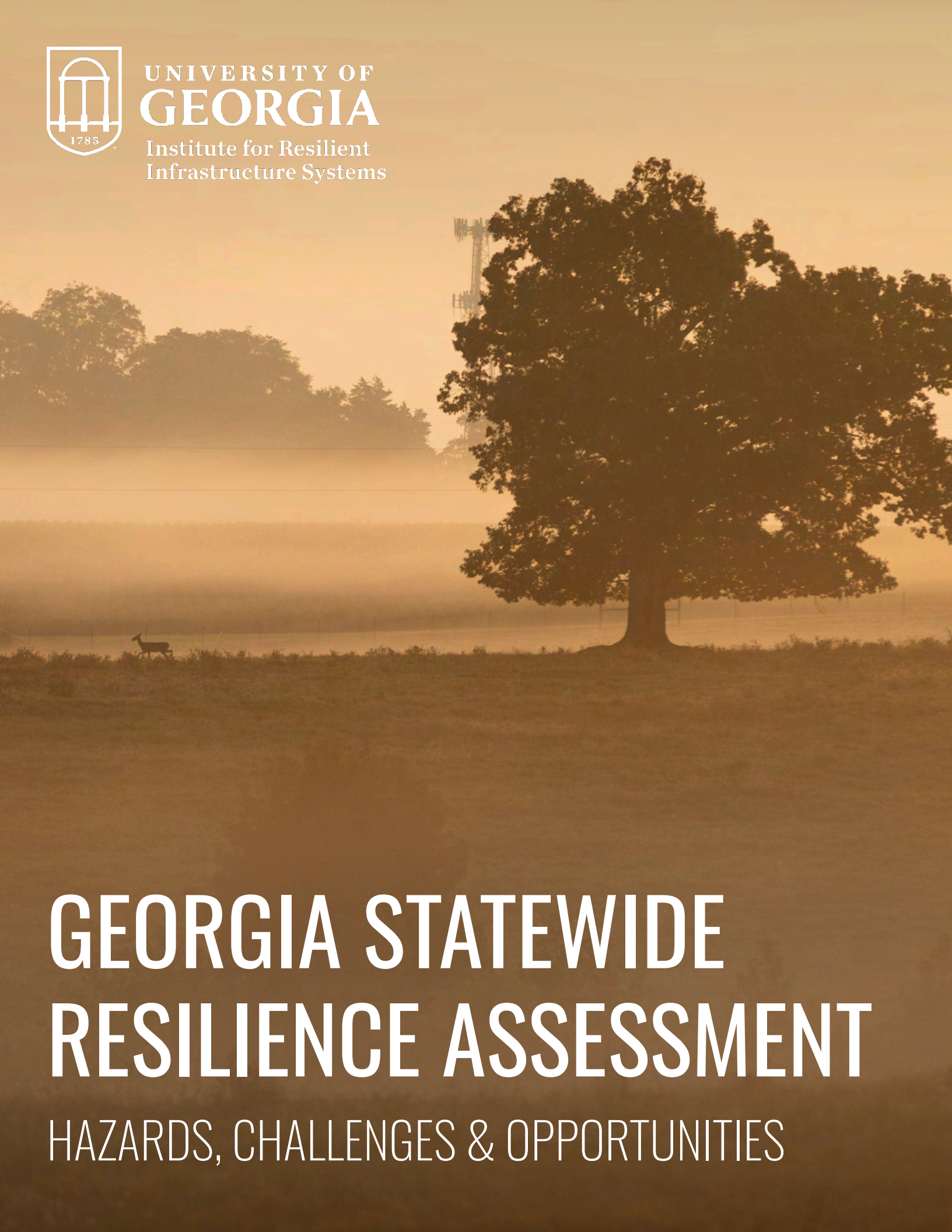

UNIVERSITY OF GEORGIA
Institute for Resilient Infrastructure Systems

GEORGIA STATEWIDE RESILIENCE ASSESSMENT

HAZARDS, CHALLENGES & OPPORTUNITIES

CONTENTS

University of Georgia Institute for Resilient Infrastructure Systems, 2025

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EXECUTIVE SUMMARY

Georgia's cities, towns and rural communities are under increasing strain from compounding hazards, aging infrastructure and service interruptions. Flooding remains Georgia's most persistent hazard, alongside drought, extreme temperatures, high winds, wildfires and other storm events (GEMA/HS, 2024). Since 2000, Georgia has experienced over 100 severe storm events resulting in tens of billions of dollars in economic cost. Georgia has already experienced more major disasters in the last five years than in each of the two preceding decades (NCEI, 2025).

In the fall of 2024, while the resilience assessment described in this report was underway, Hurricane Helene struck, causing more than $79 billion in damages across the Southeast (OCM, 2025). The storm severely impacted homes, farmland and power systems, leaving over one million Georgians without electricity (Georgia Power, 2024b).

And it narrowly missed further damage. A representative from a Georgia utility company noted that had Helene maintained its northern track, Atlanta's electric grid could have remained offline for up to three weeks, potentially triggering cascading failures across the eastern seaboard's infrastructure systems. This scenario could have also caused even more widespread supply chain disruptions and placed overwhelming strain on emergency response systems. Helene's timing and scale underscored an urgent truth: resilience planning and programming must be proactive and coordinated across the state.

The impacts of these hazards are not abstract, and they are not limited to isolated events like hurricanes. Communities across Georgia experience the consequences on a daily basis. Power outages, drought-stricken crops, failing culverts and overwhelmed stormwater systems are becoming increasingly common (Fant et al., 2020; Khan et al., 2022; Apurv & Cai, 2021). Infrastructure systems originally built for smaller populations and less extreme conditions are now under constant pressure.

These challenges often fall outside of declared and televised emergencies, yet they affect public services, strain local budgets and stretch limited staff. In Metro Atlanta, the stormwater infrastructure gap alone is estimated at $620 million per year, reflecting just one area where risks continue to accumulate (ASCE GA, 2025).

This report, developed by the Institute for Resilient Infrastructure Systems at the University of Georgia (UGA IRIS), presents the findings of a year-long statewide assessment reflecting the perspectives of over 130 individuals from utilities, local governments, emergency response agencies, watershed boards, economic development authorities and regional commissions. The research team gathered perspectives using in-person and virtual regional and statewide convenings, live audience polling through Mentimeter, roundtables and other small group discussions.

This process identified regional and statewide hazards, resilience planning challenges and opportunities, and scalable resilience exemplars. Summaries of these findings and resulting recommendations can be found in the chapters that follow. This report does not aim to provide an exhaustive accounting of the hazards within Georgia, but instead to synthesize a selection of lived experiences from individuals in and around Georgia, with the existing body of resilience and infrastructure data and literature.

Across Georgia, local governments face limited capacity and funding, and outdated policies that make proactive resilience planning difficult. Many recognize the compounding risks but lack the staff, technical capacity and resources to navigate complex federal grant requirements, meet matching fund thresholds or sustain long-term strategies. Existing regional frameworks often lack sufficient authority or coordination to support implementation.

At the same time, decades of development in flood-prone areas and aging infrastructure have increased the exposure of homes, businesses and public assets. Conventional systems like culverts, dams and seawalls often remain in place for generations, locking communities into costly infrastructure that places them at risk (Thacker, 2019; Hosseinzadeh, 2022). Meanwhile, more innovative infrastructure solutions, such as natural infrastructure, are less likely to be prioritized due to undervaluation of benefits, restrictive governance and lack of public education (Nelson, 2020).

Public education and communication about resilience are also limited, which can contribute to an unwillingness to invest in pre-disaster resilience solutions and safeguards. Gaps in targeted information about action steps the public should take during a disaster contribute to safety risks, misinformation and injuries from untrained volunteer responses, which creates additional burdens for emergency responders.

While communities face significant challenges in implementing resilience, Georgia can build on successful partnerships, programs and local leadership already in place across the state. A growing number of local leaders across Georgia are developing innovative approaches to stormwater management, natural infrastructure and regional coordination that can inform statewide solutions.

The opportunity ahead lies not in defining the vision but in aligning existing efforts, expanding technical support and building the coordination needed to apply these solutions across Georgia's diverse regions. These cases demonstrate tested, transferable approaches that can help shape a more coordinated statewide resilience strategy.

In addition to scaling up these existing efforts, there are also practical, low-cost and/or low-barrier actions that could strengthen resilience quickly at both the local and state level. For example, by making already-existing rainfall data and updated flood hazard maps widely accessible, communities can more clearly assess flood risks. This report organizes these opportunities into five focus areas:

- Statewide coordination, planning and funding strategies
- Building local capacity and scaling up success
- Modernized and resilient infrastructure
- Multi-benefit hybrid and natural infrastructure projects
- Resilient Georgians for a resilient state

This effort has revealed two strong consensus statements heard across the State:

First, local and regional efforts provide a strong foundation for accelerating and expanding innovative resilience planning and programs.

Second, cross-agency and cross-jurisdiction coordination can build efficient, cost-effective and durable resilience programs–helping to build on and connect existing resilience initiatives across Georgia and overcome inefficiencies and gaps in protection.

This report highlights six local and regional resilience-planning exemplars across the state:

1. The Camden County Resiliency Implementation Workplan,
2. The Roadmap to Resilience for Chatham County plan,
3. The Albany and Dougherty County Resiliency Playbook,
4. The Tybee Island Natural Infrastructure Master Plan,
5. The Mapping Flood Vulnerability in the Savannah Metro Area project, and
6. The Atlanta Regional Commission Regional Resilience Plan.

Each demonstrates approaches that can be scaled and connected to form a more integrated statewide strategy.

The core elements for a statewide resilience initiative are already in place through local leadership, tested solutions and emerging partnerships. As communities navigate the growing pressures of extreme weather, sea level rise and aging infrastructure, several have developed resilience plans that offer clear, actionable roadmaps.

Based on these findings and perspectives, this report closes with key recommendations for a resilient Georgia that would address these compounding hazards and gaps, and seize emerging opportunities that span the full cycle of resilience from preparing to adapting to changing conditions. These recommendations offer a statewide roadmap organized around four integrated strategies:

Georgia must build state-level capacity through a statewide interagency resilience hub, regional technical transfer networks and refined funding policies that improve data access, coordination and support for local governments.

A multi-agency network coalition should be established to align the work of jurisdictions and agencies, promote cross-sector coordination, formalize partnerships and provide direct technical assistance to local communities.

Georgia should demonstrate, communicate and accelerate the economic benefits of resilience planning and infrastructure investments by developing statewide messaging, targeted incentives and cost-benefit analyses that demonstrate long-term savings, protect critical industries and encourage private investment.

Georgia must scale regional resilience planning frameworks through modernized asset management for both natural and conventional infrastructure, updated engineering design standards and the creation of standardized local resilience plan templates and benchmarks that streamline planning, reduce capacity burdens and promote consistent, long-term resilience across the state.

Georgia is made up of not only a diverse geographical landscape, but of individuals and communities with a variety of perspectives, challenges and assets. What unites the state is the desire for a thriving livelihood, where residents can safely work and live—prepared to tackle life's challenges. Resilience planning is a key component of creating and sustaining a high quality of life for Georgia's residents. Through the guidance outlined in this document, key stakeholders can navigate the steps needed to better integrate resilience planning into the state's priorities, in turn improving the lives of the people and habitats that constitute the very fabric of this great state.

UNIVERSITY OF GEORGIA
Institute for Resilient Infrastructure Systems

Dear Colleagues,

Over the past year, our team of researchers at the University of Georgia's Institute for Resilience Infrastructure Systems (IRIS) have traveled to all regions of Georgia to learn from people and communities on the front lines of building resilience. We heard from utility managers, planners, farmers, energy providers, emergency managers, conservationists, military personnel, community leaders and many others as they shared their successes, struggles and hopes for building resilience in the state of Georgia. This report describes many of their remarkable efforts and identifies challenges and opportunities for expanding and accelerating resilience actions in our state.

Two particularly strong consensus statements emerged across the state. First, there are already many local and regional efforts underway that provide a strong foundation for advancing and expanding resilience planning and programs. Second, existing resilience initiatives across Georgia are largely isolated and uncoordinated. This fragmentation of effort and lack of communication and coordination can slow success and create unnecessary inefficiencies and gaps in protection for people and communities. Participants consistently told us that they are convinced that improved coordination across agencies, sectors and jurisdictions is essential for building effective resilience programs. Many of their statements are woven throughout the report. I know you will be impressed by the breadth and depth of their insights, as well as their motivation to work together in partnership. There is, without a doubt, a sweeping desire for greater coordination and leadership within resilience across the state. And there is a strong consensus that Georgia is poised for success—the time is right to build a more resilient state.

The UGA IRIS team is very grateful to the large number of individuals and organizations that contributed to this effort. It has been an honor to host and participate in these conversations. We are also very grateful to Kristiane Huber, Mathew Sanders and Velma Smith with The Pew Charitable Trusts for their valuable insights and support throughout this journey.

Sincerely,

Brian Bledsoe

Brian P. Bledsoe, Ph.D., P.E. F.ASCE
UGA Athletic Association Distinguished Professor in Resilient Infrastructure
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LIST OF FIGURES

INTRODUCTION

From the rolling mountains and orchards of North Georgia to the lowland farms and coastlines of South Georgia, communities across the state face a wide range of natural hazards that threaten lives, livelihoods, and critical infrastructure.

While storms and flooding are widely recognized as the most prevalent risks statewide (GEMA/HS, 2024), each region of Georgia also contends with unique challenges from drought, extreme temperatures, high winds, wildfires and other compounding hazards and threats. Compounding hazards are defined by the American Society of Civil Engineers (ASCE) as the occurrence of more than one hazard and the interaction among them (ASCE, 2021b), for example, the coupled effects of extreme heat and drought on wildfire risk.

In the face of compound hazards, communities across Georgia are navigating the combined pressures of aging infrastructure, rapid population growth and shifting service demands (GEMA/HS, 2024), highlighting the need for a deepened understanding and adoption of resilience planning and programs. Resilience is defined as "the ability to prepare and plan for, absorb, recover from and more successfully adapt to adverse events" (NASEM, 2012).

Resilience planning has become increasingly challenging, especially in places where limited staffing and technical expertise, burdensome grant processes, uncertain funding and unclear returns on investment make it difficult to implement long-term improvements. In many communities, it remains difficult to prioritize resilience efforts amid competing economic development goals, regulatory hurdles and a lack of public awareness.

Despite these challenges, resilience efforts are taking shape both within Georgia and across the United States. Twelve states have established an agency for resilience planning or coordination efforts, and eleven states have a designated chief resilience officer. Eighteen states have established guidelines for a statewide resilience plan, and thirteen states have designed financial or technical assistance programs to help local jurisdictions plan for resilience (APA, 2023).

While states across the country have taken varying approaches to institutionalizing resilience, this report focuses on the state of Georgia, aiming to understand what resilience looks like across sectors and regions specific to the state's unique needs.

Methods

Commissioned by The Pew Charitable Trusts and developed by the Institute for Resilient Infrastructure Systems (IRIS) at the University of Georgia, this effort presents the findings of a year-long statewide assessment. Over the past year, IRIS convened five roundtables, each bringing together 15 to 20 local and regional leaders. The roundtables culminated in a statewide convening with over 60 members and featured a panel of experts who have successfully implemented resilience programs in their region and keynotes from resilience leaders from the South Carolina Office of Resilience (SCOR) and the Maryland Department of Emergency Management (MDEM).

Researchers supplemented the regional roundtables and convenings with targeted in-person and virtual meetings. In total, this work reflects the perspectives of over 130 key stakeholders statewide, with representatives from utility companies, local governments, emergency response agencies, watershed boards, economic development authorities, regional commissions, military installations, private sectors and non-profit organizations.

Participants shared expertise across sectors, including regional and city planning, energy, transportation, agriculture, water management, forestry and natural resources. An overview of the timeline and geographic areas covered is depicted in *Figure 1*.

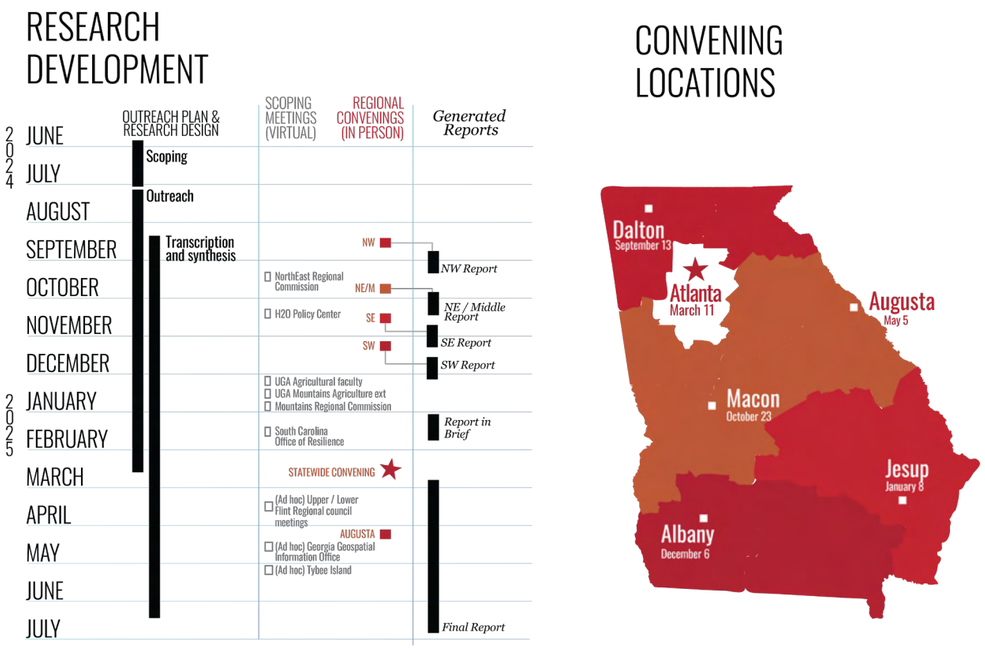


Figure 1. *Research development process including convenings and meetings held to represent regions across the state, and the timeline.*

To structure this assessment, the state outside the Metro Atlanta region was divided into five subregions based on a synthesis of regional commission and water planning council boundaries, economic and risk context, and geographical and ecological similarity. Regional partners were engaged through a mix of existing relationships and new outreach.

