Triangle Regional Resilience Partnership

Resilience Assessment

EXECUTIVE SUMMARY

PREPARED FOR THE

TRIANGLE J COUNCIL OF GOVERNMENTS

OCTOBER 2018

Executive Summary

Resilience is about planning and investing today for a better future.

The Triangle region of North Carolina, like other communities across the United States, faces increasingly severe impacts from weather- and climate-related threats—threats that are expected to become even more frequent and severe in the future. The region is simultaneously dealing with stressors unrelated to climate, such as rapid population growth, continued development, and shifts in economic and demographic trends.

To better prepare for and adapt to these changing realities, the Triangle Regional Resilience Partnership (the TRRP)—in partnership with UNC Asheville's National Environmental Modeling and Analysis Center (NEMAC) and the Triangle J Council of Governments—performed a quantified assessment to help regional decision makers understand which assets are most vulnerable to specific threats and provide guidance on potential solutions. This regional assessment provides an initial framework to inform more detailed local plans and investments.

How is the Triangle Region Changing?

The region is experiencing certain trends, primarily:

Increasing extreme precipitation events that lead to more frequent local flooding

Increasing temperatures and temperature variability

Increasing frequency and duration of drought conditions

Robust population growth leading to an increasing demand for resources and services and increasing social vulnerability

The purpose of the assessment was to examine these and other trends to see how these changes impact our valued assets—such as human health, infrastructure, and agriculture.

How Do These Changes Impact the Triangle Region?

The assessment explores how and where our assets—people, property, services, and infrastructure—are impacted by these changes. There is a trend toward increasing **vulnerability and risk** in these key areas:

» Impacts of Flooding on Properties and Road Access

With an expectation of increased precipitation and continued development comes the reality of increased localized flooding.

A major or widespread flooding event in the region could result in more than 30,000 properties becoming partially or fully inaccessible to residents and emergency vehicles due to either inundated or damaged roads.

» Impacts of Minor Flooding on All Assets

The threat of minor flooding—flooding events that cause stress to stormwater systems, regardless of the size—arises from extreme or heavy precipitation that could result in runoff and erosion and impacts to surface water quality.

» Impacts of Water Shortage on Water Supply

Changes in the amount and intensity of rainfall can and will affect the quality and quantity of regional water supplies.

» Impacts of Extreme Heat on Residents

Extreme heat can cause negative health impacts, which causes concern for the region's socially vulnerable populations.

» Impacts of Wildfire on Residential Properties

Development in the region has led to many homes being located in the wildland-urban interface, raising their vulnerability and risk to wildfire.

> Socially vulnerable populations in the Triangle region may be disproportionately affected by stressors and impacts.

How Can We Use the Assessment?

The assessment should be considered a starting point—one that focuses on regional solutions and begins the process of building community preparedness. Local governments should use the assessment as a guide for more detailed local planning to promote a more equitable and resilient future. The assessment empowers the region and its people to integrate long-term data analysis into current decision-making processes so that they can make decisions with confidence and take action to build a resilient, climate-ready place to live, work, and thrive.

Using results from the assessment, the TRRP partners developed a number of **options and strategies** to help guide the region as it responds to climate and non-climate stressors while providing an improved quality of life and supporting regional vitality and livability.

The Triangle Regional Resilience Partnership

The TRRP is a cooperative partnership among the Town of Cary, the Town of Chapel Hill, the City of Durham, the City of Raleigh, Durham County, and Orange County. The Steering Committee is composed of the partners' Sustainability Managers, Sustainability Directors, and Resilience Officers. The Triangle J Council of Governments provides administrative assistance.

Community Resilience

Resilience is the capacity of a community, business, or natural system to prevent, withstand, respond to, and recover from a disruption.

Many local governments are recognizing the need to build community resilience as they experience (1) rapid growth, and (2) more frequent and/or severe extreme weather events.

The goal of resilience is more than simply "bouncing back" after an event—the idea is to "bounce forward" to a place where the community will be better able to withstand a future event.

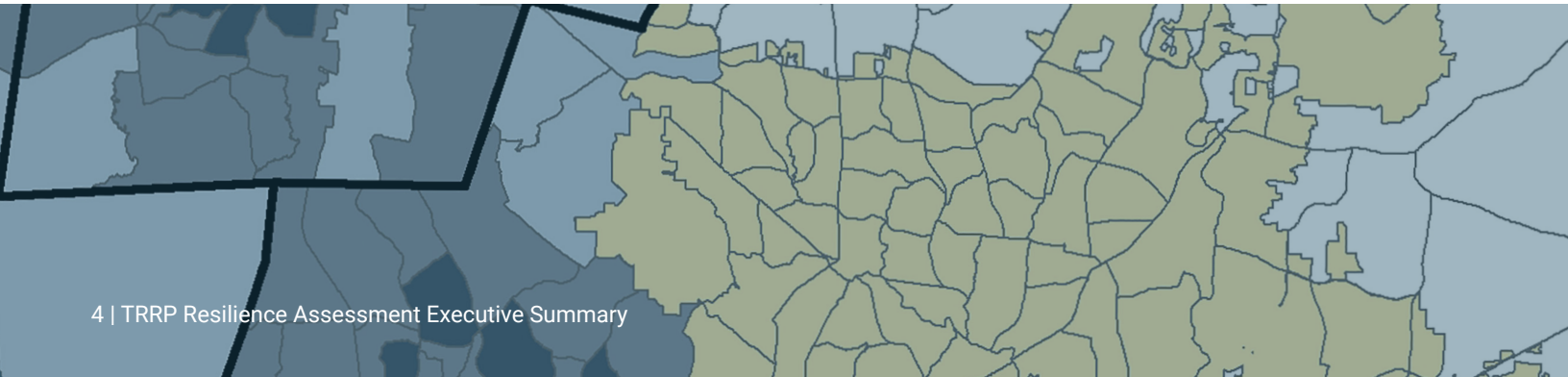
The Resilience Assessment Process

The Triangle Regional Resilience Assessment used a quantified process to identify and respond to both climate threats and non-climate stressors in the region. Using the "Steps to Resilience" framework from the U.S. Climate Resilience Toolkit[1] and guided by NEMAC, the TRRP partners determined key assets in each community, assessed the vulnerability and risks that these assets face, and developed potential strategies to address those vulnerabilities and risks to improve the region's overall resilience.

