State Legislature, Orange County municipalities, and Orange County rural residents to support clean energy initiatives for our urban and rural communities, and resist the weakening of air quality monitoring requirements, especially for vehicles.

For residents

- Sign up for daily AQI email notifications from EnviroFlash, particularly if you or a member of your family belongs to a group who may be more sensitive to poor air quality, such as children or older adults, people with asthma or heart disease.
- Consider using public transportation, car-pooling, and biking or walking, when practical, to get from one place to another. For assistance in finding the best way to leave your car at home go to: https://gotriangle.org/residential
- If your car will be stationary for more than 10 seconds and you're out of traffic, turn it off. Modern engine starters use very little fuel, so you'll save money and reduce emissions. For more information go to www.DrivingIsExhausting.com.
- When purchasing new or used equipment, whether a vehicle or other power operated equipment, think 'Clean Energy' first, such as 'hybrid' or 'electric' equipment. In many cases this equipment is also cheaper, quieter, and less smelly to operate.

Towards Climate Change Resilience

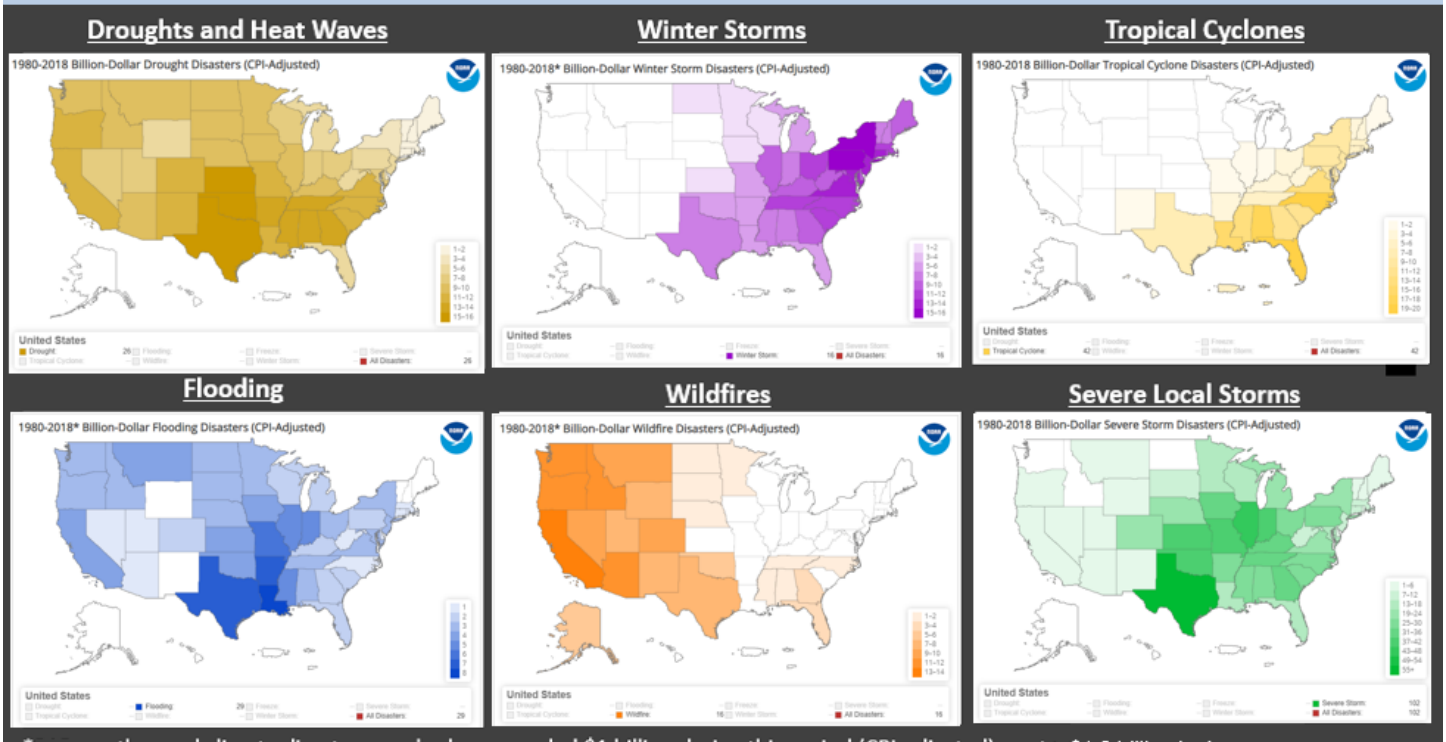
Climate resilience is the ability for a community to remain functional and safe when faced with the consequences of a changing climate. Certain adaptations can allow a community to recover from disasters sooner.