The IRIS team traveled across five subregions of the state (North/Northwest, Northeast, Middle, Southeast and Southwest Georgia) to understand regional gaps, challenges and ongoing efforts. These sessions provided community and region-level insights and perspectives that formed the basis of our findings and revealed opportunities to scale up promising initiatives.

Each regional convening followed a consistent interactive four-hour format: a statewide hazard overview with tailored regional implications, live audience polling using Mentimeter and facilitated roundtable discussions. Convening participants were prompted to explore and share perceptions of resilience, connections to their day-to-day work, gaps in local capacity and stories of success. This approach applied the principles of policy co-construction, integrating technical analysis with local expertise to develop grounded, actionable resilience strategies.

The meetings were recorded, transcribed and summarized, and then analyzed using inductive content. This report features many direct quotations from participants.

To protect anonymity while preserving regional specificity, quotes and findings within the document are deidentified and only labeled by location. The six in-person convenings (five subregional and one statewide) appear as follows:

1. Northeast and Middle Georgia (NE/MGA)
2. North Georgia (NGA)
3. Southeast Georgia (SEGA)
4. Southwest Georgia (SWGA)
5. Augusta, Georgia (Augusta) (A dedicated Augusta convening was held due to the scale and specificity of impacts following Hurricane Helene.)
6. Statewide Convening (Statewide)

While an in-person session was initially planned for the Mountains region, Helene's impact necessitated an alternative approach that included three virtual discussions with stakeholders, including regional planners, UGA Cooperative Extension representatives and UGA faculty working directly with agricultural producers. References to these sessions are noted in the report as (Mountains Scoping Meetings).

A few additional virtual ad hoc meetings with more than 10 resilience stakeholders were also held to test emerging ideas and identify knowledge gaps. References to these sessions are noted in the report as (Ad hoc meetings).

About This Report

While each region faces distinct challenges, a common theme emerged: communities across Georgia are increasingly concerned about the growing prevalence, frequency and severity of hazards.

This concern was brought into sharp focus in the fall of 2024, when Hurricane Helene swept across the state, striking while this assessment was already underway. The storm killed at least 250 people, including 37 Georgia residents, left more than one million residents without power, damaged hundreds of homes and buildings and caused an estimated $6.46 billion in agricultural and forestry losses across the entire state (Hagen et al., 2025; Kolich, 2024). Helene now stands as the most destructive storm in Georgia Power's 140-year history (Georgia Power, 2024b) and was a defining moment that shaped conversations in nearly every regional convening.

These conversations made clear that while no two regions are alike, Georgians across the state are grappling with shared vulnerabilities and a desire for clear, coordinated action at the local, regional and statewide levels.

This report aims to reflect those perspectives and insights by offering a practical foundation for advancing resilience planning and strengthening Georgia's capacity to absorb, recover from and adapt to hazards. It identifies scalable solutions that could be applied regionally and at the statewide level, equipping communities to meet an uncertain future with greater preparedness and confidence.

The next section of this report describes the prominent hazards in the state of Georgia and how their impacts vary across regions. The challenges and opportunities sections outline the core obstacles that communities face, alongside local solutions that offer pathways for broader application. The exemplars section highlights innovative resilience efforts already underway at the regional level within Georgia. Finally, the recommendations section draws insights from across all the previous sections to present a statewide vision for advancing resilience across Georgia.

HAZARDS AND THEIR IMPACTS IN THE STATE OF GEORGIA

While each community faces challenges shaped by its unique geography, demographics and economic context, common themes emerged across the regional convenings regarding the hazards Georgians face.

Participants consistently identified storms, flooding, drought, extreme temperatures, wind, wildfire and combinations thereof, or compound hazards, as primary risks that threaten public safety, infrastructure and community well-being. Compound hazards are overlapping and interconnected hazards. Examples include flooding from the compounding effects of heavy rain, high winds and storm surge on top of sea level rise, or the interplay between drought, extreme heat and wildfire.

The following section provides an overview of each hazard type, highlighting both the physical impacts and the underlying factors that influence local vulnerability and the capacity to respond.

Hazards are processes or occurrences with the potential to cause damage to health, lives, infrastructure, property, livelihoods, service provision, ecosystems and resources (NASEM, 2024).

Defining the hazards discussed in this report:

• ***Flooding:*** As defined by the Federal Emergency Management Agency (FEMA), flooding is a general and temporary condition of partial or complete inundation of two or more acres of normally dry land area. Causes of flooding vary by region. Coastal areas often face a combination of storm surges and tidal and riverine flooding, while inland areas may experience flooding due to intense rainfall and poor drainage infrastructure.

• ***Drought:*** FEMA defines drought as a deficiency of precipitation over an extended period of time resulting in a water shortage. Droughts are determined by current levels of precipitation and evapotranspiration (the combined processes that move water from the Earth's surface into the atmosphere in a region). Droughts can vary from short-term (less than 6 months) to much longer, depending on the hydrology, vegetation, climate and ecology of the region (NDMS, 2025).

• ***Extreme temperatures:*** Extreme temperatures range in definition based on location, but both higher-than-normal heat and periods below freezing (32°F/0°C) can be incredibly dangerous to human health. Extreme heat waves and cold snaps tend to vary significantly by region and local geography (Ingram et al., 2013).

• ***Wind hazards:*** FEMA defines strong wind as damaging winds that are classified as exceeding 58 mph. Strong winds can be associated with severe weather or can occur outside of storm events. They can lead to property damage, power outages and broader infrastructure impacts.

• ***Wildfire:*** A wildfire is an unplanned fire burning in natural or wildland areas such as forests, shrub lands, grasslands, or prairies. Georgia experiences thousands of wildfires annually, with an average area of over seven acres. Most of these ignite due to debris burning, as well as weather conditions and lack of preemptive fuel reduction (Georgia Forestry Commission, 2025b).

• ***Compound risks:*** Compound risks are the occurrence of more than one hazard and the interaction among them as independent, simultaneous, coupled, successive, cascading, or compounding, that threaten a specific community or geographic region (ASCE, 2021b). Compound risks often increase the severity of impacts compared to each hazard alone. For example, a combination of drought and extreme heat may cause an increased risk of wildfire.

The hazards discussed in this report do not constitute all threats to Georgia communities. Additional hazards such as other forms of severe weather, disease outbreaks, cybersecurity and economic threats also pose compounding challenges.

FEMA/DHS

Flooding

Flooding is recognized as the most widespread and persistent hazard statewide, but its specific impacts vary by geography (GEMA/HS, 2024).

Coastal

In Southeast Georgia, coastal and low-lying areas face multiple flood risks, including storm surge, tidal flooding and riverine flooding during heavy rainfall events. These risks are further intensified by rising sea levels, outdated flood hazard maps and continued development in flood-prone areas.

Coastal community officials are increasingly grappling with how to design and build infrastructure capable of withstanding these growing flood hazards. As one convening member noted, "Our department is going to be leading that charge and ensuring that we [...] build better before, [so] that we have all of our residential areas and our business infrastructure able to withstand storm surge–being at sea level in a peninsula" (SEGA).

In many coastal communities, flooding increasingly threatens daily life, even outside of storm events. So-called "sunny-day flooding," where high tides alone cause inundation, creates disruptions for transportation and access to essential services and economic activity, especially for vulnerable small businesses.

One convening participant described, "Whether we are building up street paving and drainage in neighborhoods to be able to handle [...] flooding, or whether we're finding funds for generators for our municipalities for these times, it's interesting to stop and think about how everything that we do touches [everything else]" (SEGA).

Inland

Inland communities across Georgia are facing similar challenges as flood risks increase. Participants from every region described more frequent inland flooding driven by increasingly intense rainfall that exceeds the capacity of undersized drainage infrastructure that was designed for conditions that no longer exist.

In Southwest Georgia, this is resulting in recurrent inundation that overloads local stormwater systems. In Northwest and Northeast Georgia, participants cited the combined effects of rapid urbanization and steep terrain, which contribute to flash flooding that regularly impacts roads, homes and businesses.

A study of the 2009 flood in Atlanta showed that even impervious surfaces that were located geographically far from streams increased runoff and the risk of flooding (Debbage and Shepherd, 2019). Across all regions, aging stormwater infrastructure and continued development pressure are compounding these risks and further increasing vulnerability to flood-related impacts (Nixon et al., 2024; Georgescu et al., 2021; Aon, 2023; Debbage and Shepherd, 2018).

Flood risk is also unevenly distributed across communities, with patterns of exposure closely linked to underlying social vulnerability. Populations consisting of individuals with lower incomes, limited education, disabilities, single-parent households and racial or ethnic minorities often face higher exposure due to a greater likelihood of residing in flood-prone areas and having reduced access to adaptive resources (Bigi et al., 2021; Rufat et al., 2015).

A recent study of the cities of Atlanta and Charlotte found that vulnerable individuals were 14 to 42% more likely to live in an area at risk of flooding (Debbage, 2019). Another study examined patterns in flood inequity across multiple recurrence intervals (a 5-year, 10-year, 20-year, 50-year and 100-year flood) in the Brooklyn Creek watershed in Athens, GA, a highly developed basin with elevated runoff and frequent flooding (Selsor et al., 2023) (*Figure 2*). The study found that low-income, Hispanic and African American populations were 2.3 times more exposed to flooding. Disparities in flood exposure were most pronounced at the 10-year flood interval, suggesting that inequities may be greatest during more frequent, lower-intensity flood events (Selsor et al., 2023).

Improving access to updated flood data and stormwater infrastructure in under-resourced areas can take a step toward addressing long-standing exposure disparities while increasing statewide resilience.

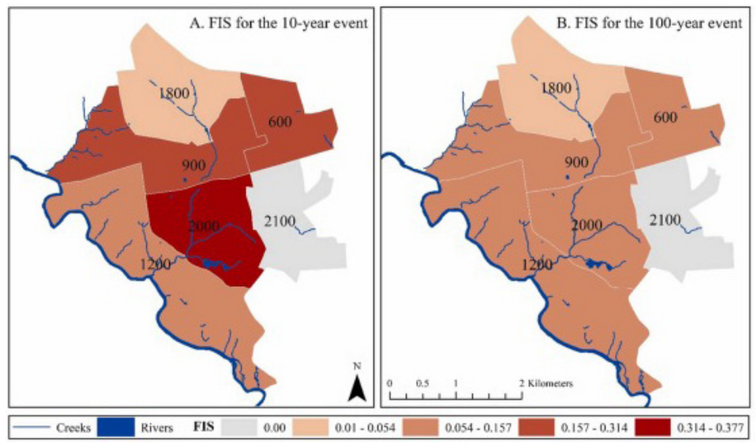


Figure 2. *Two maps showing flood inequity scores (FIS), comparing a 10-year-flood (left) with a 100-year-flood (Selsor et al., 2023).*

Intensified Rainfall

Rainfall events across Georgia have intensified over time, increasing in both the volume of stormwater and the speed at which it falls in a more developed landscape, therefore exacerbating the risk of flooding (Crimmins et al., 2023).

As one convening participant noted, “I don’t think we have a flooding problem at all. I think we have a time and space problem.” In other words, stormwater from intense rainfall events requires undeveloped space for spreading out and storing runoff over enough time for it to soak in and gradually drain to creeks and rivers (NGA).

The combination of prolonged drought and intensified rainfall further complicates infiltration capacity. Extended dry periods harden soil surfaces, particularly in clay- and rock-dominated areas such as North Georgia and the Piedmont, reducing the ability of heavy rain and stormwater to absorb into the ground. This leads to greater volumes of overland flow and increased localized flooding (NGA).

Drought

Georgia has a well-documented history of drought, with the earliest recorded severe drought lasting from 1903 to 1905 (USGS, 2000). Drought prevalence has increased over time, with implications for water supply, agriculture and/or food security (Apurv & Cai, 2021), as well as wildfire risk (GFC, 2025c) and data center demand.

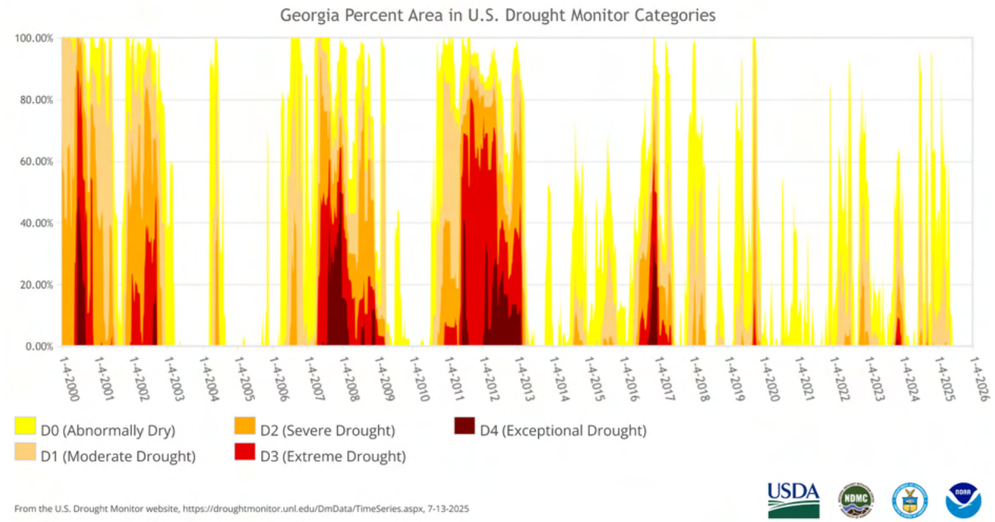


Figure 3. *Impact of the 2016-2019 drought on Georgia (NDMC, 2025).*

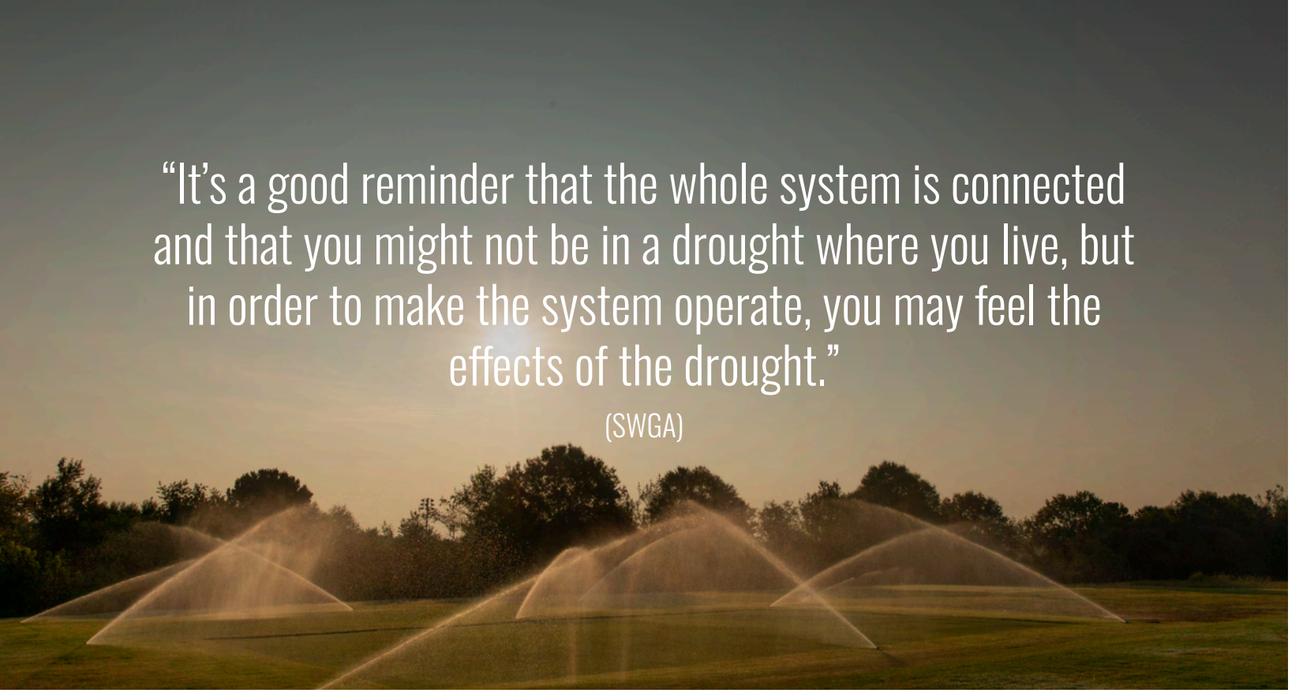
As *Figure 3* illustrates, Georgia ranked in the 94th percentile for drought risk in the United States. Although few regional participants identified drought as their highest immediate threat, many emphasized its growing frequency and far-reaching impacts, particularly following several severe drought periods in recent decades (Pederson et al., 2012).

In Southwest and Southeast Georgia, extended droughts disrupt agricultural production, strain rural economies and increase dependence on groundwater and river-based irrigation systems. Northwest and Northeast Georgia participants expressed concerns about drinking water security, wildfire risk and fragmented regional water management and planning structures that leave some municipalities vulnerable due to reliance on single-source water supplies or shallow wells that dry during prolonged drought conditions.