GIS-based analyses were performed and mapped at the census tract level to assess regional-scale impacts. Not all areas within a census tract will have uniform vulnerability, and localized impacts may vary within any given census tract.

Interactions between climate and non-climate stressors are complex, and the decisions being made are related to growth/sustainability and to climate. For example, the amount of precipitation that falls (or the lack thereof) is not a threat in and of itself. Extreme precipitation, however, is a climate stressor if enough of it falls in a short time frame and/or in combination with a high level of impervious surface—leading to the threat of flooding. Changing conditions can affect both climate and non-climate stressors, resulting in increased threats and hazards to key community assets.

1 toolkit.climate.gov



The Triangle Region

Shared values and assets are vital to the way of life in this part of North Carolina and contribute to the regional culture of TRRP cities, towns, and counties. Key regional values and assets include:

- A strong, diversified economy;
- A highly educated populace, with excellent higher education institutions;
- Plentiful parks and open space;
- A regional culture of connectivity;
- Resurgent downtown spaces;
- Transit solutions to connect hubs and develop walkable neighborhoods;
- A sustainable environment;
- An abundant surface water supply (in normal conditions);
- A robust tree canopy; and
- Historic and cultural destinations that support quality of life (e.g., culture, entertainment, and dining).

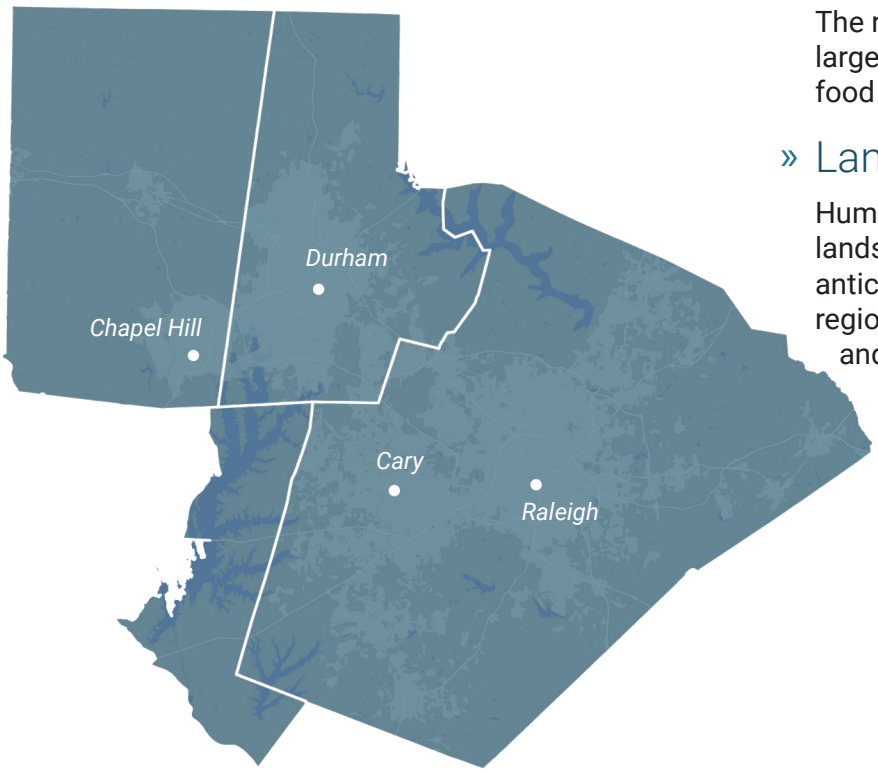
Each community has its own set of values. The assessment does not attempt to reflect each community's values, but rather to show regional variability in order to facilitate regional coordination and collaboration to enhance resilience. Each partner needs to define its own acceptable risk level and make plans to address the risks that affect its community.

» Water

The region boasts a plentiful supply of surface water, but may not have adequate water supply during periods of drought.

» Transportation

The region is a transportation node for the Southeastern U.S., supporting regional as well as local mobility.



» Energy

Increased growth and subsequent demand may stress local energy supplies, which would have an impact on the local economy and quality of life. Higher prices and/or a limited fuel supply would make a car-dominated and air-conditioning-dependent economy vulnerable.

» Food

The region's proximity to the state's largest agricultural area is beneficial for food sustainability and resilience.

» Land Use Patterns

Human changes to urban and rural landscapes that are not adaptive to anticipated risks could exacerbate regional impacts, such as from flooding and wildfire.

Social Vulnerability

Socially vulnerable populations may experience more severe impacts on their health and access to services from extreme weather events.

Climate Stressors

The assessment identifies several climate stressors, primarily:

Increasing extreme precipitation events that lead to more frequent local flooding

Increasing temperatures and temperature variability

Increased frequency and duration of drought conditions

Non-Climate Stressors

Robust population growth leading to an increased demand for resources and services and increasing social vulnerability

The Triangle region has a reputation for a good quality of life, affordable housing, and excellent opportunity for high-paying jobs. This has led to robust population growth: from 1970 to 2016, the Triangle Region's population grew **over 250%**—compared to a national average of **less than 60%**—and growth is projected to continue at this rate.