Climate change is expected to alter the Triangle region in a variety of ways, including:

- Increasing extreme precipitation events that lead to more frequent local flooding;
- Increasing temperatures and temperature variability with linked extreme heat events;
- Increasing frequency and duration of drought conditions that lead to water shortages and wildfires.

Robust population growth in our region coupled with the impacts of climate change may lead to an increasing demand for resources and services and increasing social vulnerability. While no new buildings can be built in Orange County within the 100 or 500 year floodplains, in 2015 Orange County Emergency Management staff identified over 130 existing buildings that were at an increased risk of flooding.

Billion-dollar weather and climate disasters frequency mapping: 1980-2018*



*241 weather and climate disasters reached or exceeded $1 billion during this period (CPI-adjusted); cost > $1.6 trillion in damages

Please note that the map reflects a summation of billion-dollar events for each state affected (i.e., it does not mean that each state shown suffered at least $1 billion in losses for each event).

In 2017, Orange County, the Town of Chapel Hill, City of Raleigh, City of Durham, Durham County, and the Town of Cary formed the Triangle Regional Resilience Partnership (TRRP) to better understand, plan and coordinate regional preparedness for the impacts of environmental, social and economic disruption. Guided by the Triangle J Council of Governments, the TRRP contracted with UNC Asheville's National Environmental Modeling and Analysis Center to facilitate and provide technical assistance in developing a resilience assessment. The assessment identifies options and strategies that cities, towns and counties in our region can act on to become more resilient in the face of environmental, social and economic disruption. It establishes a starting point for continued planning and collaboration to help ensure that the Triangle remains a premiere area in the United States to live.

Recommendations

For the BOCC and other decision makers

- Incorporate the appropriate resilience measures from the Triangle Regional Resilience Assessment into the update to the Eno-Haw Hazard Mitigation Plan.
- Continue to support the County's floodplain management program and where feasible implement further protections.
- Continue to support the Triangle Regional Resiliency Partnership.

For residents

- Pay attention to climate risk factors when purchasing property such as the location of the nearest floodplain.
- Take advantage of free emergency management trainings and become involved in ongoing preparedness efforts. During a significant event, emergency response resources are often overwhelmed and within the first 72 hours it is necessary for neighbors to assist neighbors. With the County's growing 65-and-older population, this is becoming ever more important.
- Many homeowner's insurance policies do not protect against flood damage, and heavy rains are causing flooding even outside of floodplains. Seek the guidance of local floodplain administrators to advise on insurance opportunities and constraints.
- The development of new homes in floodplains is prohibited in Orange County. If you have an existing home within the 0.2% (aka 500 year) floodplain, look into resilience options for your home such as voluntarily buying flood insurance. Often, banks require flood insurance for properties in the 1% (100-year) floodplain, but flooding within the 0.2% floodplain is becoming more common.