The most significant threat from drought to all regions is likely the impact on water supply. Participants from Southeast Georgia underscored the vulnerability of rural communities reliant on private wells and limited infrastructure:

> *“If a drought hits hard, rural communities that rely on well water are the first to suffer, but there’s no real backup plan for them.”*
>
> *“Private wells are drying up faster than expected and there’s no statewide monitoring system to track which areas are running out of groundwater.”*
>
> *“There are still people drinking from shallow wells, which dry up seasonally and are vulnerable to contamination.”*

Participants from the Southeast Georgia region also spoke of the threat of compounding hazards on the water supply. As one participant stated, “What happens when we get both heatwaves and droughts at the same time? We’re already seeing rivers drop to dangerously low levels, which affects water supply and energy generation” (SEGA). Climatic assessments have identified an overall trend towards drying and warming observed across the state, but the Southeast coastal region faces some of the most significant impacts (KC et al., 2015).



Stakeholders from multiple regions echoed concerns about a lack of redundancy in water systems: if one major supply runs low, many areas don’t have backup resources. Others in the region noted that the Floridan Aquifer is a highly resilient and productive shared resource across Georgia, Florida and South Carolina, but there is a lack of inter-state coordination planning for long-term drought resilience (SWGA).

This lack of coordination has proven to be especially challenging during droughts; the 2006 to 2009 drought prompted the tri-state “water wars,” which concerned the Apalachicola-Chattahoochee-Flint River Basin and Alabama-Coosa-Tallapoosa River Basin, both of which flow through Georgia and Alabama into Florida. This drought made water scarcity a focus of the public and decision-makers across the state (Pederson et al., 2012).

Members of the Southwest Georgia convening gave an example from the 2006-2009 drought and its impacts on wildfire risk and ability to respond to fires. They recalled how the drought—which mostly impacted Northwest Georgia–did not affect the southwest directly but caused challenges with filling downstream reservoirs used for fire management in the region.

In the Northeast Georgia region, participants mentioned that drought was having unanticipated environmental effects, including reducing the carbon sink benefits of existing tree cover and exacerbating urban heat island effects, which may not be accounted for in hazard-planning models (NEGA).

Several participants spoke of the expansive impacts of drought and how drought in one area of a region can have far-reaching impacts that put the needs of one community at odds with those of another.

Participants highlighted the 2016-2019 drought in Northern Georgia as a notable example. When rainfall eventually returned to portions of the region, the U.S. Army Corps of Engineers (USACE) prioritized refilling Lake Lanier rather than releasing water, leaving communities downstream without relief and prolonging drought conditions despite localized rainfall (SWGA).

Extreme Temperatures

Extreme temperatures are increasingly common occurrences across the state, with expected abnormal highs and lows that deviate from median historic temperatures (Ingram et al., 2013).

Over the next few decades, Southeast and Southwest Georgia are expected to experience longer and more intense heat waves (*Figure 4*), which strain energy grids and water supplies and can cause illness and death among vulnerable populations, including children and older adults.

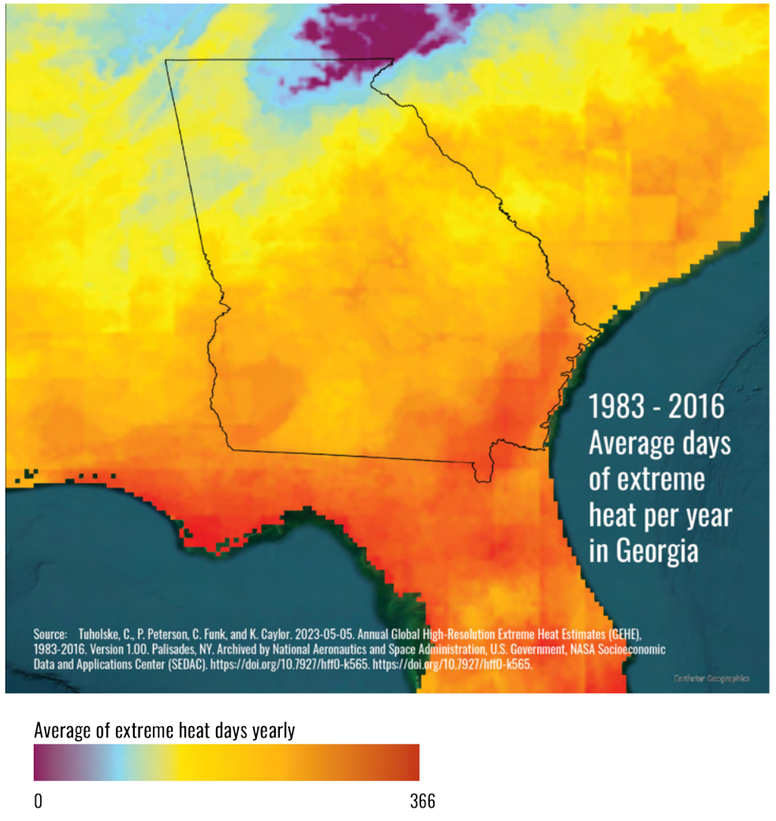


Figure 4. *Extreme heat estimates: Annual global high extreme heat estimates (number of days where the temperature is >30°C) (Tuholske, 2023).*

Unusually cold periods, which are also expected to become increasingly common in North Georgia, can cause road hazards, ground aircraft, damage infrastructure and increase energy demands and costs for households.

Across all regions, energy demand surges during extreme temperatures, sometimes leading to rolling blackouts and system failures in areas with vulnerable infrastructure at both extremes.

Periods of extreme temperature present more than just physical infrastructure issues–they are also a food security challenge. Extreme cold can affect important Georgia crops such as blueberries, peaches and pecans by chilling plants too much in their winter dormancy (Kolich, 2023). Meanwhile, extreme heat significantly decreases crop yields, especially when concurrent with drought or heavy rainfall (Eck et al., 2020).

Heat

Extreme heat threatens critical infrastructure from roadways to HVAC systems, costing the United States economy as much as $100 billion per year (CISA, 2025a). Power lines become less efficient, concrete structures degrade more quickly, and cooling capacities are reduced, causing higher heat stress for both structures and the people within them.

While heat waves are expected to increase in both frequency and length, exposure to heat is exacerbated within urban areas due to the urban heat island effect (UHI). Census data from 2020 indicates a vast majority of Georgia's population resides in or near urban centers—over 7.9 million of the state's total 10.7M population (U.S. Census Bureau, n.d.). A 2011 journal article by Kleerekoper and colleagues titled "How to make a city climate-proof, addressing the urban heat island effect" outlines the causes of the urban heat island phenomenon, as described below (*Figure 5*):

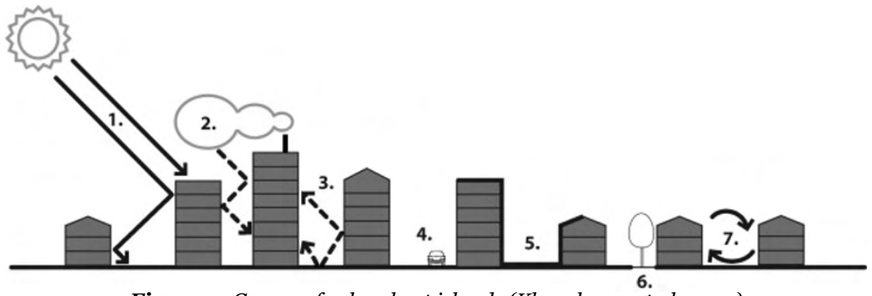


Figure 5. *Causes of urban heat islands (Kleerekoper et al., 2011)*

1. Heat from the sun is absorbed by structures and heatwaves are reflected between structures.

2. Air pollution in the atmosphere absorbs and re-emits radiation to urban areas.

3. Tall buildings block the sky, which prevents heat from escaping from "street canyons."

4. Human-created heat is released through traffic, space heating and industry.

5. Buildings with large thermal mass retain heat for longer—cities have a larger surface area compared to rural areas and can store more heat.

6. Waterproofed surfaces (such as impermeable surfaces without vegetation) decrease evaporation into the atmosphere.

7. Wind is broken by buildings, preventing the transport of heat away from the city.

The UHI highlights the importance of trees and vegetation within urban settings that can provide heat mitigation services. A member of the Southwest Georgia convening recalled examples where residents of one neighborhood were less affected by a heatwave due to the accessibility of trees and the shade they provide.

Access to shade can be particularly difficult for individuals who live in areas with higher crime rates; another participant from the Southwest Georgia convening recalled a heat wave when a neighborhood with a higher crime rate had heat-related fatalities, as residents were forced to stay inside their apartments due to safety concerns with going outside (SWGA)

Extreme heat impacts not only urban populations but rural communities as well. In both urban and rural settings, older homes with less efficient HVAC systems, windows, and other modern cooling technologies make temperature control more difficult and costly. These high energy costs disproportionately affect residents who are low-income. A participant from the Southeast Georgia region noted, "The issue isn't just extreme heat—it's that people can't afford the energy to cool their homes, and that's where we see deaths happening" (SEGA).

Even in cases where people have the financial resources to cool their homes, there is an increasing shortage of skilled workers who can both fix failing HVAC systems and integrate new technologies to mitigate these failures (Energy Design Systems, 2024).

Heat waves often push HVAC systems to the edge of their operating capacities, resulting in system failures that require expertise to fix. During these heat waves, HVAC technicians can fall behind in implementing these fixes due to the large volume of calls they receive and the shortage of qualified technicians, leaving people without the ability to cool their homes effectively.

Additionally, many Georgians work in agriculture, construction, military and other outdoor settings. Working in these conditions is unsafe and reduces productivity (Parsons et al., 2021). To reduce heat stress at work, the National Integrated Heat Health Information System (NIHHIS) offers information on weather warnings and signs of heat illness to help employers provide a safe workplace during high temperatures (NIHHIS, 2025).

A participant from Robins Air Force Base noted that there are significant impacts to aircraft associated with heat waves, resulting in the suspension of missions due to the grounding of these aircraft, as they are not equipped to operate in extreme heat conditions (NEGA). As heat waves become more intense and frequent, physical infrastructure and lives are both at risk.


AP Photo/Davis Tulis

Cold

Northwest and Northeast Georgia, as well as the Georgia mountains, are less impacted by extreme heat. However, these regions face unexpected cold snaps with critical infrastructure risks, including burst service lines and pipes, road hazards and increased heating costs.

Several participants mentioned that extreme cold is often overlooked, yet it has the possibility to cause damage to infrastructure, disruption to transportation systems and high energy costs for both individuals and communities (SEGA; Black & Mote, 2015; Henderson & Muller, 1997). Southeast Georgia participants noted, "Energy bills spike in both summer and winter, but cold-related energy costs often get overlooked compared to heat" (SEGA).

In January of 2014, a snow and ice storm rendered bridges and roads impassable for days across the state and in response, the Georgia Department of Transportation (GDOT) increased its winter weather emergency protocols (GDOT, 2025b).

In January of 2025, another snow and ice storm hit the southeast. CNN reported wide-reaching impacts to transit systems, including 225 car crashes on interstates around Georgia and 590 grounded flights at Atlanta's Hartsfield-Jackson International Airport (Gilbert, 2025).

Southern Georgia is also impacted by cold snaps, and problems can be exacerbated by building standards that do not account for them, including inadequate insulation and bury depth standards for homes and service lines. Participants from the Northeast/Middle Georgia convening also spoke of a recent situation in which pipes froze and burst in multiple government buildings and repairs took weeks (NE/MGA).

In addition to interior building water lines, there were reports of exterior water supply lines to buildings also bursting when they were not buried deep enough to avoid freezing during cold snaps. This highlights the importance of updating design manuals and enforcing those changes during construction. Some also mentioned how a recent massive freeze in Texas (NCEI, 2023) made many people realize how unprepared the Southeast is for prolonged cold weather, stating, "Our systems just aren't built for it" (SEGA).

Like extreme heat, extreme cold can impact the operations of military installations in Georgia. Participants from the Northeast Georgia region mentioned that extreme temperatures had caused issues during colder months at Warner Robins Air Force Base, with sudden freezes impacting airplanes during takeoff and landing, as their small airport lacks commissioned de-icing equipment.

Wind Hazards

High winds are largely associated with hurricanes, tornadoes and severe thunderstorms. Even outside of those threats, high winds are producing increasingly frequent and intense impacts across the country, resulting in property damage, widespread power outages and broader infrastructure disruptions (Murley et al., 2020; Knox et al., 2011).

While Helene proved that wind hazards from hurricanes can extend hundreds of miles inland (Bledsoe et al., 2024), the coastal areas of Southeast Georgia are most at risk of hurricane-force winds, which can result in devastating damage to communities. Several members mentioned the effects of wind on different types of structures common in the Southeast like mobile homes and warehouses, most of which are not built to withstand hurricane forces (SEGA).

Southeast convening members in particular expressed growing concern about the increasing frequency and severity of wind-related damage, noting that in some cases, wind impacts can exceed those caused by flooding, and that often they happen outside of larger weather events like tornadoes and hurricanes.

These impacts are illustrated by the quotes below:

"Why is it that a windy day can knock out power to 90% of our county?"

"We've seen too many cases where a strong thunderstorm, not even a hurricane, brings down trees, power lines and entire road networks."

"During Hurricane Helene, the wind damage took out multiple water systems because the pumps didn't have backup generators. We had areas with no running water for weeks."

"We're seeing stronger and more frequent wind events, and yet we're still building critical infrastructure the same way we did 30 years ago."

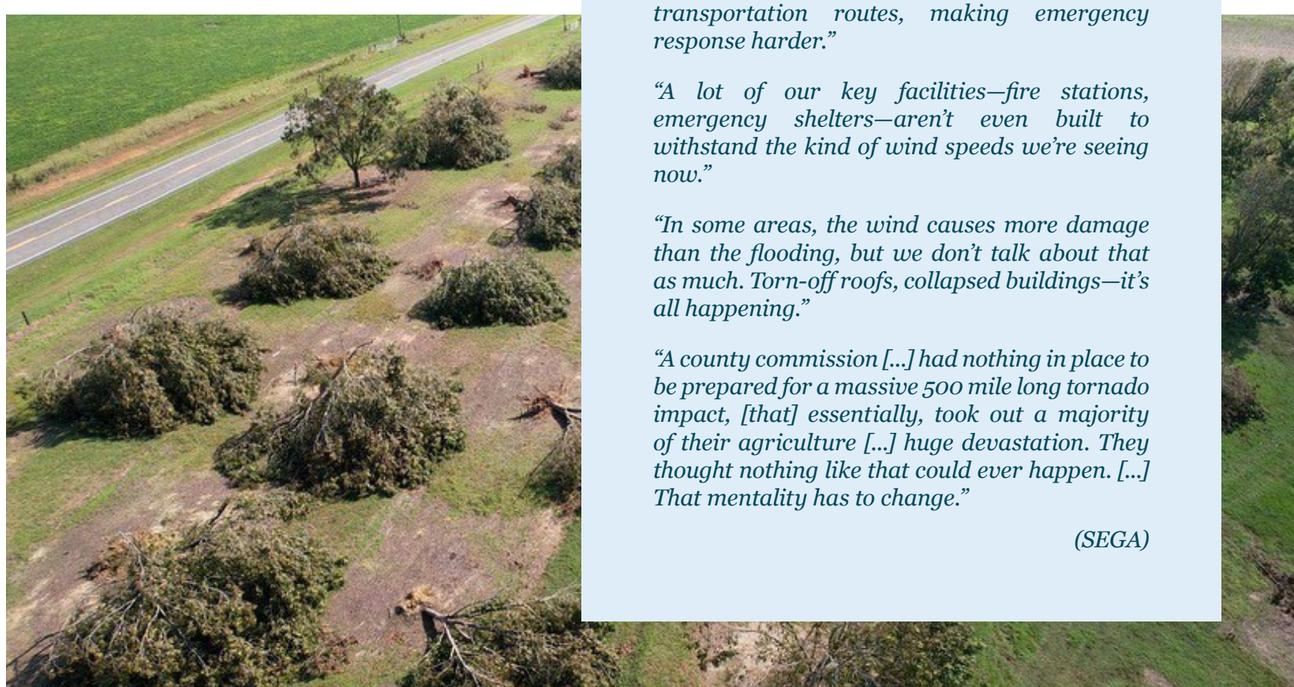
"Even before a hurricane makes landfall, the outer wind bands knock out power and transportation routes, making emergency response harder."

"A lot of our key facilities—fire stations, emergency shelters—aren't even built to withstand the kind of wind speeds we're seeing now."

"In some areas, the wind causes more damage than the flooding, but we don't talk about that as much. Torn-off roofs, collapsed buildings—it's all happening."

"A county commission [...] had nothing in place to be prepared for a massive 500 mile long tornado impact, [that] essentially, took out a majority of their agriculture [...] huge devastation. They thought nothing like that could ever happen. [...] That mentality has to change."

(SEGA)



Southwest Georgia, with its rural landscapes, experiences both straight-line winds and hurricane remnants, often leading to tree-related power failures and communication disruptions.

The participants mentioned that new building codes may discourage residents from rebuilding after disasters and hazard events, citing the example of a 2017 tornado, which resulted in over half of the buildings in one town needing to be repaired and brought up to new standards.