The desire for newer houses in the suburbs resulted in sprawl, leading to:

- An increased demand for resources and services: water, energy, roads, schools, emergency services.
- Higher than normal average wages and median home prices do not translate across all sectors, leading to greater disparity and increased social vulnerability for some populations.

Vulnerability and Risk

The assessment, based on the national standard risk framework, shows how the people, places, and assets of the Triangle region are affected by climate threats and non-climate stressors.

When considering the vulnerability and risk to people, the assessment focuses on socially vulnerable populations. Impacts to property and infrastructure were considered when focusing on the transportation, water, natural areas, health, and public services sectors.

The results of the analysis show a concerning trend toward increased vulnerability and risk for some assets and threats in the Triangle region.

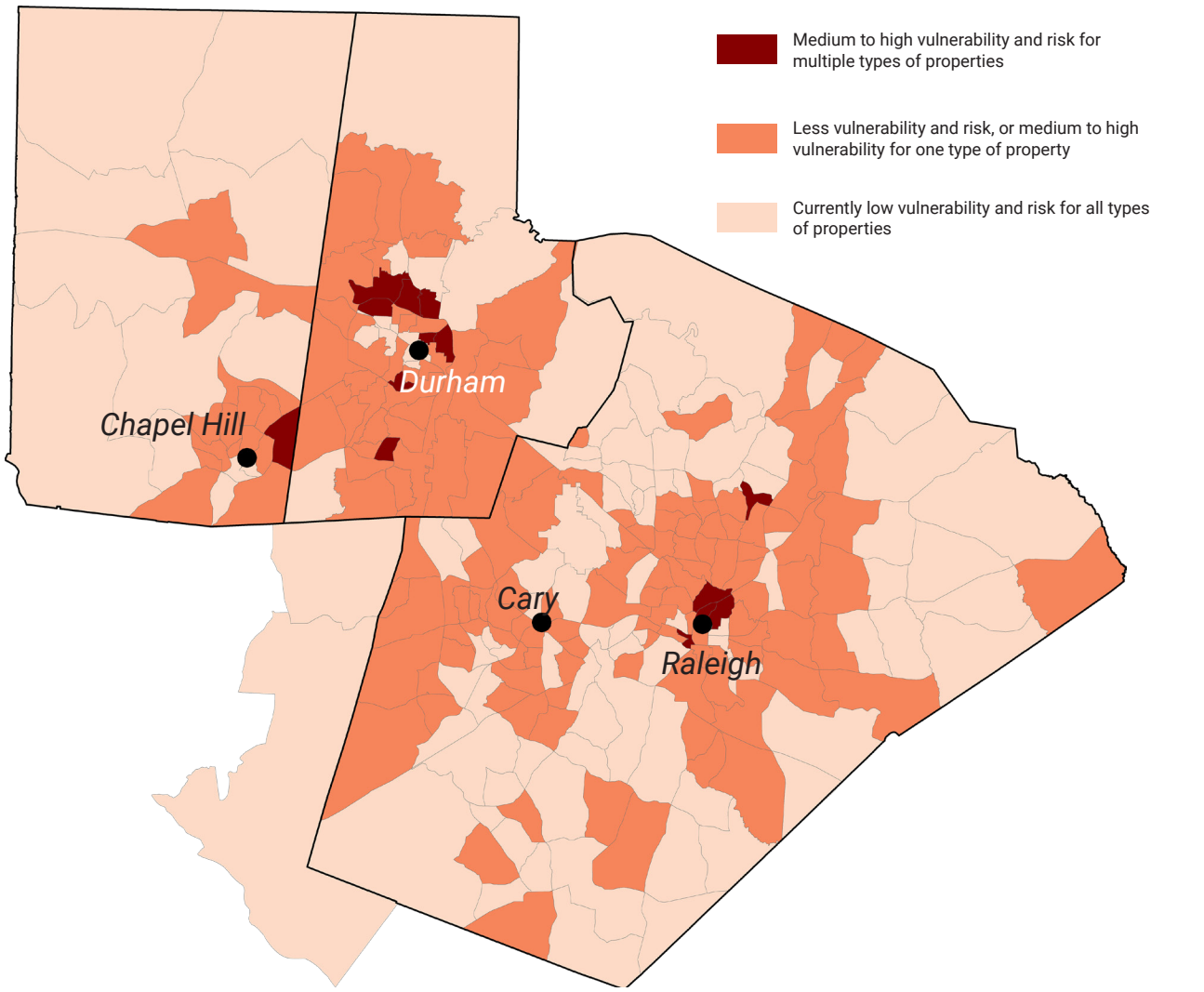
Results from the vulnerability and risk analysis performed as part of the assessment are found below and on the following pages. The analysis results are presented in "asset-threat pairs"—that is, examining the impact of one threat on one asset type—and are aggregated to and displayed at the census tract level. The asset-threat pairs included here are some that posed significant vulnerability and risk and were of high concern to the TRRP partners. They also show the range of regional issues and opportunities included in the assessment.

Please refer to the Technical Report for a full list of analyzed asset-threat pairs, the results of the analysis, and the vulnerability and risk rulesets and criteria used for all asset-threat pairs.

Properties and Flooding

With an expectation of more frequent and intense precipitation events and continued population growth and urbanization comes the reality of increased localized flooding that can affect commercial, industrial, and residential properties.