Conserving Energy and Decarbonizing Daily Life

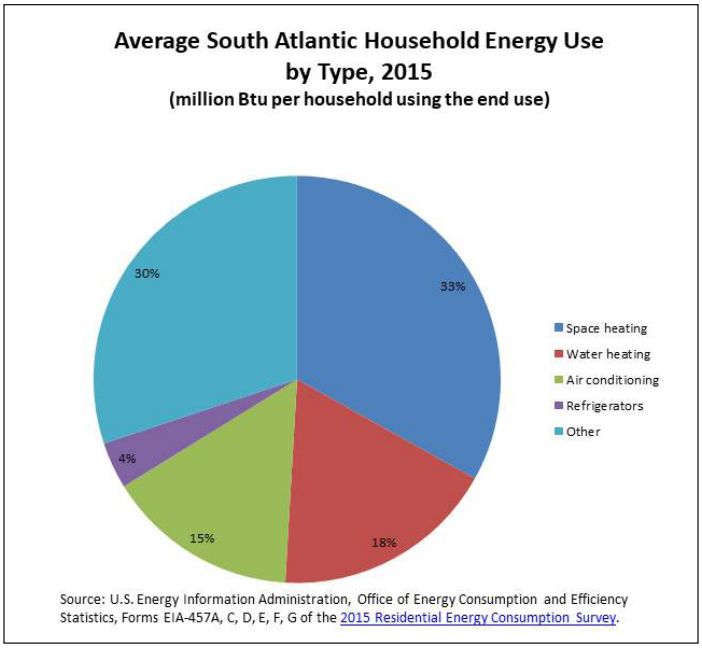
Reducing the energy required by daily life is the cheapest and fastest step towards transitioning away from our carbon-intensive fossil fuel-based energy sources. An important second step is to electrify fossil fuel-based building systems and appliances.

Where we stand now

When the US joined the Paris Climate Agreement, our Nationally Determined Contribution was to reduce greenhouse gas emissions between 26 and 28 percent by 2025 based on 2005 baseline emissions levels. In 2017, as the federal government was indicating its interest in leaving this international agreement, the Board of County Commissioners passed a resolution to proportionally uphold Orange County's part of that commitment.

To achieve this goal proportionally for Orange County, and as a participant in the Global Covenant of Mayors for Climate and Energy, the County is working on a climate action planning process beginning with an update to its 2005 greenhouse gas inventory. From 2010 to 2017, County facilities achieved a 21.6% reduction in energy usage per square foot through a combination of energy efficiency measures, avoiding a significant amount of cost and carbon emissions.

Beyond Orange County operations, about 30 percent of all of the greenhouse gases from electricity and natural gas usage are attributable to the residential sector[1]. In 2017, the County had approximately 57,000 utility customers that each emitted about 4.5 metric tons of carbon dioxide equivalent (CO_{2e}) emissions. A 2017 North Carolina Department of Environmental Quality inventory of human-caused greenhouse gas emissions found electricity generation was the single largest source, accounting for 35.6% of state-wide emissions. These CO_{2e} emissions can be significantly reduced by Orange County residents conserving energy and decarbonizing their household activities. The following pie chart shows energy usage in a typical US home based on the US Energy Information Administration's 2015 Residential Energy Consumption Survey.



Reduce wasted energy

One way to conserve energy is to improve the design of new buildings and to upgrade existing buildings to become more energy efficient. Leadership in Energy and Environmental Design (LEED) certification is the most widely recognized green building rating system, and there are several others. Energy audits can be performed to analyze energy use and identify opportunities for improvement. Ensuring that energy efficiencies are maximized makes good economic sense as well, often resulting in a 2-5 year simple payback according to the NC Division of Environmental Quality.

Another way that residents, businesses, and government can improve energy conservation is by transitioning to more energy efficient products. One example is replacing inefficient incandescent light bulbs with more efficient, longer-lasting LED bulbs. Although these and other energy-efficient alternatives can sometimes have a higher upfront cost, their longer lifespan and lower energy use can save a considerable amount of money over time. The price of energy-efficient products is also steadily decreasing due to improvements in technology. Appliances with the "ENERGY STAR" label are federally guaranteed to consume less energy than standard non-energy efficient models.

Limit emissions by electrifying space and water heating

About 25% of the CO2e emissions for all of Orange County's residences are attributable to about 23,000 residences using natural gas for space heating, water heating, clothes drying and cooking. These emissions are from burning natural gas in the house and do not account for extraction or distribution leakage.