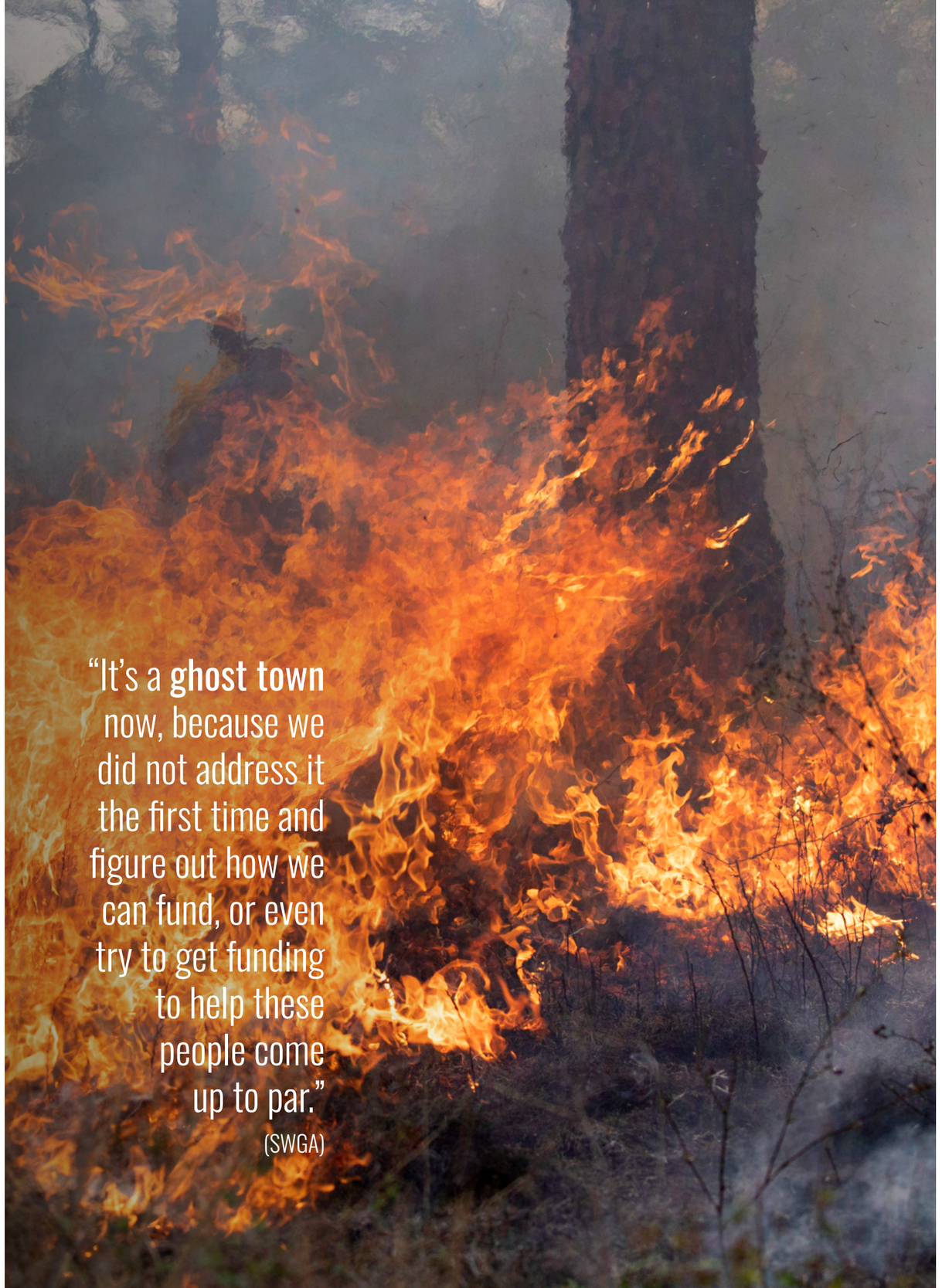
In that instance, the costs and barriers to rebuild proved to be too much for many residents, with one participant noting, "It's a ghost town now, because we did not address it the first time and figure out how we can fund, or even try to get funding to help these people come up to par" (SWGA).

The state remains highly vulnerable to tornado outbreaks, which have the potential to destroy homes, compromise critical infrastructure and disrupt essential services (GEMA/HS, 2024).

In the North Georgia region, there was significant discussion about the threat of wind hazards and the intertwined threat of extreme heat to the electric grid. Wind hazards and fallen trees cause regional electric power interruptions. Relocating electrical facilities underground is a costly challenge for much of Northern Georgia due to shallow bedrock in some areas and the need for more intensive excavation procedures.

Participants in the Northeast Georgia region also mentioned wind hazards as an increasing concern due to fallen trees causing regional power outages. One participant shared, "We had a microburst that took out 1,800 feet of lights" (NEGA). Another noted an increase in the number of insurance claims they are seeing for wind damage to homes.

Members of the Northeast convening also spoke of an April 2017 tornadic event that hit a military airfield and dispersed insulation from an under-construction airplane hangar, destroyed signage and disrupted sensors and instrumentation. This required closing the airfield and affected military readiness (NEGA).



Wildfire

Concern related to wildfires continues to grow across Georgia, where an average of approximately 2,300 wildfires occur per year (GFC, 2025c; Lutz & Kann, 2025). Georgia has already experienced significant wildfires in 2025, with fires engulfing thousands of acres across the state (Murry, 2025).

Southern Georgia is expected to be at the greatest risk of wildfires (though notably not discussed during the Southern Georgia convenings). Southern Georgia contains the majority of the state's commercial timberlands, which generate billions in economic impact each year (*Figure 6*). This growing risk is attributed to a projected increase in drought conditions, shifting humidity patterns and increased availability of fuel from dry vegetation (Lutz & Kann, 2025). Southern Georgia is not the only region of the state at risk, with Northern Georgia also an area of concern where thousands of acres of forested land are located.

The Georgia Forestry Commission states that the number one cause of wildfires in Georgia is from escaped debris burning (Murry, 2025). This can be challenging to address because it requires individuals to monitor and contain burning activities and report fire emergencies to authorities in a timely manner before they result in widespread damage.

Wildfires were most discussed by the members of the North Georgia convening, who noted that droughts, dry conditions and winds in the area often exacerbate wildfire risks. As one participant relayed, "This past summer the landfills were dealing with a lot of issues because it was so hot and it was so dry, and so they were just constantly catching on fire, which is not typical for our landfills" (NGA).

There was also concern from the North Georgia participants about the microclimate and the urban heat island effect exacerbating wildfire risks. The region occasionally does have severe wildfires–with the last one occurring over 12 years ago on one of the ridges in the region–but there are also significant preventative measures already in place. One participant mentioned that the Forest Service has a fairly robust fire regime where they do controlled burns to help prevent wildfires (NGA).

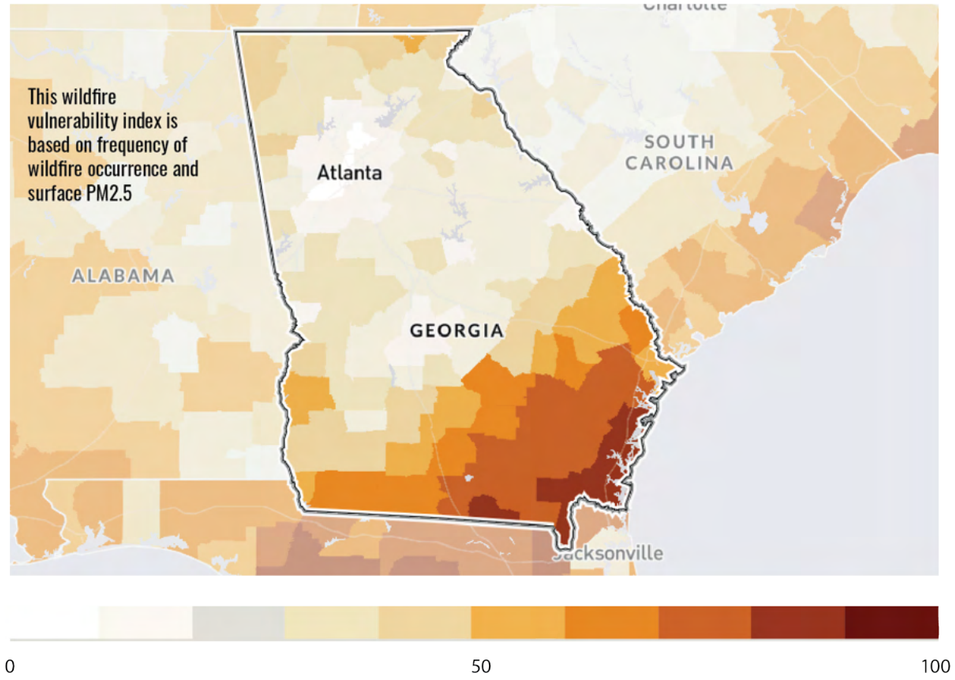


Figure 6. *A map from the U.S. Climate Vulnerability Index showing the risk of wildfires throughout the state, with Southern Georgia and rural areas at the greatest risk (Environmental Defense Fund et. al, 2025).*

Compound Risks

Compound risks result from combinations of hazards occurring simultaneously or in rapid succession, often increasing overall severity compared to each individual hazard alone. Throughout this report, the authors refer to hurricanes and storms as compound risks, which encompass many of the challenges posed by high wind speeds, flooding and intense rainfall.

Hurricanes and storms have caused repeated and widespread harm to Georgia's communities. Within the last decade, Georgia's coastal and inland communities faced devastation from Hurricanes Michael in 2018, Idalia in 2023 and Helene in 2025.

These concurrent risks are becoming a prevalent threat and have the potential to cause widespread harm for communities. For example, drought, extreme heat and wind hazards can combine to create ideal conditions for wildfires to start and spread. Heavy rain, coastal storm surge and river flooding can combine to overwhelm coastal communities and infrastructure. Across the state, hazard vulnerability is a complex mosaic dependent on geography, social and economic sensitivity, structural deficiencies and exposure to both natural and man-made threats (NASEM, 2024).

Participants from Northern Georgia spoke of how droughts can increase wind damage, noting that droughts weaken tree roots and cause them to fall during high-wind events (NGA).

Changing conditions can also alter exposure to hazards. For example, members of the Southwest Georgia region spoke of the interplay between extreme heat and hurricanes, explaining that certain heat and pressure conditions sustain hurricanes longer as they travel inland, saying, "That's another big risk with the heat–hurricanes showing up in places that you wouldn't usually expect them to or traveling places that they wouldn't fall into" (SWGA).

Representatives from Augusta noted that local capacity for fire response is limited, and that managing more than three simultaneous fires would require outside assistance. They described how, in the immediate aftermath of Hurricane Helene, five fires broke out as power was being restored, driven by factors such as improperly placed fuel generators, generator malfunctions and storm debris. Compounding these challenges, many areas affected by the storm lacked water service, and extensive damage to the pipe infrastructure from debris and uprooted trees further hindered response efforts (Augusta).

Participants also discussed the compounding impacts of natural hazards on critical infrastructure systems, including food supply chains and agricultural economies across regions. As one Northwest Georgia participant noted, a significant drought approximately 12 years ago forced many farmers to sell cattle earlier than planned, leading to depressed cattle prices and broader economic ripple effects.

A participant in the Southwest Georgia convening recalled how a recent hurricane impacted restaurants, remarking, "You walked in and they had [signs] on the door, 'no salads, no vegetables,' for weeks, almost up to a month."

The participant suggested that other natural hazards, such as droughts, could compound these problems, affecting local agriculture and requiring Georgians to import food from further away (SWGA).

Fresh water supplies are also threatened by compound risks, especially when flood and wind hazards combine. As one participant from the Southeast Georgia convening stated, "During Helene, [there were] low water advisories for these small community water systems. But people didn't have electricity to boil the water…well, we have to get you water, but there's no public transportation, and you don't have a car…there's a whole sense of redundancy that we need to prepare for" (SEGA).

Another participant spoke from personal experience about the concern for how rapid loss of resources caused by natural disasters could lead to human health crises, saying, "I didn't have power for six days because of the hurricane. That means I had no electricity, I had no heat, no AC, no water, […] Do we want to get into [it]? Can't flush toilets. In the more urban areas that were devastated by Helene, we [had] human health crises [happen] really fast" (SEGA).

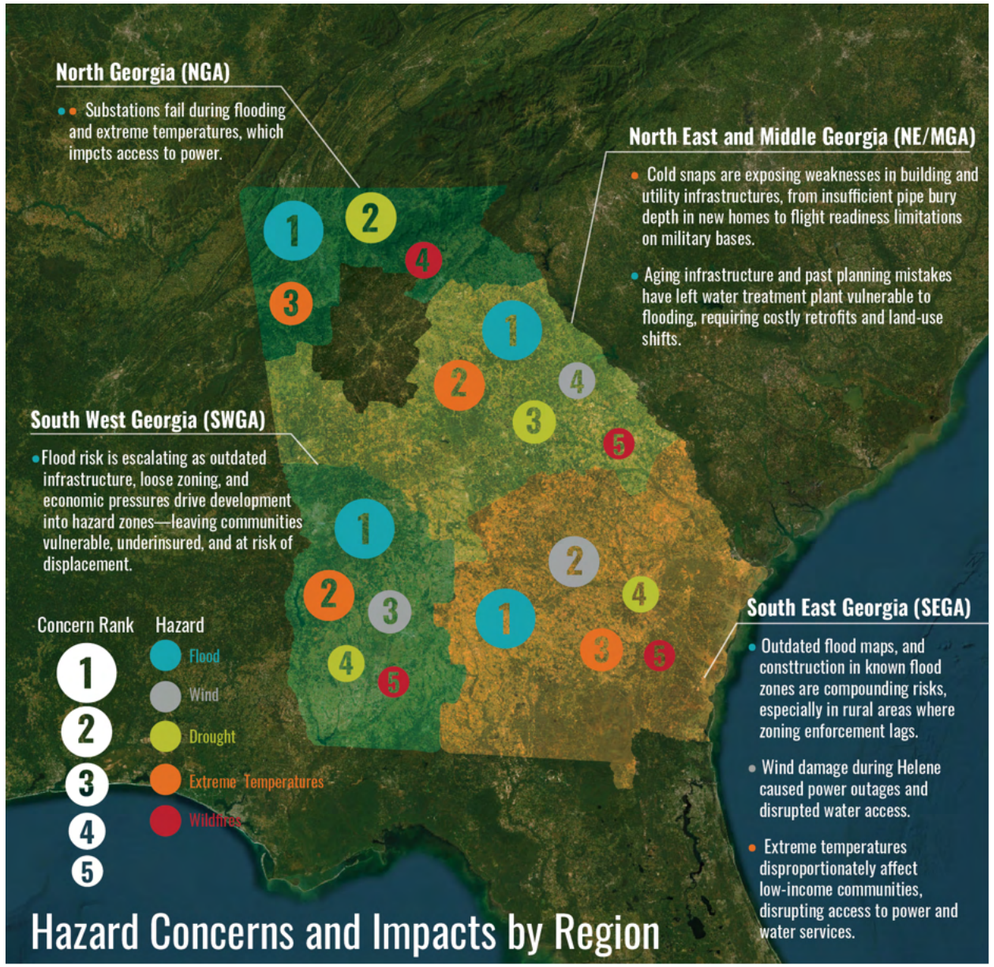
FEMA/DHS

UGA IRIS's Assessment of Hazard Impacts Across Regions

Convening members from each region reported varying levels of concern over each hazard (*Figure 7*). However, when reports from convening members are combined with external information and social vulnerabilities, the picture of hazard severity that each region faces is sobering.

UGA IRIS assessed the threats of each hazard throughout each region and their impacts on different sectors based on data from the convenings and interviews, as well as relevant literature and statewide hazard data:

Figure 7. *Assessment of hazard impacts across regions, as assessed by IRIS.*



Cross-Regional Hazard Pressure Points

	Energy	Water	Agriculture	Military	Health	Property	Economy
NGA	● ● ●		● ●		●		●
NE/MGA	●		●	● ●		● ●	● ●
SWGA	●		● ●		●	● ● ●	●
SEGA	● ●	● ●	●		● ●	●	

Figure 8. *Regional Hazard Concerns and Systemic Impacts Across Georgia as per convening member survey responses.*

CONCLUSION

The hazards discussed above present interconnected and compounding threats to communities across Georgia, with far-reaching consequences for public safety, infrastructure, economic stability and human health. The themes identified through the regional convenings and ad hoc meetings highlight both the complex challenges and the opportunities that exist within Georgia's human and built infrastructure systems.

The following sections build on these insights to further examine the statewide resilience landscape and identify pathways for strengthening Georgia's ability to prepare for, respond to and adapt to evolving hazard risks.

CHALLENGES

Georgia's communities are navigating increasingly complex hazards that cut across both geography and sectors. Flooding, drought, extreme temperatures, wind events and compounding hazards impact water supply, transportation networks, energy systems, agriculture and public health. Participants across the regional convenings consistently emphasized that the risks are growing more severe: no part of the state is insulated from their growing impacts.

Finding solutions to these challenges is not simple. Many communities face persistent capacity and resource constraints that limit their ability to plan for, finance and implement long-term resilience programming.

Notable contributions to rising vulnerability include:

- *Aging infrastructure that was not necessarily designed for today's extremes*
- *Rapid development patterns to keep pace with economic development*
- *Urbanization that is often out of balance with wetland preservation and resilience planning efforts*
- *Disconnected governance structures*

In preparing for, responding to and recovering from these threats, communities must navigate a combination of physical risks, social vulnerabilities and complicated socio-political landscapes.

This section synthesizes the contributing factors and systemic challenges identified by participants across the regional convenings that shape how hazards impact communities and influence resilience outcomes across five main themes:

1) Coordination
2) Capacity
3) Vulnerable Infrastructure
4) Implementation
5) Education and Awareness

1. COORDINATION

Coordination across agencies can be complex. Agencies in the state must improve coordination for better alignment of goals, shared resources and effective hazard response.