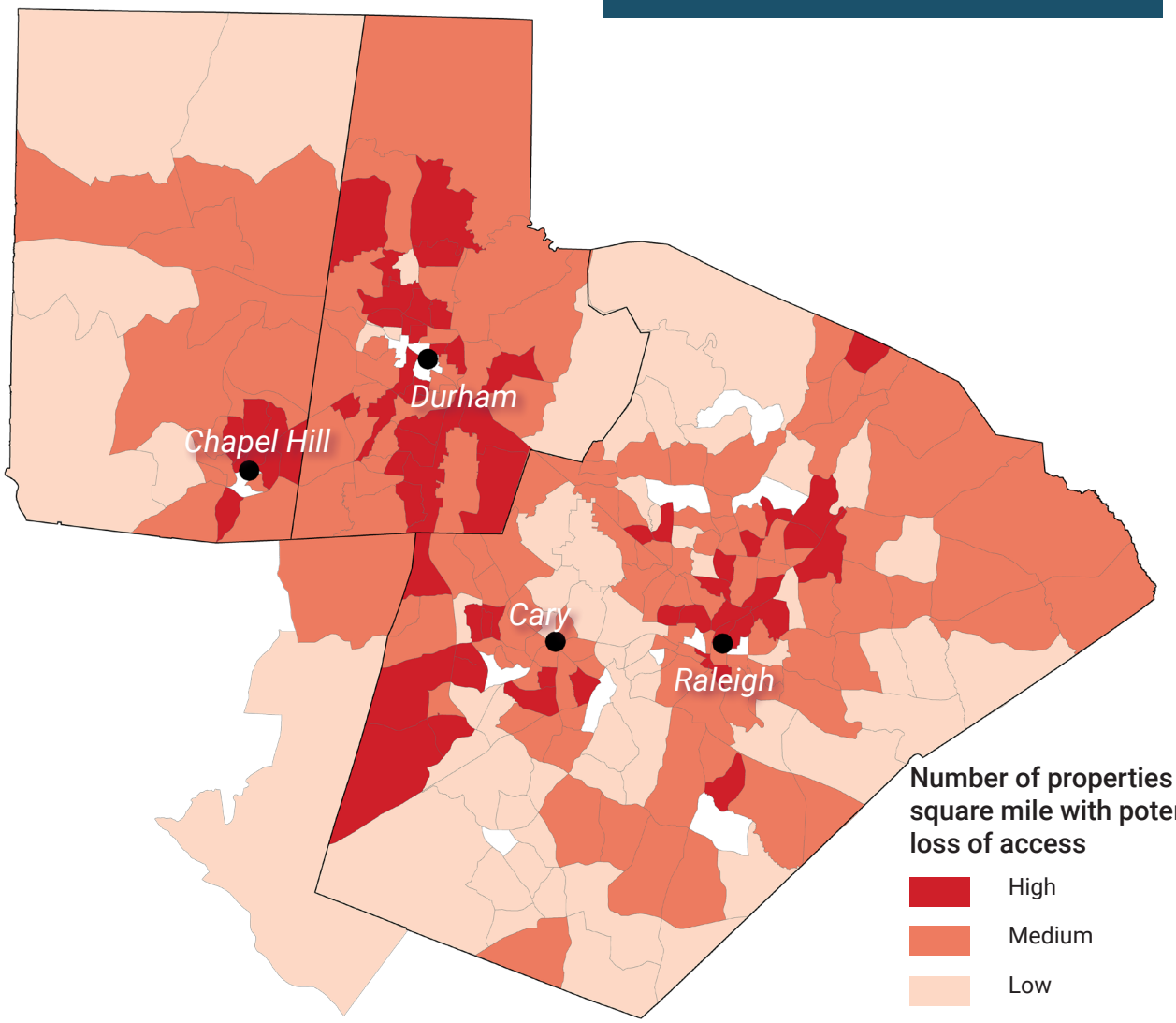
The assessment shows that a large number of commercial, industrial, and residential properties in the region face significant vulnerability and risk due to flooding.



Road Access and Flooding

Beyond day-to-day transportation needs, roads provide vitally important access for safety and emergency services. Many of these are in areas with a single access point. Red areas on the map have the highest estimated number of properties with the potential for loss of access during a flood event.