Even though the choice of natural gas is understandable as it is currently less expensive than electricity per unit of energy, in the long term, moving away from natural gas to energy sources that are more easily supplied by renewables is an important step. To ultimately eliminate the generation of greenhouse gases from household activities will require replacing gas appliances with electrical appliances which could currently add up to several thousand dollars for each household. The most practical decarbonization approach for many households may be to explore electrification of appliances as they wear out, especially if this can be coupled with the installation of a solar photovoltaic system to offset the new electrical usage. Given decades-long lifetimes of buildings and some appliances, the decision to purchase electrical equipment instead of natural gas equipment should be made today if Orange County is to meet its community-wide 100% renewable energy goal by 2050.

Recommendations

For the BOCC and other decision makers

- Work with utilities to create and promote financing options to incentivize consumers and businesses to make upgrades and improve energy efficiency in existing buildings.
- Commit to green building standards for all new County facilities and develop programs to provide reductions or rebates for building permit fees to encourage sustainable building practices for County residents and businesses.
- Provide an energy conservation page on the County website that helps residents and businesses navigate ways to reduce energy consumption.
- Ask the appropriate staff to research electrification incentive programs run by other local governments and utilities to identify feasible models.

For residents

- Take advantage of existing programs offered by utilities for special rates and rebates for energy conservation such as Duke Energy's smartsaver rebates and Piedmont Electric Cooperative's special rates and rebates.
- Install "smart" thermostats and power strips to reduce energy consumption.
- Reduce your home's biggest energy drain by setting your thermostat to run a few degrees hotter in the summer and a few degrees cooler in the winter.
- Make sure your water heater is not set to deliver hot water to the tap beyond 120 degrees. Water heated past 120 degrees is not necessary for residential cleaning purposes, it will reduce a safety hazard for children, and reducing this setting makes an energy efficiency impact 24 hours a day since your water heater is always on.
- Upgrade lighting to LED light bulbs.
- When replacing appliances, look for the "ENERGY STAR" label.

References

[1] Data from Duke Energy on all Orange County usage and emissions in 2017. Received Oct 3, 2018.

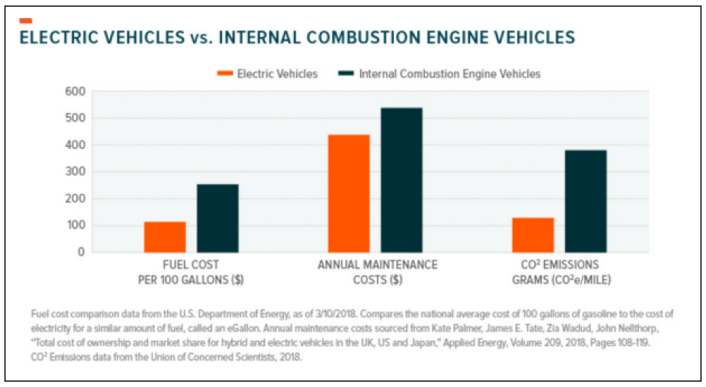
Electric Vehicles as a Climate Mitigation Strategy

The transportation sector is responsible for 32.5% of North Carolina's greenhouse gas emissions according to the NC Department of Environmental Quality. Electric vehicle models are currently available that may be viable replacements for many of Orange County's fleet vehicles. Beyond cutting transportation-related carbon emissions in half, there are several additional benefits for Orange County and its residents to transition to electric vehicles.

Electric Vehicles Reduce Emissions

Internal combustion engine vehicles create far more air pollution than electric vehicles. They emit carbon monoxide and hydrocarbons. As the fuel burns, nitrogen and oxygen react and form nitrogen oxides, which causes bronchitis, asthma and emphysema. When nitrogen oxide reacts with oxygen, it creates ozone. The ozone reacts with water and forms nitric acid, a highly corrosive material. Internal combustion vehicles emit tiny particles in their exhaust, which is responsible for visual air pollution, as well as carbon dioxide, a powerful greenhouse gas.