1.1 Lack of coordination across a fragmented landscape of local, regional and state agencies

Key takeaway: *Each region of the state has its own diverse set of organizations with specific responsibilities for providing services and governance to communities. While many agencies are working actively on resilience, stakeholders consistently expressed a desire for stronger alignment and communication across jurisdictions. Additionally, frequent changes in elected officials make it difficult to execute and complete projects.*

Across all regional convenings and meetings, participants consistently emphasized that while there are examples of successful coordination, largely governance structures remain disjointed, with limited formal communication channels to support regional and state-level resilience coordination.

This disconnect could result in missed opportunities for hazard mitigation, inconsistent development decisions, and reduced capacity to address cross-jurisdictional risks (SEGA). Hazards do not stop at county, state or metro lines, but planning often does.

Meanwhile, the infrastructure systems communities rely on (including power grids, transportation networks, water and stormwater systems) are largely governed by entities separated by jurisdiction. For example, if one town updates its stormwater regulations, but a town eight miles away does not, the anticipated benefits of that update may not come to fruition (NGA).

Another disconnect comes from a misalignment between project timelines and the terms of elected officials. Comprehensive plans and strategic efforts may be discarded and/or become irrelevant at the end of every local election cycle, which causes general disenchantment at the community level. As one community member from the Southeast Georgia convening said, "We see with our grant implementation, we'll have projects that are long-term that we've worked on for years and years, and we get new administration, and it's–well, we're heading in a different direction–and that's frustrating for sure" (SEGA).

2. CAPACITY

Outdated tools, limited technical expertise and a lack of foundational data constrain the ability of communities to plan for and implement resilience strategies. New knowledge exists, but there are barriers to translating the latest resilience innovations into practice.

2.1 Limited access to relevant data and outdated public sector resources

Key takeaway: *Communities may not have access to key information, such as up-to-date and detailed maps of flood risk, to use in resilience planning. Even when they do have access, they may not have personnel trained to interpret and use the data.*

A recurring theme throughout the convenings was the lack of reliable, actionable information that can be used when resilience planning. Convening participants indicated they are aware of data produced by federal- and state-level entities, but limited access to those data sources and to the expertise needed to interpret them for resilience is a lost opportunity (NE/MGA; NGA).

The members mentioned the importance of not only mapping hazard impacts but also diagnosing multiple vulnerabilities. This can be assessed by intersecting hazard mapping with socio-demographic data to understand preparedness across income or other demographic brackets.

Aside from a few region or sector-specific entities such as the UGA Weather Network (Mountains Scoping Meetings), participants noted a resounding absence of centers that provide vulnerability and resilience planning support to communities and governments.

Across almost all of the convenings, participants cited the need for more current and detailed flood maps, and the need for comprehensive inventory and mapping of infrastructure assets to prioritize future investments.

For example, a member from the Southeast Georgia convening spoke about how inadequate infrastructure led to flooding outside the floodplain and a need for updated maps, saying, “But some things that we’ve been working on [...] it’s not in the floodplain. You look at the map, it’s like, no, this isn’t a flood zone. It’s fine. But they have consistent stormwater flooding because there is no stormwater infrastructure. There is nowhere for the water to go: water falls on the surface and it makes people’s yards pond” (SEGA).

Access to accurate, fine-scale data is vital to protecting communities from the damaging effects of floods. *Figures 9-10* show examples of these maps, which account for future rainfall and land use conditions and illustrate how development occurs in areas that are immediately outside the regulatory flood hazard zone but nevertheless at high risk of flooding (Selsor, et al., 2023).

Figure 9. *Flood hazard maps of Proctor Creek (Atlanta) and North Oconee River (Athens) showing the Special Flood Hazard Area (“100-year floodplain” based on past conditions) used to regulate development in the floodplain versus the floodplains areas that have at least a 10% chance of flooding over 30- and 50-year planning periods based on* ***current conditions.***

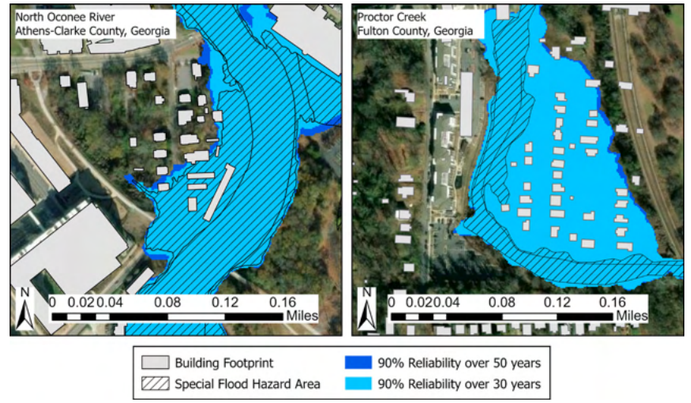
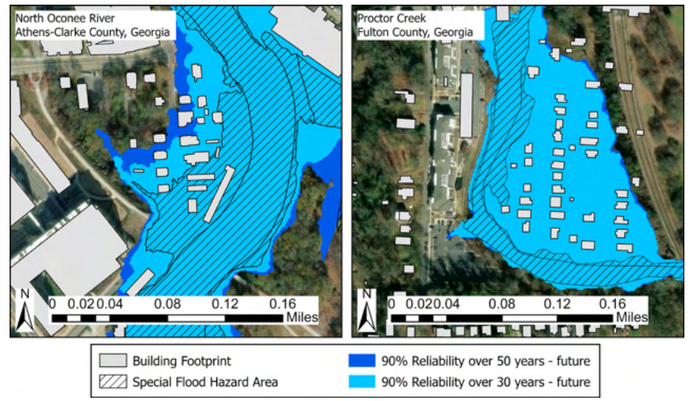


Figure 10. *Flood hazard maps of Proctor Creek (Atlanta) and North Oconee River (Athens) showing the Special Flood Hazard Area (“100-year floodplain” based on past conditions) used to regulate development in the floodplain versus the floodplains areas that have at least a 10% chance of flooding over 30- and 50-year planning periods based on* ***future conditions.***



Outdated resources, such as incomplete flood maps based on past land use and rainfall, can cause major challenges in planning for and mitigating flooding. Several convening participants spoke about maps that haven’t been updated in decades and others that are based on dated technology for predicting rainfall and flooding. These maps also fail to account for changing future conditions, including increased severity of rainfall and greater percentages of impervious surfaces in developed areas (such as roads, parking lots, roofs, compacted soils, etc.)

One participant noted that outdated flood maps can contribute to development in high-risk areas, increasing exposure to future flood hazards, saying, “The problem is that people keep building right up to the FEMA [Federal Emergency Management Agency] line, but when we do better mapping, we find that the flood hazard area actually goes way beyond that” (SEGA). Some resilience leaders have aimed to address this issue, luch as the South Carolina Office of Resilience (SCOR) in their Resilience Atlas.

2.2 Emerging academic and scientific knowledge not integrated into planning and practice

Key takeaway: *Communities across Georgia are struggling to keep pace with new technologies and scientific insights. Without the integration of emerging tools, more up-to-date data, and advanced planning practices, resilience efforts remain constrained in the face of growing climate and infrastructure risks.*

As technology and scientific understanding of resilience continue to advance, challenges arise in how to integrate these advancements into planning strategies and practical solutions at the municipal level.

These gaps may be addressed through strategic community planning that includes:

- Comprehensive asset management plans
- Innovative resilience planning strategies
- Efficient infrastructure rehabilitation techniques
- Low-cost real-time control (especially microcontrollers and other automation applications for grid systems)
- Best practices in hazard modeling

This gap in the integration of knowledge into practice has grown simultaneously with the urgency and importance of building resilience in cities. Innovations in building resilience at the city level should include holistic approaches to resilience planning that incorporate a system-level analysis and account for all phases of resilience, from risk identification to long-term recovery.

However, this type of work requires extensive technical expertise, along with significant labor demands. These demands often result in significant costs and capacity constraints, which in turn limit the adoption of robust resilience efforts at the local level.

A Need for Comprehensive Asset Management Plans

A foundational first step in integrating technology into resilience planning is developing comprehensive asset management plans. These plans help communities assess where they are in their resilience journey, including assessing baseline information, identifying vulnerabilities, and projecting future needs.

Applying advanced tools and emerging techniques such as robust risk assessment methodologies, infrastructure project development and prioritization, and funding identification, all of which are pivotal to an effective and actionable asset management plan, requires technical skills and institutional resources that are often unavailable.

Stalled Adoption of Solutions

Once communities have identified their baseline and where their vulnerabilities lie through asset management planning, they then have the challenge of identifying what the appropriate solution might be.

A myriad of potential solutions exist for communities, ranging from large-scale projects that incorporate natural infrastructure to smaller scale technological updates that extend the life of existing systems and boost their resilience.

While cost-effective infrastructure rehabilitation techniques exist—such as cured-in-place pipelining and silicone cable injection, which can extend the life of existing systems without the need for full replacement—knowledge gaps and limited funding can stall adoption.

Similarly, technologies like smart switches and Supervisory Control and Data Acquisition (SCADA) systems enhance real-time monitoring and control across critical infrastructure but may require more capital to implement.

These solutions will be explored further in the Opportunities section.

Knowledge Gaps in Flood Risk

Because flooding emerges as one of the top hazards across the state of Georgia, there is also a concerning gap in technology that provides communities with the information they need to not only evaluate their flood risk and vulnerabilities but also design infrastructure to mitigate these vulnerabilities.

Foundational to all stormwater and flood control infrastructure assessment and design is the understanding of local rainfall patterns. The Georgia Department of Transportation's Drainage Design Policy Manual directs practitioners to utilize published rainfall frequency estimates provided by the National Oceanic and Atmospheric Administration's (NOAA) Atlas 14 (GDOT, 2025a; HDSC, 2025).

While NOAA Atlas 14 is the industry standard, research shows that the rainfall frequency estimates provided tend to underestimate actual rainfall intensities (Kim et al., 2022), resulting in undersized stormwater infrastructure before it's even built. While NOAA Atlas 15, the next generation of Atlas 14, aims to provide updated rainfall frequency estimates that account for future conditions, there have been significant delays to its release due to federal funding cuts.

The problem is compounded by inconsistencies and outdated boundaries in FEMA flood maps, which can give property owners a false sense of security, especially for properties located along mapped floodplain fringes.

Inconsistencies are attributed to uncertainties in precipitation estimates, stream flow, topographic representation, modeling parameters and techniques and geospatial operations (Merwade et al., 2008). Integrating new flood map evaluation techniques to improve the accuracy of mapped floodplains across the nation proves to be a time- and resource-intensive endeavor.

Additional Technological Vulnerabilities

Artificial intelligence (AI) presents both opportunities and risks for local governments. While AI can enhance data analytics and monitoring, it also raises concerns around cybersecurity and data privacy. Communities are struggling to keep pace with this rapidly evolving field (SWGA; Augusta).

Finally, communication systems, including radio towers, cell networks, and emergency response infrastructure, remain vulnerable to disruption from both minor and major hazards. Updating these systems is critical and would improve their functionality in hazardous conditions (SEGA; Augusta).

The ability to communicate is crucial during disasters, as it allows communities to coordinate a disaster-relief response and move into recovery and adaptation mode. As one Southeast Georgia participant noted, "Communication to us right now is making sure that everybody can communicate. Through Storm Helene, it was very difficult for us to say where we were and what was happening in that moment" (SEGA).

2.3 Barriers to effective grant applications and funding opportunities

Key takeaway: *Communities may not have the personnel, experience or matching funds to successfully apply for grants. Even when grants are awarded, communities may face significant barriers to successful project implementation.*

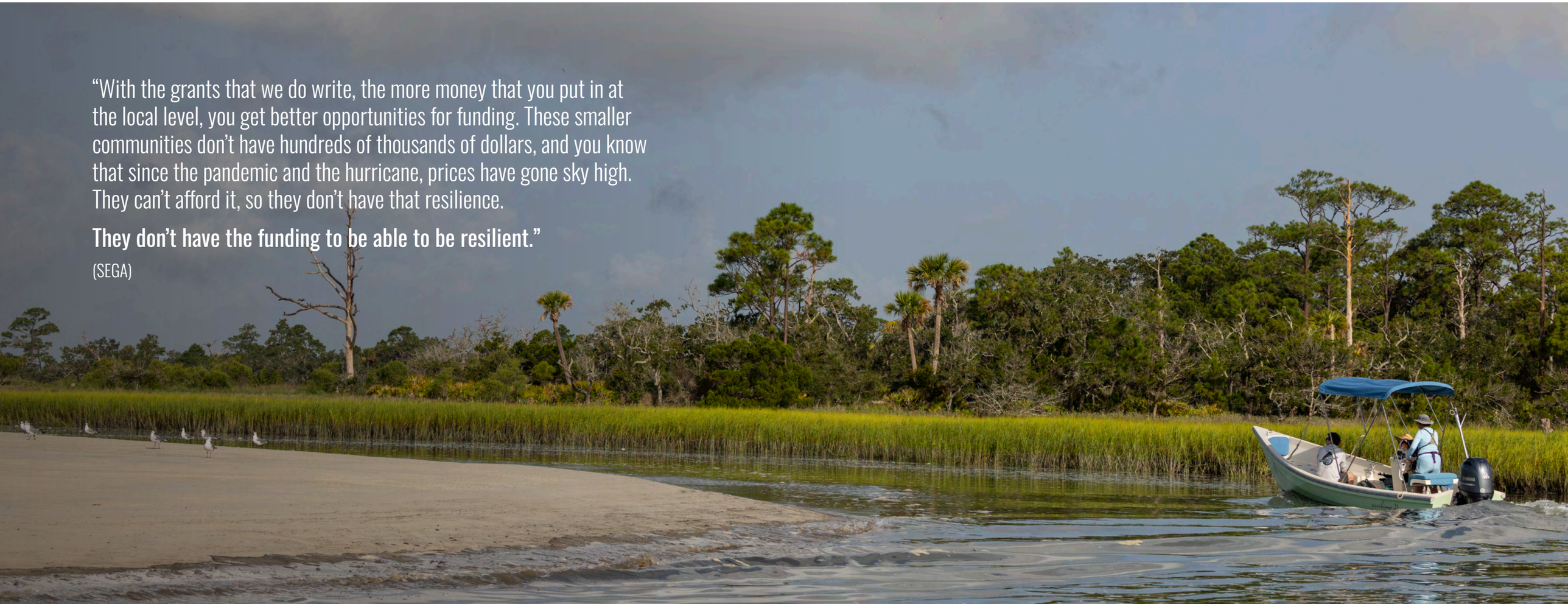
Federal, state, and private funding programs for resilience, including those under FEMA, the United States Department of Agriculture (USDA) and others, remain highly competitive, administratively complex and slow. Recent reductions, such as the discontinuation of the Building Resilient Infrastructure and Communities (BRIC) program, have made applying for funding even more challenging (SWGA; NE/MGA).

Small rural communities, which are often most in need, may be unaware that grant funding opportunities exist. If they are aware, they are still often unable to compete for these grants, due to the onerous process, a lack of necessary matching funds or a requirement for evidence or data that the community does not have the time or ability to collect. In many cases, a few grant writers are spread thin across multiple jurisdictions, which leaves these communities in a reactive cycle rather than able to execute long-term strategies (SEGA; NE/MGA; NGA).

If a grant is awarded, many communities are not set up to readily manage the funds in full compliance with stipulations around contracting, procurement, auditing and reporting, among other requirements.

Many of the same barriers that exist in applying for funding also serve as challenges in successfully implementing projects: limited staff capacity, outdated technological resources and lack of previous grant experience can make it difficult or impossible for small communities to successfully execute projects, meet stipulated timelines and fulfill reporting requirements.

Additionally, the current funding landscape can discourage innovation. If communities implement new hybrid or natural infrastructure approaches and those projects fall short or are perceived as risky, they may jeopardize their chances of receiving future funding. This creates a major barrier to the adoption of potentially transformative technologies (SEGA).



"With the grants that we do write, the more money that you put in at the local level, you get better opportunities for funding. These smaller communities don't have hundreds of thousands of dollars, and you know that since the pandemic and the hurricane, prices have gone sky high. They can't afford it, so they don't have that resilience.

They don't have the funding to be able to be resilient."

(SEGA)

3. VULNERABLE INFRASTRUCTURE

Georgia's infrastructure was not necessarily built for today's extremes. Concern about costs, uncertain timelines for returns, and lack of investment leaves many systems exposed to avoidable risks.

3.1 Existing infrastructure is not designed to withstand emerging extremes

Key takeaway: *Aging infrastructure in all sectors–power, stormwater, transportation, housing–cannot withstand new extremes. There is a need for more robust and flexible design standards.*

Much of Georgia's infrastructure is reaching the end of its intended service life. Additionally, it was not designed to withstand the intensity of today's extreme weather events. Even fully operational systems remain vulnerable to damage from flooding, high winds, extreme heat and severe cold, which place increasing strain on both physical assets and the communities that depend on them.

The 2024 Georgia Infrastructure Report Card issued by the American Society of Civil Engineers (ASCE) gave Georgia's infrastructure a grade of C+. While it's noted that significant improvements have been made within the last several years, it highlights that there is much work left to do in almost all sectors of infrastructure.

Key takeaways and recommendations from the report related to infrastructure resilience against hazards include:

1. Invest in a Resilient Grid:

"Retrofits and new connections in the energy grid will ensure resilience to extreme weather and a backbone supporting population and business growth" (ASCE GA, 2025). This suggestion refers to smart and "micro" grid technologies, which can help provide more stable sources of energy; during outages, these technologies enable energy companies to keep power on for unimpacted areas and to restore power more quickly to impacted areas. Retrofits may also include ensuring that equipment is elevated away from potential flooding and able to withstand extreme temperatures and winds.