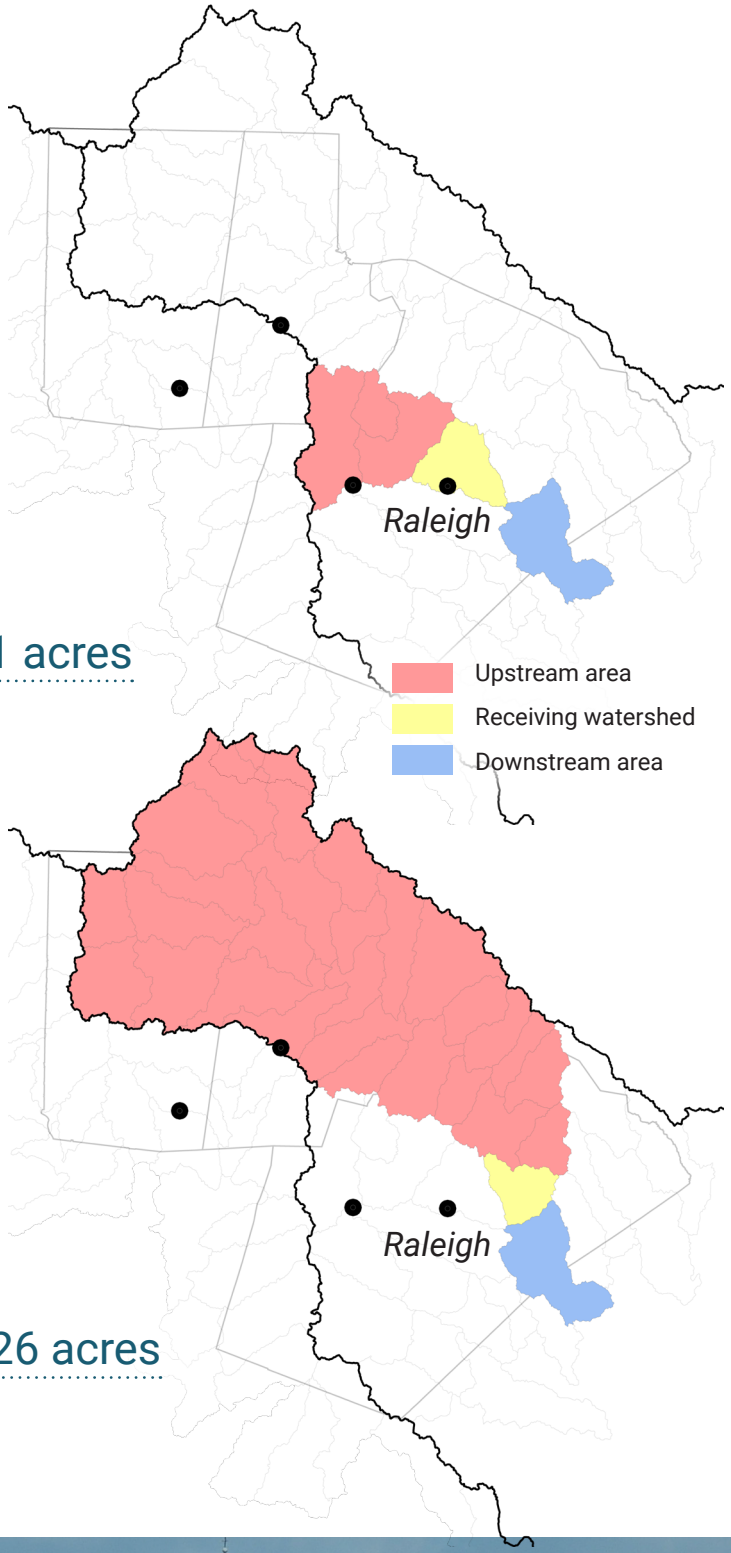
Depending on the circumstances, a flooding event in the region could result in more than 30,000 properties becoming inaccessible to residents and emergency vehicles due to either inundated or damaged roads.



All Assets and Minor Flooding

Minor flooding events are usually less severe than major flooding, but can still cause significant impacts. Minor flooding is heavily influenced by the amount of developed land cover and impervious surfaces that contribute to runoff.

The problems related to minor flooding are regional because of the connectivity of shared watersheds in the region. Compare how east Raleigh and northeast Raleigh may be impacted differently due to amount of developed land cover and the size (area) of the watersheds upstream.



NORTHEAST/CENTRAL RALEIGH

Total Upstream Area | 92,971 acres

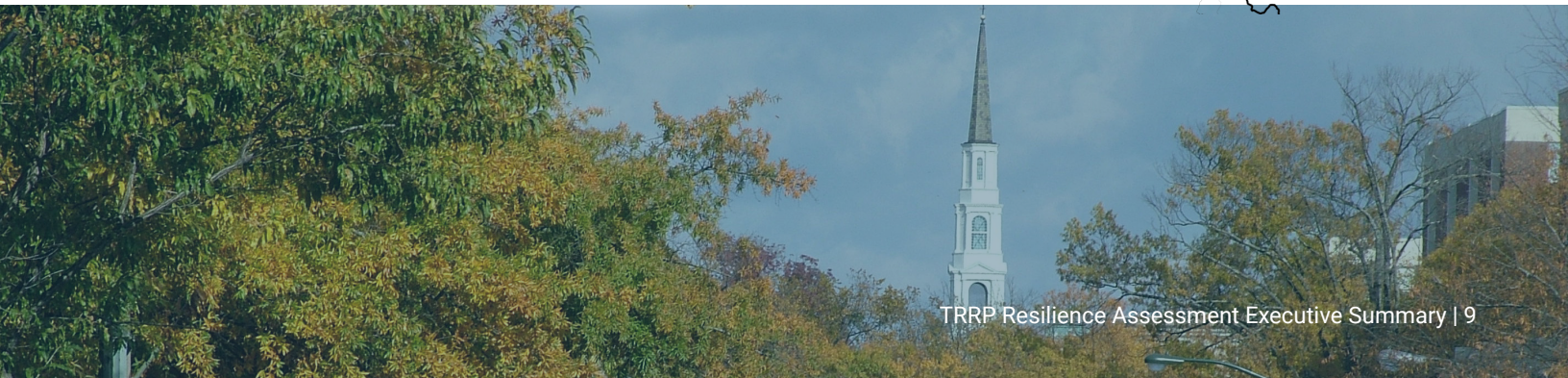
Total Upstream Developed Land Cover | 35%

The threat of minor flooding arises from extreme or heavy precipitation that results in runoff and erosion.