Electric vehicles emit none of these polluting and greenhouse gases at their tailpipe and less than half of the overall emissions of comparable fossil fuel vehicles according to a study by the Union of Concerned Scientists. Emissions are cut in half for battery electric vehicles over their lifetime even when accounting for the manufacturing of their batteries. They have no combustion engine and no exhaust system. Transitioning to an electric vehicle fleet would help the county meet its emissions goals to reduce carbon emissions by 26% by 2025 based on a 2005 baseline. The county fleet travels roughly 3 million miles per year on average. If all of those miles were electric, more than 600 metric tons of CO_2 equivalent emissions would be avoided. With cleaner air and less noise and other benefits, an Orange County transition to electric vehicles would mean a healthier lifestyle for all its residents.

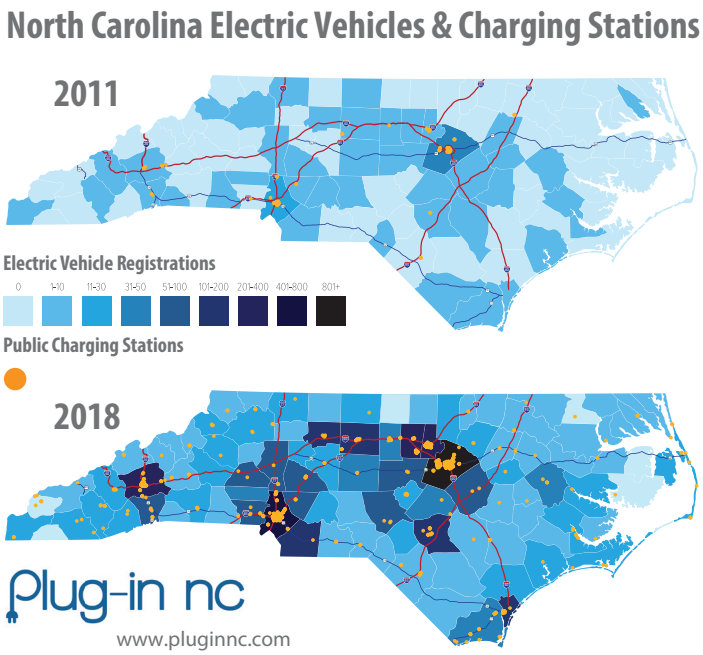


Cost of electric vehicles

The up-front costs of electric vehicles are high but decreasing, and electric vehicles are cheaper to maintain and operate. At the time of writing, the average cost for a gallon of gasoline in NC is $2.39. According to the US Department of Energy, to go the same distance with an electric vehicle would only cost $1.07. Fuel prices also change regularly in the course of one budget cycle, whereas electricity prices stay low and increase predictably. Furthermore, electric vehicles require no oil changes, and their regenerative braking system means less wear on brake pads and less maintenance time and cost overall.

Up-front costs of electric vehicles could be reduced in several ways. If they were leased rather than purchased, there are grants available to buy down the cost premium of those leases. With increased electric fleet vehicles comes the need for increased charging infrastructure. Since fleet vehicles often return to the same parking lot each evening, most charging could be completed overnight while the vehicles are idle. There are grants regularly available to help support the expansion of electric vehicle charging infrastructure.

Governor Cooper's Executive Order No. 80 has indicated the state's interest in expanding the number of electric vehicles on the road to 80,000 by 2025. According to the newly released NC ZEV Plan, Orange County is located along two "Designated Electric Vehicle Corridors" and can be a leader in that effort.



Recommendations

For the BOCC and other decision makers

- Budget for replacing fossil fuel fleet vehicles with electric vehicles as they need replacing over time.
- Encourage residents to purchase electric vehicles by maintaining and expanding the county's free public electric vehicle charging station network.
- Explore a regulation requiring all new construction in the county to install electric vehicle charging stations at appropriate high-traffic locations like restaurants and hotels.

For residents

- Electric vehicles may become as cheap as gasoline vehicles within 6 years. Make a commitment that your next vehicle will be fully electric or a hybrid.
- Support county, state and federal legislation promoting electric vehicles.
- Support electric public transportation.

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