2. Set Responsible, Resilient Utility Rates and User Fees:

"Utility rates for drinking water, wastewater services and electricity, as well as funding for stormwater, have not kept up with the recent significant cost increases and trail national averages. In water systems, new regulations on treatment, pipeline replacements, and addressing extreme weather conditions increase needs" (ASCE GA, 2025). Utility rate increases to fully account for the full cost of service, including capital, maintenance and operating needs are recommended. Analysis should include life-cycle costs of materials, labor inflation and resilience upgrades necessary for extreme weather (SWGA).

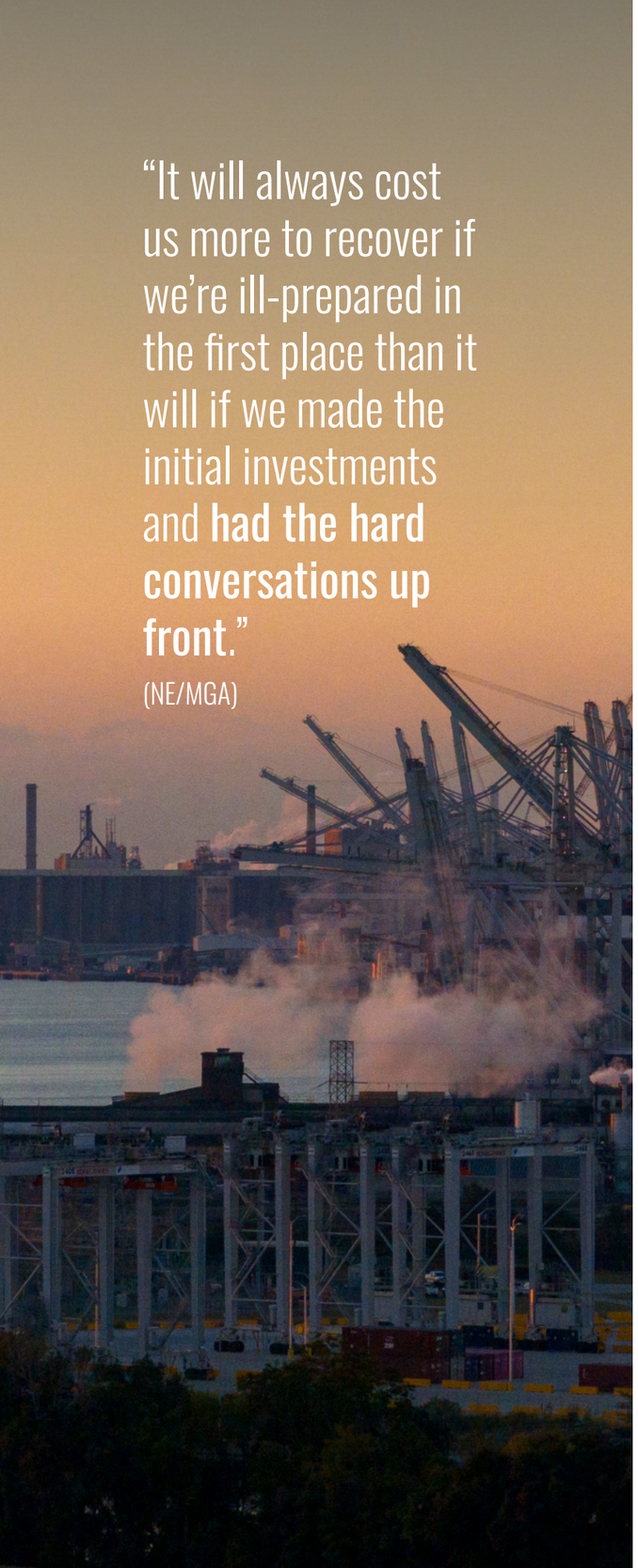
3. Bolster Stormwater Systems Against New Extremes:

"Georgia's stormwater infrastructure has continued to improve in recent years. However, progress has not kept up with threats from increased runoff and pollutant loads. Changing land use and development supercharge those hazards. Water planning documents addressing stormwater needs were updated across the state in 2022-2023, but consistent, flexible funding mechanisms have not been established to meet needs. Sixty-four local governments in Georgia have stormwater utilities, about the same as five years ago. Only some of those utilities have increased fees to fully account for aging infrastructure and project cost increases. Analysis of available data provided by the Atlanta Regional Commission (ARC) indicates there is an annual gap of over $620 million between stormwater infrastructure needs and funding in Metro Atlanta alone. Resilience threats are also growing. The Georgia Stormwater Management Manual Coastal Supplement will soon address current and future needs related to sea level rise and changing storm patterns for the coastal area. However, areas beyond the coast face changing storm patterns that will need to be addressed in design standards" (ASCE GA, 2025).

The 2024 Georgia Infrastructure Report Card echoes the sentiments and concerns raised throughout all of the regional convenings; there is much room for improvement.

Several participants spoke of how energy grids are not prepared for extreme temperatures, noting, "We talk about energy resilience, but the grid isn't designed for these extremes. Power plants are struggling to keep up with demand in both summer and winter" (SEGA). This is compounded by changing load management needs and energy demands, such as ongoing electrification and data center/AI expansion.

Participants mentioned that new construction needs to consider preparedness for extreme temperatures. "If we can build new homes to energy-efficient standards," said one SEGA participant, "we can reduce the impact of both extreme heat and cold. But most developments aren't factoring that in."



Another added, “We are pouring millions into housing projects, but we need to be designing these homes with resilience in mind, like the fortified home standard, so people have a home to come back to after a disaster” (SEGA).

A Northeast Georgia representative noted, “There are also challenges more broadly with new homes not being built to a proper bury depth for the pipes, which in the new frequency of freezing temperatures, could be an issue” (NEGA).

Increasing flood hazards also require utility components and substations to be retrofitted to withstand rising waters. “Based on the way [sub] stations were done back in the day, we now have to retrofit equipment so that it’s elevated off the ground,” said one SWGA participant. “They have to do maintenance on exposure to flooding conditions, you know, where the equipment is not necessarily designed to be under water. It’s water resistant, not waterproof” (SWGA).

Of particular concern in the face of increased flooding is the lack of more robust design standards and consideration of future conditions for hurricane evacuation routes; up until recently, all highways were graded to a 100-year flood, which has a 1% chance of happening each year (Sevier, 2023). However, changing conditions have rendered that standard inadequate, particularly for escape routes. Flooded hurricane evacuation routes could trap evacuees as they seek safety and limit the ability of rescue services to access areas in need (Bigi et al., 2021). ASCE 7-22, a recently unveiled toolkit, will help ameliorate this issue by increasing the standard to a 500-year flood (Sevier, 2023).

3.2 Perceived uncertainty in return on investment of resilient infrastructure

Key takeaway: *A lack of trust in the eventual return on investment (ROI) of resilient infrastructure may contribute to delayed adoption.*

The long-term impacts of infrastructure choices present an ongoing challenge for city planners and other municipal leaders. Once installed, conventional infrastructure (especially stormwater infrastructure such as flood walls or culverts) has a lifespan of 50-100 years, and may not be updated for far longer due to competing funding priorities (ASCE, 2021a).

Infrastructure decisions made today last for generations and are difficult to reverse, especially as hazards intensify and community needs evolve. Because conventional infrastructure tends to be expensive and structurally rigid, integrating nature-based and other resilient solutions is often seen as an added challenge rather than a strategic upgrade.

Additionally, natural infrastructure is not maintenance-free. While trees provide many essential services and benefits, such as heat mitigation, stormwater storage, and erosion control, poorly planned vegetation can destroy infrastructure as readily as it supports it. Tree roots uprooting pipes and fallen limbs taking down power lines are common occurrences during extreme weather events. Of the total 2.4 million cubic yards of vegetative debris removed in Augusta following Hurricane Helene, wood from felled trees was a significant percentage (Van Buren 2025a, 2025b).

These realities underscore a need for planning and maintenance of trees and other vegetation like that of any other form of urban infrastructure. Like sewer lines and power grids, natural infrastructure must be designed to limit unintended harm and withstand stress.

When an opportunity arises to invest in infrastructure solutions that accomplish multiple benefits (like managing floods, storing excess stormwater, providing recreational access to natural spaces or creating habitats), the upfront cost may be erroneously perceived as higher than that of conventional infrastructure.

However, the long-term benefits, including increased recreation, improved health and water quality, job creation and reduced maintenance, may tell a different story. Over time, the additional benefits provided by multi-purpose, resilience-oriented projects could save money, especially during multiple disasters, such as compounding heat waves, droughts and wildfires (USCC, 2024).

In general, quantifying the full array of benefits provided and dollars saved thanks to resilience planning is difficult in part because it is impossible to predict the timing of future returns on investment, making it easier to prioritize other, more easily quantified needs. Neighboring states like Kentucky and Florida are building the economic case (KYEM, n.d.; FLEM, 2017). Cumulative ROIs demonstrate the value of proactive investment.

As one participant said, “We have to invest small and build up. Yes, it may take 30, 40, 50 years for us to see the full return on our investment, but if we’re going to continue to grow at the rapid rate we’re seeing, especially here in the middle of Georgia, that mindset is subject to change. Yes, it’s going to come at a high cost, but that is a conversation that we’re really going to have to start having” (NE/MGA).

4. IMPLEMENTATION

Even where resilience strategies exist, outdated governance structures and weak enforcement make it difficult to balance development with long-term resilience planning efforts.

4.1 Dated governance and risky development

Key takeaway: *Growing populations, outdated ordinances and financial incentives lead to development without due consideration for shifting flood zones or overwhelmed stormwater systems. At the same time, some zoning laws and regulations can hinder communities' ability to implement resilience measures.*

Georgia's population is growing (U.S. Census Bureau, 2024). While this brings economic promise and an improvement to the quality of life for Georgia residents, the rapidly accelerating need for additional development is often concentrated in areas with high flood risk, which simultaneously increases the number of homes and businesses impacted by floods and overwhelms the existing infrastructure (SEGA; SWGA; Mountains Scoping Meetings).

A context-aware, proactive approach to planning for future housing in response to the economic growth in Georgia would lessen the need for reactive, short-term fixes to emerging problems (SWGA). Growth and development can provide long-term livability for future generations, but only if new housing and businesses are built in low-risk areas, which can be a challenge to identify due to constantly changing dynamics.

While densification is often hailed as a solution for cost-effective, conscientious growth, the realities of implementation are more nuanced. For example, in Augusta, population growth and haphazard development (in the floodplain, right against the riparian buffer) are compounded by a push to reduce lot sizes to 22 feet in width. This, in turn, reduces the necessary space to install the supporting infrastructure required and increases impervious area (Augusta). Similar concerns about space were echoed across other regional meetings.

Meanwhile, financial incentives often support new property development without accompanying investment in future-ready infrastructure. Combined with outdated policies and ordinances, these kinds of development patterns can create a barrier to long-term resilience.

Several regions discussed the challenges of development as it relates to flood risk within their area. State leaders often feel pressure to support new construction due to financial incentives like tax revenues, with members of the convenings noting that, "Developers don't care about a 100-year flood projection, and city leaders are under pressure to approve new projects because they need the tax revenue," and "The challenge is that a lot of our local governments depend on property taxes to fund essential services, so even if they know a development is in a flood-prone area, they feel like they can't afford to say no" (SEGA).

Another participant remarked, "McIntosh County is nearly one-third wetlands, and a large percentage of our land is federally or state-owned, which means we aren't getting tax revenue from it. That makes it hard to turn down development, even when we know it's a flood risk" (SEGA).

A member of the NGA convening noted, "We had essentially 150 years of development with no consideration for stormwater management, because there was not an ordinance in place until

2005 or 2006 that regulated development as it pertained to stormwater. This resulted in a large amount of development in areas that should never have been developed, including in floodplains, [with] structures in very close proximity to critical drainage ways and a lot of impervious areas" (NGA).

On a more granular level, building codes are also a critical concern. While updating building codes to shape a more resilient built environment is essential, these very codes often render reconstruction and renovation unaffordable to home and business owners (NGA; NE/MGA).

A member of the Southeast Georgia convening noted the need to develop specific policies blocking new construction, especially for individuals trying to build structures in flood zones who cannot afford flood insurance. The member explained that after a flood, these homeowners are likely to be displaced, as their homes will need to be rebuilt to meet new building standards.

By creating policies that keep people from building in these zones in the first place, community leaders can reduce the risks to their residents and avoid inevitable challenges down the line (SEGA). A member of the Southeast convening summarized the need for this: "…the classic short-term gain versus long-term cost problem—cities approve new housing and businesses, and then five years later, they're stuck dealing with stormwater issues and flood damage" (SEGA).

This challenge is further amplified as major industry players relocate offices and manufacturing facilities to Georgia, including recent growth in the automotive sector. One participant emphasized that the impacts of major industry expansions extend beyond environmental concerns, particularly in communities with limited zoning regulations, stating, "As long as they apply for the permits based on current laws, they can build—whether it makes sense or not" (SEGA).

Development also increases impermeable surfaces while decreasing naturally occurring stormwater retention, resulting in higher rates of stormwater runoff. This increase in runoff is more likely to cause flooding when existing drainage systems are overwhelmed (NGA).

The construction of industrial facilities such as the Rivian and Hyundai plants and data centers in Metro Atlanta and the Mountains regions is expected to alter watershed resilience across Georgia (SEGA; Ad hoc meetings). However, there are no clear guidelines on best practices for siting and accommodating new developments of this magnitude.

One participant in the Southeast Georgia convening, asserting concern that flood planning techniques were not accurately reflecting the rapidly changing urban space, stated, "The whole landscape is evolving way too fast for the current methodology of creating the flood maps" (SEGA).

Building restrictions should protect against residential and commercial development in high-risk areas, but these policies do not currently exist in many of these communities. Additionally, not all zoning restrictions enable flood mitigation, and some current policies may even be preventative. For example, convening members spoke of zoning laws blocking their ability to execute interventions, such as undertaking stream bank stabilization on areas in need, remarking, "The answer was, well, that's not our stream bank" (NGA).

Finally, policies must be nuanced to reflect the heterogeneity of a region. A representative from the NE/Middle Georgia region spoke about the different flood hazard protection needs within their own community, noting an additional urban area developed during a boom in automotive production in America–with a lot of pavement–which led to challenges with increased runoff and flooding. In the same region's rural areas, houses have largely been built in low-lying areas without proper drainage or the correct zoning to prevent development (NE/MGA).

"We keep seeing roads and bridges washed out in the same spots after every storm. The problem isn't just the storms—it's that we're building in places where water naturally flows."

"Infrastructure is a major issue—our drainage systems weren't built for the amount of development we have now. In some areas, storm drains back up almost immediately during heavy rain."

"People don't realize that a new shopping center built in a floodplain doesn't just put that site at risk—it pushes water into surrounding neighborhoods."

"Developers keep clear-cutting forests and draining wetlands to build subdivisions, and then people wonder why their houses flood."

"You've got entire subdivisions being approved in areas that should be stormwater buffers. Instead of using natural infrastructure, we're just paving over everything."

(SEGA)

"I feel like we're **flying in the dark** when we talk about resiliency. We need a state policy to lead us, to coordinate all of us together."
(NE/MGA)

"We have the **environmental scars** from years of no planning, or zoning, or permitting. Through land use, **we can heal some of those scars** as time goes by."
(NGA)

4.2 Lack of enforcement and implementation limits the effectiveness of regional resilience plans

Key takeaway: *Just because resilience planning has taken place at a local, regional or statewide level doesn't ensure that progress is being made toward implementing resilient strategies and projects.*

Members of local government and regional commissions described instances where research-backed recommendations were integrated into comprehensive plans but never went into effect because of a lack of legislative support, funding or financing (SEGA; Augusta).

Similarly, other members of the Southeast Georgia convening expressed frustration at the lack of traction from ground-up attempts to influence state-level policymaking and legislation and called for a focus on top-down political change. One member stated, "In my opinion, something has to be done from the top down. We're trying from the bottom up, and it's just hard. I'm a huge advocate now for every networking opportunity with leadership from the state" (SEGA). The other barriers discussed in this report are nearly impossible to address without also improving statewide coordination and support.

Additionally, when projects are implemented, they may not reflect all the original goals of a resilience plan (for example, they may be only partially implemented or be missing key elements). For this reason, measurable goals and benchmarks allow communities to assess their progress as they implement projects and may help ensure in-ground projects meet resilience goals. Ideally, resilience plans should be living documents that are continually re-evaluated, adapted and implemented.

5. EDUCATION AND AWARENESS

Georgia communities possess deep real-world knowledge and dedication that is important to involve in resilience decisions. However, failing to account for the needs and bandwidth of individuals, as well as gaps in post-disaster communication, highlights a need for stronger support systems and public engagement strategies to help Georgians recover and thrive.

5.1 Limited public understanding of resilience and hazard preparedness and uncertainty in human systems

Key takeaway: *Gaps in post-disaster communication highlight a need for stronger support systems for Georgia's residents and their vulnerable communities. Additionally, a lack of public awareness of the need for resilience planning may limit preparation for future hazards.*

As was highlighted throughout the convenings, Georgia's residents and existing resilience stakeholders and practitioners are a tremendous asset. The value of technical expertise, strong working relationships and clear communication emerged as recurring themes across regions.

However, while many participants noted the dedication of local teams in post-disaster recovery efforts, several also raised concerns about staff fatigue and burnout, particularly following repeated hazard events.