EAST RALEIGH/KNIGHTDALE

Total Upstream Area | 479,926 acres

Total Upstream Developed Land Cover | 7%



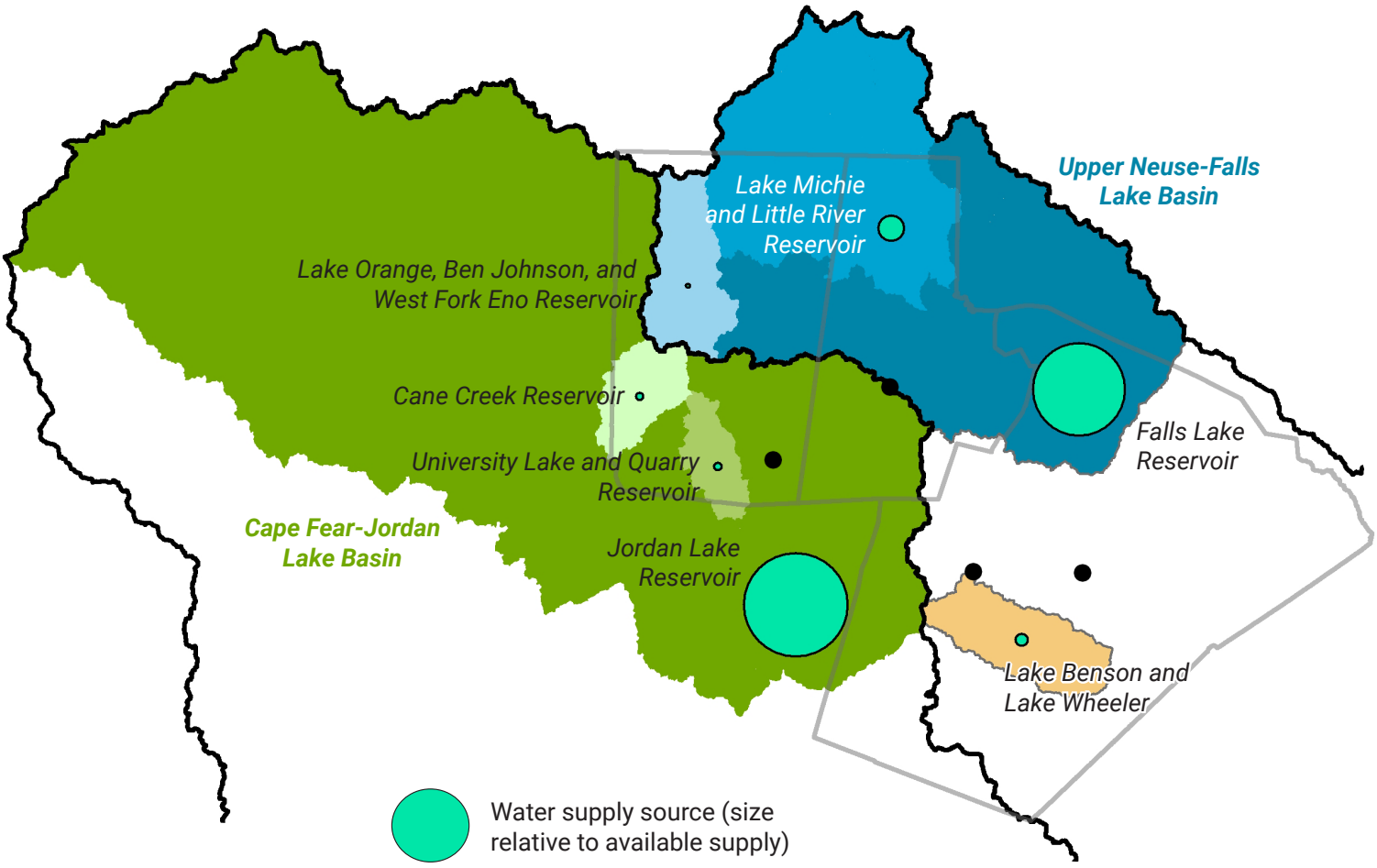
Water Supply and Water Shortage

Non-climate factors—such as increased demand and aging infrastructure—compound climate-related issues, threatening the region's supply of clean, safe water and reliable wastewater services.

As climate and non-climate stressors change, optimizing the use of supplies from different sources while meeting water-quality standards may present new challenges, even for veteran water managers.

The region has a strong history of partnership on water resource issues, such as the Jordan Lake Partnership and other continued efforts. The infrastructure investments and water sharing agreements established through these partnerships will help the region cope with water shortages; continuing the partnerships will help the region become adaptive to meeting water supply needs in the future.

> Changes in the frequency and severity of drought can and will affect the quality and quantity of regional water supplies.

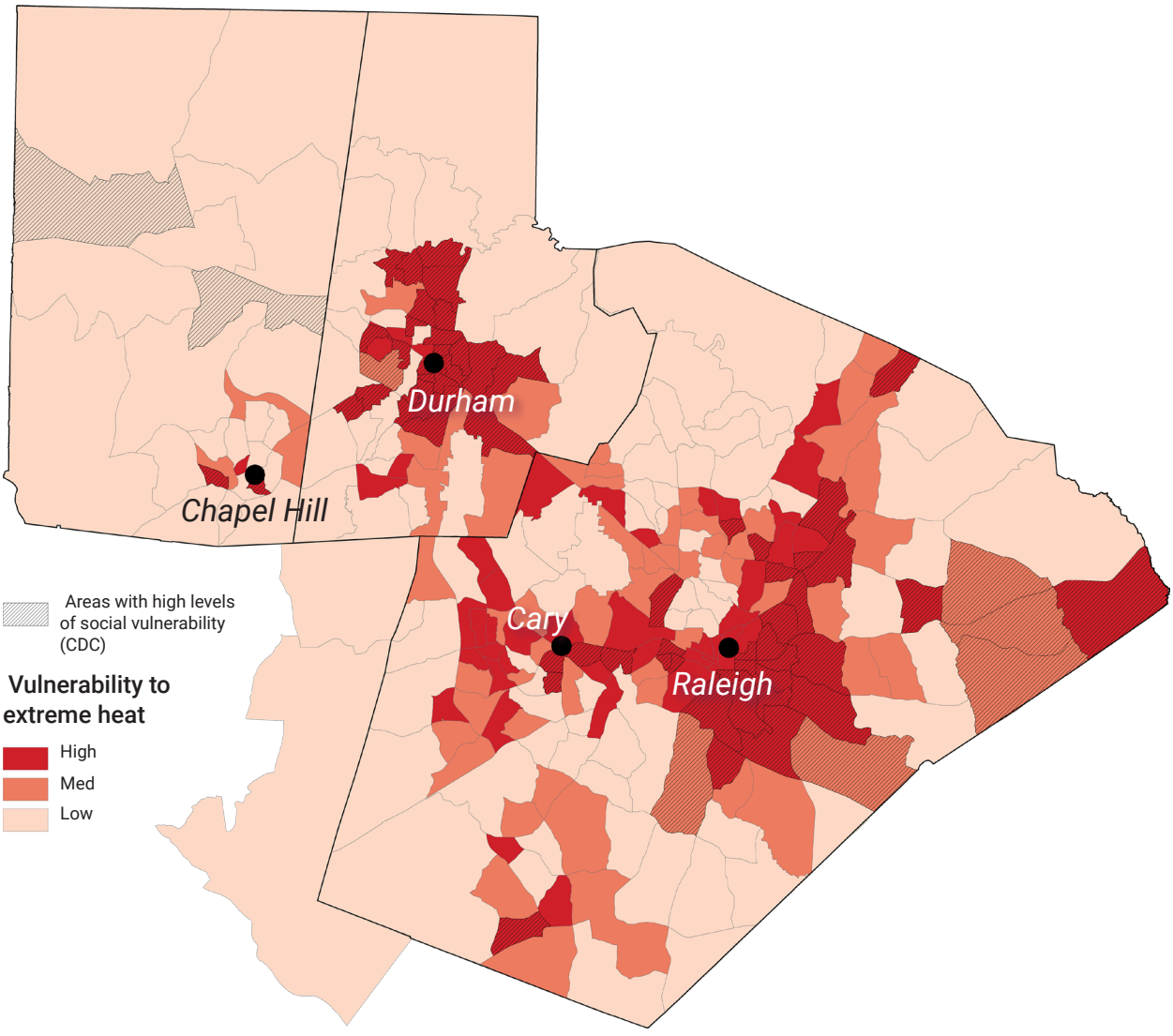


Residents and Extreme Heat

Extreme heat can cause negative health impacts, which causes concern for the region's socially vulnerable populations.

The Triangle region has a history of extreme heat events, and their number is expected to increase. For example, from 2005 to 2012 the City of Raleigh experienced a higher than normal number of days over 92°F, particularly in 2010—with 48, the most on record.

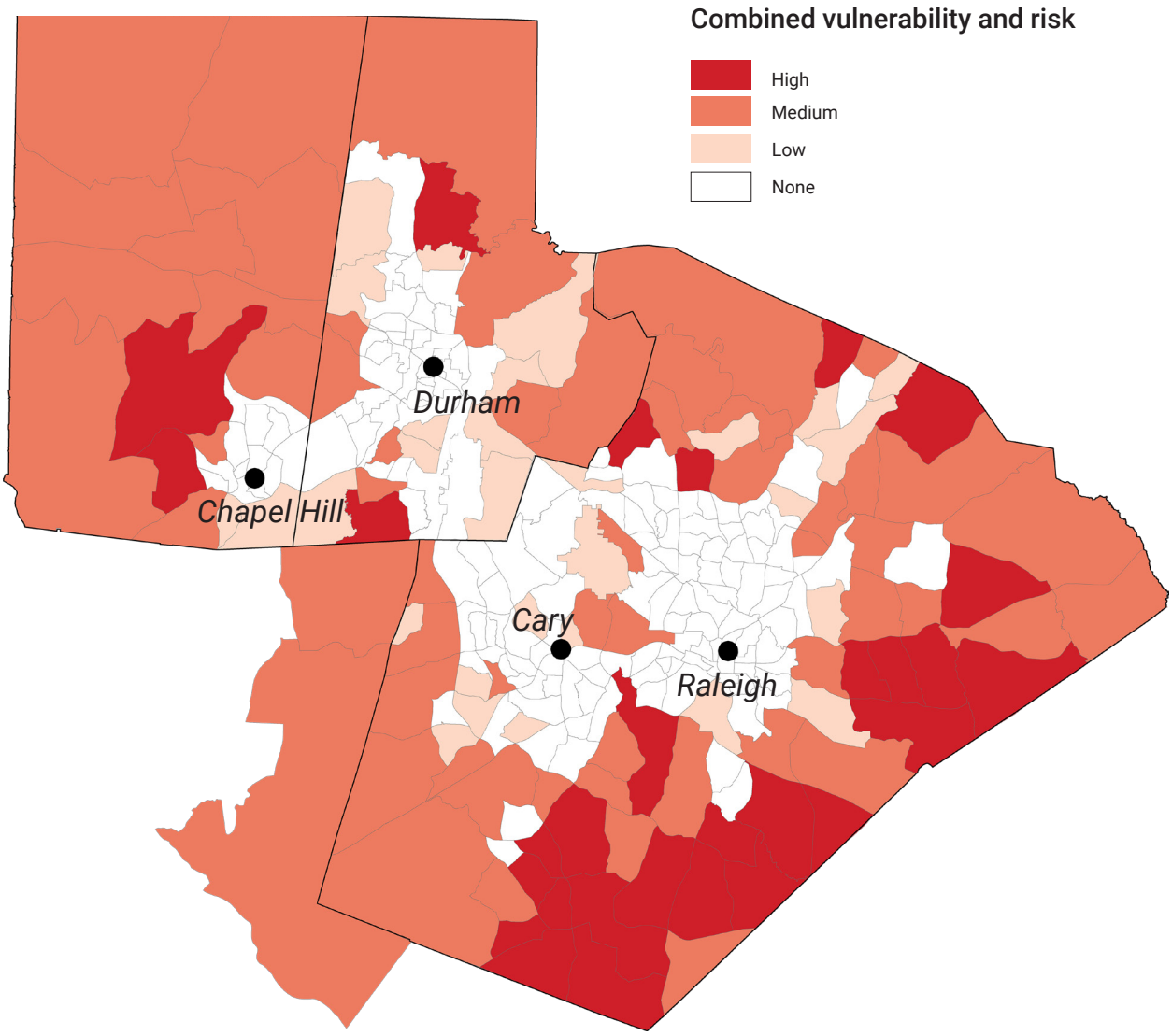
The assessment considers socially vulnerable populations (using the CDC's Social Vulnerability Index, or SVI) who live in proximity to developed land cover. The SVI includes families living below the poverty line, households with disabilities and members who are age 65 and older, and households who have limited English language proficiency, among other metrics. Socially vulnerable populations in areas with a high percentage of developed land cover and low tree canopy are most vulnerable to negative health effects related to heat stress and due to the urban heat island effect.