Despite the critical role that human infrastructure plays in supporting resilience, there are limited mechanisms currently in place to provide sustained support or to address burnout and workforce capacity over the long term (Augusta; NASEM, 2019). True resilience is more than just addressing hazards; it requires putting people first and building systems that promote lives and livelihoods.

Another theme raised during the post-Helene Augusta convening was the role of public behavior in shaping disaster response and recovery. As previously mentioned, participants noted that individual actions taken during and after disasters can unintentionally slow or disrupt recovery efforts.

Communication with residents about what to expect after disasters is also key. For example, while residents may take recommended basic preparedness steps, such as filling bathtubs for water storage, there is often limited communication from municipal services about how and when essential services like waste collection and utilities will be restored.

Finally, participants also emphasized the need to foster a shared public understanding of resilience planning. At the statewide convening, members explained that they face a lack of understanding from their stakeholders about the specific word resilience, noting that many people do not know what it means or have differing working definitions (Statewide).

Language and terminology barriers can serve to alienate a public that might otherwise be willing to buy into infrastructure changes that could strengthen their community against hazards. Leaders in the resilience sphere must seek to use language that feels accessible to all, while also working to clarify the definition of resilience and how it applies to real-world scenarios. This is an important foundation for engaging residents in planning for the future.

Increasing public awareness of risks and resilience options also promotes preparation for future hazards across sectors and communities. For example, an understanding of the dangers of building within flood hazard zones could reduce unsustainable development practices. There is a strong economic message to be broadcast to the public: investments in resilience planning and preparation ultimately save taxpayer dollars when disasters occur (USCC, 2024; ASCE, 2024).

Improved disaster education has many far-reaching benefits, including:

- Reducing the spread of misinformation
- Setting expectations for service interruptions to ease communication burdens on emergency responders
- Promoting safety by raising awareness of risks such as crisis-related theft and looting
- Minimizing the dangers of well-intentioned but untrained volunteer response that can lead to injuries and strain emergency medical services.

Participants emphasized that human behavior remains an under-examined factor in resilience planning and emergency preparedness that needs to be addressed through education and improved communication (NEGA).

Without consistent communication before, during and after hazard events, public engagement remains reactive, and support for long-term resilience planning is limited. In many rural and small communities, mistrust of federal authorities remains prevalent, though local officials often hold higher levels of community trust.

Closing this trust gap and fostering early public engagement is essential to building a stronger culture of preparedness (SWGA; NGA; Augusta).

CONCLUSION

As outlined in the preceding sections, the challenges facing Georgia's communities are multifaceted and compound upon each other, increasing risks. Identifying and understanding these challenges is a necessary first step toward advancing solutions.

The following sections highlight communities and projects that have successfully navigated many of these obstacles and present recommendations informed by both the challenges and the emerging successes already underway across the state.

OPPORTUNITIES

While communities face a myriad of challenges in implementing resilience locally, these convenings revealed numerous opportunities that lie in resilience efforts already progressing around the state.

Georgians are poised to be able to leverage this statewide constellation of successful partnerships, initiatives and programs into a coordinated statewide strategy. Additionally, there are a number of low-lift solutions that could quickly increase resilience throughout the state. This section synthesizes Georgia's opportunities for supporting resilience into five distinct categories:

1. Statewide coordination, planning and funding strategies
2. Building local capacity and scaling up success
3. Modernized and resilient infrastructure
4. Multi-benefit hybrid and natural infrastructure projects
5. Resilient Georgians for a resilient state

1. Resilience for the long haul: Statewide coordination, planning and funding strategies

To make meaningful progress, Georgia needs a systematic approach to resilience funding and planning - one that goes beyond disaster recovery. It is imperative to invest across all resilience stages, to help communities prepare for hazards, absorb impacts when disaster strikes, recover from damages, and adapt to challenges—so that future hazards are mitigated and more easily withstood.

State agencies like the Georgia Emergency Management and Homeland Security Agency (GEMA/HS) can balance investments across these stages of resilience: preparedness, absorption, recovery and adaptation. Currently, absorption and recovery dominate spending as federal and state agencies scramble to support communities during and after disasters. But a true resilience strategy invests meaningfully before the disaster, not just after.

Statewide resilience programming is key to helping communities proactively fund and implement preparation and adaptation for future hazards. Resilience planning includes:

- Creating accessible strategies for communities seeking funding
- Implementing multi-benefit natural infrastructure
- Modernizing infrastructure systems
- Creating pathways for scaling up resilience efforts

All of the above will play a part in moving Georgia from reaction to resilience, but all of these actions require collaboration across state and local levels to obtain funding, assess risks and build partnerships.

Accessible strategies for communities seeking funding

Embedding resilience into local and regional comprehensive plans is an impactful way for communities to signal readiness and attract resources. Even when communities are able to commit a portion of their own resources to implement resilience projects, they may have to adjust the design or aims of the project to better align with state and federal priorities.

As a representative from the Southwest convening said, “Grant applications must demonstrate local resource use and exhaustion before state and federal funds are sought; failure to do so results in frequent denials.” This can be problematic when funding goes to communities that have the highest capacity, instead of those that have the most need (SWGA).

A convening member from Tybee Island—where multiple resilience-related projects were implemented as spotlighted in the exemplar Tybee Island Natural Infrastructure Master Plan—suggested several ideas for supporting communities with the greatest need and drawing funding from federal grants toward promising projects for the biggest impact throughout the state. These ideas included:

- Aligning local projects with federal grant criteria to attract funding: Key to this is “read[ing] the words” in the request for proposals carefully, and aligning proposals to funding priorities.
- Creating a scalable projects library: Successful projects, including Tybee’s, have numerous transferable approaches, including self-organized grassroots relationships, a diverse but integrated funding portfolio, strategic community engagement and facilitated knowledge transfer.
- Technical support as a service: Instead of hiring in-house experts, the participant suggested that the state outsource technical assistance to qualified institutions like universities, saving costs and maximizing flexibility.

2. Pathways for scaling up local successes and building local capacity

Regional resilience networks across flexible boundaries

Across every convening, participants described a patchworked governance landscape with varying levels of interest in resilience planning and capability to implement plans.

Convenings also revealed regional differences in types of hazards that communities face based on their location (coast versus mountains), population density, existing infrastructure and development pressures (see *Figure 7*). While a standardized guidance model is essential to harmonize efforts across the state, this model should balance state and local concerns.

There is an opportunity in Georgia for a scalable governance structure model, facilitating knowledge sharing and ensuring that efforts work in harmony, while building on existing management networks (see *Figure 11*).

Below are examples of existing initiatives discussed in regional convenings that can be expanded into a statewide approach:

Developments of Regional Impact (DRIs)

Under the Georgia Planning Act of 1989, the Georgia Department of Community Affairs established procedures to review large-scale developments that are likely to have regional effects beyond the local government jurisdiction, or Developments of Regional Impact (DRIs) (GDCA, 2025).

This policy provides a process where local voices weigh in before decisions are made. By building resilience into the topics that DRIs consider, decision-makers will be forced to consider the cascading impacts of new development and local voices will have an opportunity to be heard regarding the impacts on their home, effectively helping to scale up consideration of resilience around the state.

Damage from disasters can have serious impacts on a community's economic well-being. However, large-scale projects that promise high levels of revenue can be politically difficult to challenge, even when they pose hazard concerns such as building in a floodplain or placing pressure on existing infrastructure. For this reason, structured consideration of resilience concerns may help provide a gut check for decision-makers.

Expanding the DRI framework to include resilience will facilitate multi-scalar planning for economic development and environmental security.

Watershed-based planning

Watershed plans have demonstrated reasonable success as a means for coordinating water quantity and quality management. Since 2004, over 90 watershed plans have been conceived in Georgia alone, and have provided guidance for integrating habitat and species preservation with other water resources management objectives.

An example is the Habitat Conservation Plan prepared by the Water Policy Center in Albany (SWGA; Water Council Meeting). This approach to planning also informs targeted stormwater management installations that mitigate flood hazards. The city of Dalton has several installed projects that exemplify this, including the Mill Creek watershed regional retention pond and the Tar Creek watershed regenerative stormwater conveyance system, which combines natural infrastructure and step pools to attenuate water release (NGA; Statewide).

Watershed plans are a highly scalable system that lends itself to implementation and further planning and promotes cross-sectoral collaboration to balance water demand not only for residential and commercial growth, but also for newer forms of development, including data centers and their need for cooling through water (UF/LF-Chattahoochee Water Council Meetings).

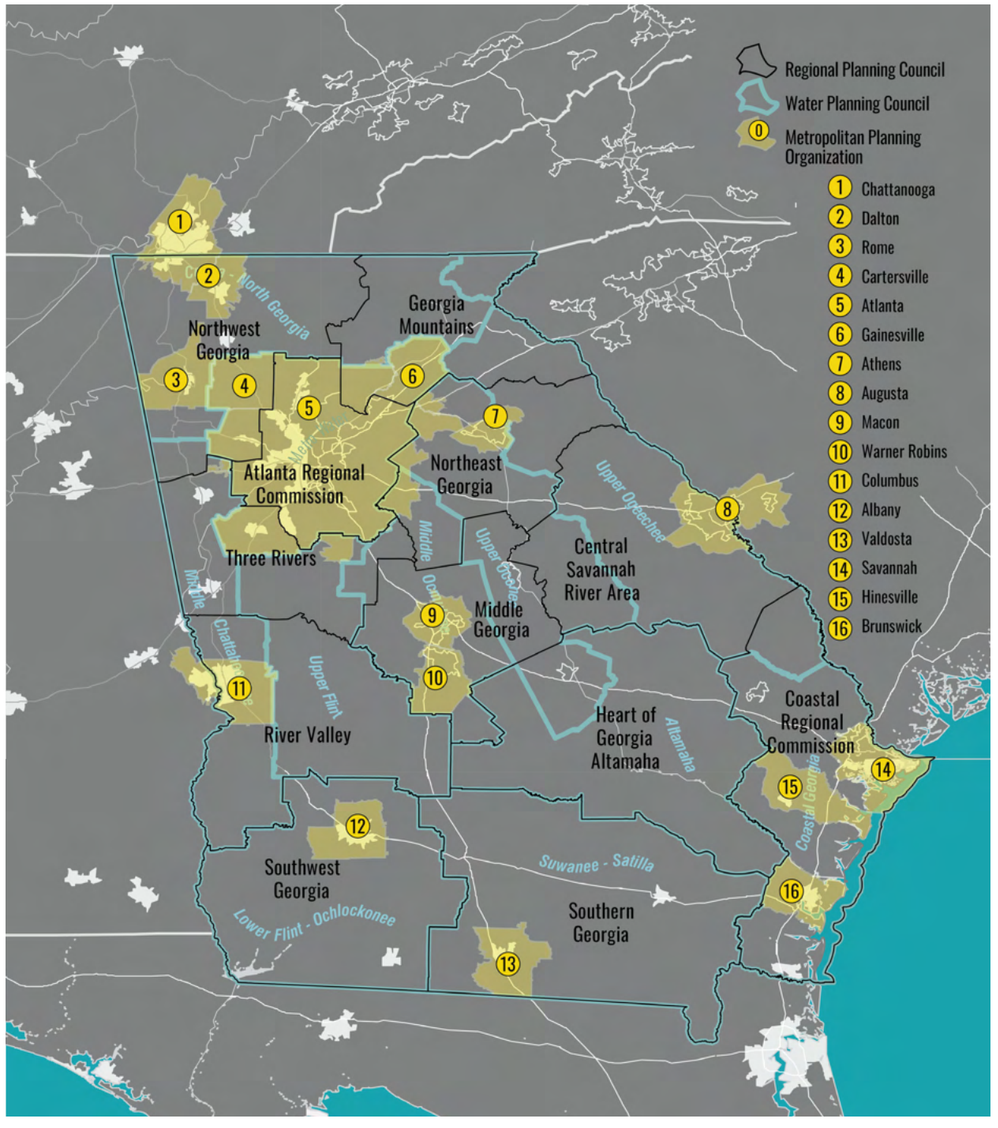


Figure 11: *Regional planning council and water planning council boundaries that could be utilized for cross-jurisdictional cooperation within the state.*

Building upon existing cross-jurisdictional networks

A number of cross-jurisdictional networks exist around the state. Building on these collaborations is a smart way to quickly increase capacity and coordinate resilience efforts.

Organizations vary in focus area and level of authority. Examples include Metropolitan Planning Organizations (MPOs), the Atlanta Regional Commission, the Metropolitan North Georgia Water Planning District, the Georgia Association of Regional Commissions and Regional Water Commissions (NE/MGA; Augusta), as well as the Georgia Association of Conservation Districts (GACD).

The **Limestone Valley Soil and Water Conservation District (S&WCD)** works across five counties in Northern Georgia to conserve Georgia's natural resources, further statewide conservation goals, educate stakeholders about natural resource stewardship and improve the quality of life for citizens through best management practices of conservation of natural resources (GACD, 2025).

The **Lower Flint-Ochlockonee River Basin's approach** to solving challenges with water availability included a roundtable where the water policy research center in Albany discussed balancing ecosystem health and habitat conservation with water consumption evolved into a multi-million-dollar project combining policy development (such as GA HB143) with physical interventions, including 240 deep aquifer wells across Southwest Georgia aimed to restore water ecosystems and the agricultural sector.

This also shifted responsibility for meter installation and monitoring to the Georgia Environmental Protection Division (EPD) and reduced the regulatory burden on farmers. This step was essential in mitigating drought in the future and building water and food security in the face of future hazards.

This initiative is a product of watershed-based planning, and could be scaled across state borders, such as the Apalachicola-Chattahoochee-Flint (ACF) stakeholders' group, which expands across Georgia, Florida and Alabama. Multi-state drought exercises across agencies and sectors were possible because of long-term solid relationships (SWGA).

Sprewell Bluff Park, Upson County, Georgia

The **Chattahoochee Fall Line Prescribed Fire Cooperative** unites federal, state, private and non-governmental partners in increasing the frequency, quality and quantity of prescribed burns on private land, with the mission of reducing the risk of catastrophic wildfires and restoring native ecosystems in West Central Georgia. Their ultimate goal is to increase the percentage of land burned in this area from 4% to 20-30%. This cooperative led to further organizing when leaders realized that local landowners were unaware of available services and programs–in response, landowners formed the West Central Georgia Forest Landowners Association, which facilitates communication between landowners and agencies (GFC 2025a).

The **Sentinel Landscape Program** provides another example of these partnerships, connecting agricultural and recreational spaces with military resiliency. In Georgia, this partnership covers a large portion of the southern half of the state and serves as a way to align the objectives of military, conservation and agricultural stakeholders to strengthen military readiness while concurrently conserving and supporting sustainable agricultural and forestry initiatives, promoting coastal resiliency and improving water quality (NEGA; Sentinel Landscapes, 2018).

Another relevant conservation-military partnership is the **Readiness and Environmental Protection Integration (REPI) Program** by the Department of Defense, which aims to support both natural resources and military missions through collaborations with other federal agencies, state and local governments, and nonprofit organizations. This program works with these partners on cost-sharing and development decisions to bolster multi-entity benefits near military installations, simultaneously supporting installation resilience and protecting surrounding environments (DOD REPI, 2025).

Fort Stewart-Hunter Army Airfield, US Army

As the state continues to develop and deepen these cross-jurisdictional channels of communication, it can also look to the examples provided by other states. For example, South Carolina has implemented watershed-level resilience coordinators, who engage local communities, gather input and develop tailored plans that prioritize resilience projects.

These plans aim to balance upstream and downstream needs, ensuring that solutions in one area do not exacerbate problems elsewhere. By moving beyond jurisdictional boundaries and considering the entire watershed, the approach emphasizes natural infrastructure, such as slowing water flow rather than simply diverting it or "getting a bigger pipe."

The watershed plans will include prioritized projects, some with preliminary engineering designs, to make them "shovel-ready" for future funding opportunities. The goal is to empower local communities, especially in rural areas, to better prepare for and respond to climate risks while fostering collaboration across regions. While South Carolina is still early in this process, they hope to eventually be able to provide templates for other states looking to implement similar programs (SCOR).

Watershed coordinators serve an additional purpose, filling a gap that was mentioned throughout Georgia convenings: short-term leadership in local government leads to short-term, inconsistent efforts. South Carolina also initially faced this problem: when the South Carolina Office of Resilience aided with a short-term resilience effort, the grant eventually ended, and communities were left without support or a continuation plan. This does not ensure long-term impact and, in turn, does not serve resilience planning, which is inherently long-term and consistent.

However, with the addition of watershed coordinators on staff, communities have continued support. This provides yet another justification for the state-funded watershed coordinators: their positions are not subject to the variability and limitations of grant funding, and they ensure long-term capacity building (SCOR).

Mutual Aid agreements and taskforce models

Formalized relationships across sectors and jurisdictions can ensure collaboration in the face of threats that don't follow jurisdictional boundaries. Several potential opportunities exist already in the state of Georgia, including:

- The Georgia Mutual Aid Group (GMAG), which could be expanded to include infrastructure

- The Georgia Geospatial Information Office (GIO), which put forward the idea of creating memorandums of agreement (MOAs) for municipalities and counties to join a data program to share their latest datasets (including streets, parcels, addresses, etc.) in order to receive free access to state-purchased high-resolution imagery (GIO, 2018)

GIO's suggested model has already been used for managing roads throughout the state. When the Georgia Department of Transportation (GDOT) became responsible for managing a much larger percentage of roads in the state, it experienced a 540% data increase overnight.

GIO proposed using regional governments to build a web of validated data across Georgia's 700 local governments, with the result of comprehensive and accurate local road data (Ad hoc meetings). This low-cost, high-impact partnership serves as an example of how a similar model could be applied to resilience.