Residential Properties and Wildfire

Increasing temperatures and drought conditions will contribute to increased wildfire frequency, intensity, and size. In the Triangle region, most of the properties with relatively high wildfire vulnerability and risk are residential.

Over 23,000 residential properties are located in the wildland-urban interface and are outside an eight-minute drive time from their local fire station.



This is not an exhaustive list of the asset-threat pairs analyzed in the assessment. To learn more about impacts to other key assets—such as transportation networks, energy supplies, and food infrastructure—please refer to the Technical Report.

Strategies to Build Resilience

The assessment is a snapshot in time identifying regional assets that may face increasing vulnerability and risk. If we do nothing, we can expect a future that includes dealing with the consequences of that vulnerability and risk.

As a part of this effort, the partners developed options and strategies that may help guide the region as it responds to both climate threats and non-climate stressors, provide an improved quality of life, and support each community's vitality and livability.

These strategies address the most vulnerable and at-risk assets and the key threats and stressors. Each strategy also addresses vulnerability and risk by either (1) reducing exposure—removing assets from harm's way, (2) increasing adaptive capacity—increasing the asset's ability to cope with impacts, or (3) supporting response and recovery.

They are regional strategies and illustrate the best use of joint planning, action, and communication efforts.

The strategies were evaluated using criteria developed based on lessons learned from other jurisdictions, both here in the U.S. and across the globe, and on principles considered by the TRRP partners to be important to the Triangle region.

EVALUATION CRITERIA

what	Ability to increase regional resilience	Provides co-benefits	Socially responsible	Ability to implement
why	To ensure that vulnerability and risks are addressed at a regional scale	To ensure that options and strategies address multiple problems	To promote fairness, equity, and social responsibility	To determine the feasibility for implementation

The resilience options and strategies will prepare the Triangle region for our changing realities.

The following potential strategies are organized into themes that represent topics of key concern for the region, based on the assessment. Some of these strategies also build on a broad set of efforts that are already underway.

PRIORITIZED OPTIONS AND STRATEGIES

» Building greater community capacity

- Develop a regional outreach and communication plan for all threats
- Create a communication plan for socially vulnerable populations
- Determine the use of distributed energy resources to provide backup power to critical facilities
- Transition public fleets to be less dependent on fossil fuels
- Establish regional coordination of fire station locations to reduce response time in key areas

» Addressing flooding

- Establish regional evaluation of flooding potential
- Conduct regional mapping assessment of stormwater conveyances
- Implement a stream monitoring system that alerts emergency management about rising water levels
- Create and implement green stormwater infrastructure programs and fee credit programs for stormwater retention
- Create green infrastructure incentives and/or policies for redevelopment and new development
- Develop cross-boundary watershed solutions through comprehensive regional collaboration

» Addressing extreme heat

- Establish regional “resilience centers” in partnership with faith-based and other community organizations
- Establish design standards to reduce heat absorption from roofs
- Increase the regional tree canopy coverage by implementing urban forestry programs

» Addressing water shortage

- Utilize regional water supply planning for long-term demands
- Enhance capacity of regional water system interconnects

Going forward, the TRRP will continue to assess the impacts of climate and non-climate stressors, explore regional collaborative approaches to address these impacts, and identify and supplement local actions.

Taking Action

How do we use the assessment to plan for action and build resilience?

The assessment identifies potential options and strategies that may be approached at the regional scale to enhance resilience and provides the basis to inform more detailed local plans and investments. These strategies represent a starting point for planning and implementing local actions to increase resilience.

The assessment itself can be used and integrated into each community's existing hazard mitigation, comprehensive, and emergency management plans to further current local actions.

Individual cities, towns, and counties can also use the assessment to generate and prioritize their own options and strategies to increase resilience at the local level, incorporating the input of all interested stakeholders.

TRIANGLE J COUNCIL OF GOVERNMENTS

UNC Asheville | NEMAC National Environmental Modeling & Analysis Center

Town of Cary

Orange County North Carolina

Raleigh

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Higgins Spooner, "Downtown Raleigh NC at night" (2018)

p. 9: Town of Chapel Hill

p. 13: Brandon Griggs (2016)

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