As a representative from GIO stated, "Hazard mitigation cannot be solely based on city limits. Floods, fire and hurricanes don't check IDs at county lines. The GIO recognizes that the regional scale is the only scale that makes sense for climate resilience and infrastructure coordination. Regional planning councils can be used to divide up the work—by watersheds, not ZIP codes, and these are validated" (NE/MGA; Augusta).

3. Modernized Infrastructure

Below are examples of infrastructure upgrades already being implemented in Georgia.

Resilient Water Supply Systems

During emergencies, access to fresh water is essential. However, flooding, damage to water treatment plants and pipes and loss of electricity can all limit access. Municipalities across Georgia are using innovative solutions to ensure they can offer fresh water to their citizens.

For example, the Macon Water Authority, in partnership with Jones County, established a brand-new reservoir: Javors Lucas Lake. This new reservoir has significantly greater water capacity to provide services throughout the area, thanks to higher elevation, increased water holding capacity and a new water treatment facility.

This improvement demonstrates adaptation following disaster. A convening member from Northeast Georgia explained, "The water authority used to have an intake directly on the Ocmulgee River and would treat it at a plant that was in the floodplain, and when the flood of 1994 happened, it ended up basically flooding that treatment facility, which I understand is actually relatively similar to a problem that Augusta just now had with Hurricane Helene" (NGA).

Municipalities can also maintain a resilient potable water distribution system by performing a failure analysis to identify where breaks could take large portions of the system offline. With this information, they can then work to strengthen and protect those areas.

This can be particularly important as potable water distribution systems are typically segmented in interconnected loops, with frequent shut-off valves to isolate broken lines and maintain system pressure. After Helene, the system in Augusta had so many breaks that it was difficult to pressurize the system (Augusta).

Resilient systems build in redundancy, including secondary water sources, where possible, as well as back-up power to assure continued operation of pumps and other equipment.

Overall, municipalities can help ensure access to fresh water in several different ways: choosing wise locations for water treatment facilities, running failure analysis to preemptively identify problem areas in the system and building backups for water access in case of emergencies.

Strong Agriculture and Food Systems

As of 2022, 42,439 Georgia farms covered 9,953,730 acres of land, averaging 235 acres each (Georgia Farm Bureau, 2025). Food and fiber production and related industries contributed approximately $91.4 billion annually to Georgia's $1.4 trillion economy in 2023 and created more than 381,200 jobs.

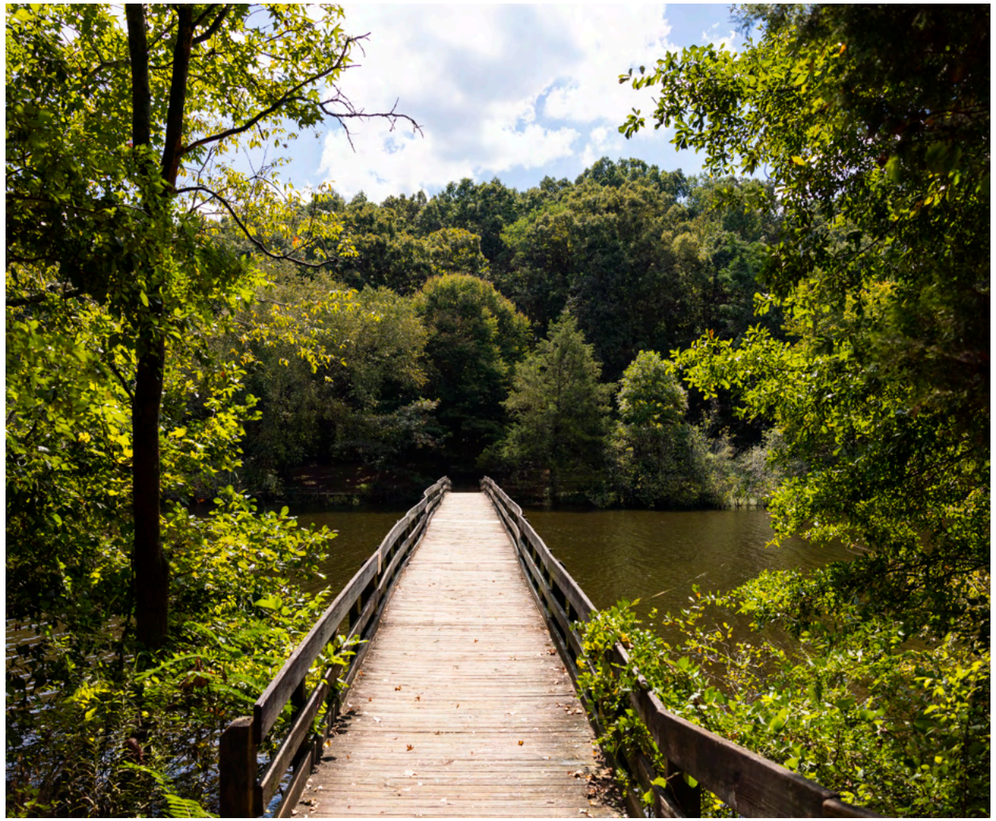
Georgia's commodities represent a value of over $17.6 billion to the state's economy (UGA CAES, 2025a). This lends perspective to the $6.46 billion agricultural and forestry damages from Hurricane Helene—resilience in agricultural systems has the potential to protect an extremely significant portion of Georgia's economy (Kolich, 2024; UGA Extension, 2024).

Georgia farmers operate under demanding year-round schedules and now contend with intensifying droughts that demand adaptive irrigation strategies, rising temperatures that threaten crops and fruit viability, and extreme wind events that impact crops and orchards. Resilience planning, along with investments in distribution infrastructure and establishment of new statewide partnerships, can bolster the economic security of these hard-working Georgians.

The Georgia Flow Incentive Trust (GA-FIT) is a partnership with Georgia farmers in the Flint River Basin to develop effective irrigation techniques in response to drought. The Drought SWAP program, in coordination with the Georgia Water Planning & Policy Center, the Georgia EPD and the Golden Triangle RC&D, provides farms that rely on surface water for irrigation with new groundwater wells that would especially help them during drought spells (GA-FIT Drought SWAP, 2025).

The Drought SWAP program aims to improve drought-year streamflows in the Lower Flint River Basin. Farmers can check for eligibility by meeting a set of criteria, including operating an active surface water irrigation system within the project area in multiple counties (GA-FIT Drought SWAP, 2025). GA-FIT is also developing the Habitat Conservation Plan (HCP), which targets freshwater mussels and the regional agricultural economy (GA-FIT HCP, 2025).

The Limestone Valley Resource Conservation and Development Council (RC&D) is working on a proposal to provide financial assistance to farmers for agricultural Best Management Practices (BMPs), among other water quality-related projects. These include bolstering creek banks with stakes and vegetation to prevent erosion and implementing nutrient management practices to reduce fertilizer and manure runoff into waterways (Limestone Valley RC&D, 2025).



Multi-Objective Waterway Crossings

Waterway crossings—where roadways are carried over water bodies such as streams and rivers—can cause roads to become impassable during high flow events. The consequences of these impassable roadways are exacerbated during severe storms and hurricanes, when flooded roads can prevent evacuation or access to medical care and other essential resources.

A common cause of this flooding is linked to undersized conveyance structures (such as culverts and bridges), which restrict water flow, cause back-ups and lead to overtopping (GA-ACT, 2021). Typical design standards of the crossings utilize antiquated data, such as NOAA Atlas 14, and oftentimes do not account for future conditions within the structure's watershed that could alter the flows the structure experiences (GDOT, 2025a).

In addition to roadway serviceability concerns, these structures often serve as a barrier for both terrestrial wildlife and aquatic organisms. Terrestrial wildlife, such as deer, that utilize streams and rivers as corridors to travel, are forced to cross roadways at these locations, sometimes resulting in vehicular collisions. Where these structures restrict the channel or have an outlet that is higher than the streambed, the natural movement of aquatic organisms through the waterway is also disrupted. This can result in habitat fragmentation that reduces the habitat for these organisms.

The implementation of multi-objective waterway crossings at these road-waterway junctures aims to address not just human-related issues of these crossings, but also wildlife-related consequences. Multi-objective waterway crossing design is rooted in more comprehensive hydrologic and hydraulic analyses that project future conditions within the contributing watershed, such as changes in rainfall patterns and land use. This approach aims to provide adequately sized structures that minimize roadway overtopping throughout their design life.

Multi-objective crossings should also account for the criticality of the roadway, such as whether it is a hurricane evacuation route versus an infrequently used rural road, matching more robust design requirements to more critical routes. Requiring critical roadways, like hurricane evacuation routes, to be designed to convey much larger flows will better support necessary travel during emergencies.

These multi-objective waterway crossings also address the wildlife concern: creating space for wildlife passage can decrease wildlife-vehicle collisions and increase connectivity for aquatic organisms (GA-ACT, 2021). These crossings engineer with the environment, not against it, allowing the water body to behave more in line with its natural condition. Multi-objective waterway crossings produce more resilient crossings and are a win-win-win.

Participants in the North Georgia convening spoke about how they are already implementing these multi-objective waterway crossings locally, noting additional opportunities for both wildlife and humans to benefit from projects in more areas.

Upgrades to the Electrical Grid

Smart grids and switches are being considered to provide more adaptability in the grid system. Some of the discussion during the convenings included solutions that members are currently using to address the risk of electrical outages and system failures during severe weather, especially noting the risk of falling trees due to winds. A Northern Georgia participant noted, "…many people in that area don't want you in their yard and don't want you cutting that tree back. Those are the same people that are calling and complaining when their power goes out every storm. We've even implemented smart switches in the distribution system where this particular area doesn't want us to cut the trees. We're going to put a switch right there when a tree does fall, and we're going to keep everybody else on that circuit in power" (NGA).

Microgrids, which are local energy systems that can operate as "islands" or as part of the larger energy grid, offer advanced automation and control. Microgrids are especially useful during power outage events, ensuring uninterrupted power for businesses and municipalities (PowerSecure, 2025; NREL, 2025). Microgrid installations are receiving traction across the Southeast, including the Tech Square at Georgia Tech microgrid (Isles, 2021).

Another potential approach to decreasing outages includes burying central distribution lines (or "undergrounding"). This practice prevents outages due to falling trees and helps accelerate the restoration of power. However, undergrounding is expensive and labor-intensive, especially if bedrock is near the surface. By prioritizing undergrounding the distribution lines, the state can reduce the extent and duration of power outages (Fenrick & Getachew, 2012).

Participants of the Southwest Georgia convening spoke of silicone cable injections as a low-cost way to increase the longevity of underground cables and performance in the face of hazards (SWGA). The installation does not require prolonged excavation and is not labor-intensive. Injecting silicone fluid into the insulation of aging underground cables can rejuvenate them, reduce service disruption and extend their lifespan by 30 years (SWGA).

Georgia Power's response to Hurricane Helene offers a compelling example of scalable resilience models. When the hurricane struck, it left more than 1.5 million customers without power, damaged more than 11,800 utility poles, downed over 1,500 miles of power lines and damaged more than 5,800 transformers in 53 counties that were declared major disaster areas by FEMA. Despite this disruption, Georgia Power restored power for over 523,000 customers within the first 48 hours and reached 95% restoration within 8 days (Georgia Power, 2024b).

This was made possible through two main strategies. First, the company has made investments in "self-healing" technology, which enables a system to automatically respond to outages, reducing interruptions (Georgia Power, 2025). More than 60% of the company's distribution grid uses these self-healing technologies. Thanks to this technology, Georgia Power reported 15% fewer power outages and restoration times an average of 27 minutes faster than the previous year (Georgia Power, 2025).

The second strategy is a coordinated, multi-scalar response in logistics and interagency collaboration. Across the state, a team of 20,000 personnel including workers from 35 partner companies across the United States and Canada came together to form a response team with 12 staging sites.

This seamless emergency response operation was essential to restore power to citizens in Georgia. Equally important is the scaffolding of mutual assistance agreements that was built well before the disaster, enabling swift and coordinated efforts. The robust network of material vendors and state partners like Alabama and Mississippi Power hastened recovery. This approach, combining strategic infrastructure development and the cultivation of collaborative partnerships, is a great representation of what can be accomplished when long-term resilience strategies and investments are developed before disaster strikes.

Georgia is also working to improve its detection of rain events in the Atlanta and Northeast Georgia region: the University of Georgia and Georgia Tech recently purchased a radar system that is providing additional weather monitoring, while a private company called Climavision is helping to fill radar gaps within the state. Its system can help with rainfall intensity and severe storms.

4. Multi-benefit hybrid and natural infrastructure projects

Working with our natural infrastructure

According to the Institute for Resilient Infrastructure Systems, "Infrastructure is more than just roads and buildings; it is also everything from forests, which purify our drinking water, to river floodplains, which reduce damage to homes downstream during storms. Natural infrastructure uses natural processes and ecosystem services to support engineering objectives, such as reducing flood damage and ensuring safe and ample water supplies" (UGA IRIS, 2021). Alongside flood risk reduction, stormwater storage, erosion control, air and water quality improvement and heat mitigation, natural infrastructure features also provide habitat for wildlife and recreation space for communities.

Georgia is rich with natural infrastructure. On the coast, its marshes are among the largest and most productive in the country. Inland, vast forested areas purify air and water, control erosion, serve as habitat for wildlife and make for beautiful recreation spaces (GADNR, 2025; GFC, 2025b). The state's rivers and streams are also home to some of the most biodiverse aquatic ecosystems on the planet (Elkins et al., 2019) and Georgia's rich coastal plain supports abundant agriculture (UGA CAES, 2025b).

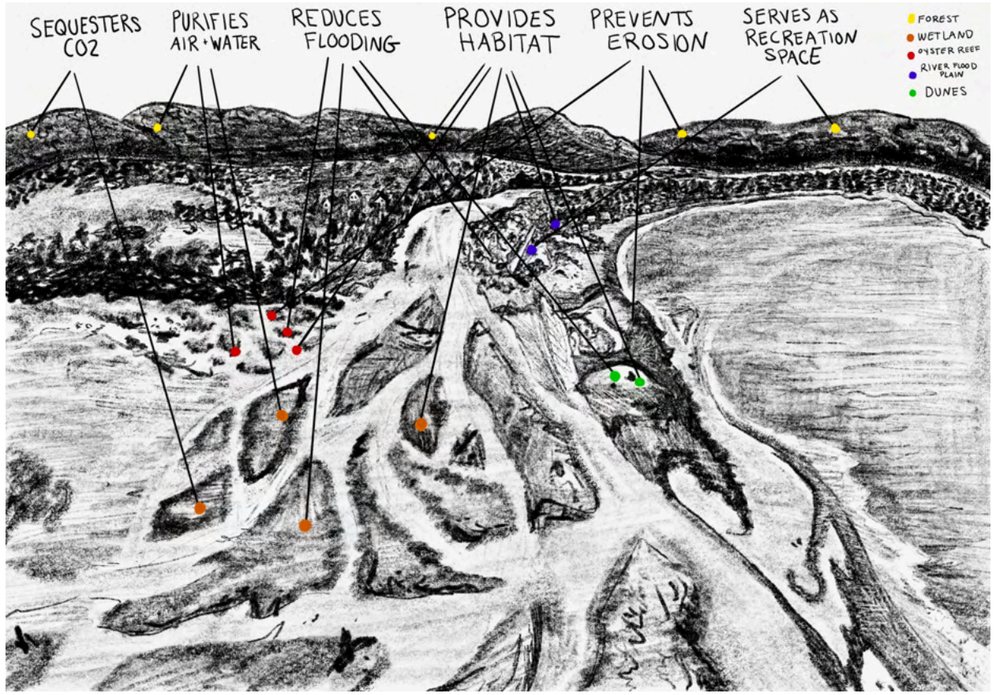


Figure 12. *Illustration depicting how natural infrastructure across landscapes provides ecosystem services.*

When combined with human innovation and conventional infrastructure, natural infrastructure can help address longstanding problems. For example, levee setbacks create floodplains up and downstream from developed areas. These floodplains support wildlife habitat and provide space for the river to spread out, so that stormwater fills floodplains and reduces flooding in cities and towns (Chambers et al., 2024).

The benefits of natural infrastructure are not constrained to rural areas. Availability of open green spaces is traditionally linked to well-being and livability in cities and towns, improving both physical and mental health in neighborhoods nearby (Lee et al., 2015).

Evidence also suggests that natural infrastructure approaches can be as cost-effective as conventional approaches (Vicarelli et al., 2024; Narayan et al., 2016): natural infrastructure delivers a broader array of benefits and can recover from hazards and adapt to ongoing changes.

In the City of Tybee Island's Natural Infrastructure Master Plan, modeling comparisons of flood reduction with and without natural infrastructure showed that natural infrastructure features performed better than conventional infrastructure during moderate and high flood events, while conventional infrastructure played the most important role during low flood events (Robertson et al., 2023).

These results speak to the importance of natural infrastructure not as an afterthought, but as a primary tool in building the resilience of communities.

Researchers are still learning about the many functions of natural spaces. For instance, during the convenings, participants spoke of how open, natural areas may also play an important role in providing communities with the space to recover. Convening participants reported that urban green spaces were vital during post-hurricane recovery. Open spaces, such as grassy and vegetated areas, which don't serve an operational function in day-to-day city life (like that of a parking lot), offered temporary debris storage and aid distribution sites during the city of Augusta's recovery efforts from Hurricane Helene (Augusta).

Through strategic planning, wise risk assessment and a marriage of conventional and natural infrastructure, these natural features can be supported in helping to create a more resilient Georgia.

Holding space for recreation and stormwater

In Dalton, the Mill Creek Trails and Park System was built within a floodplain to support recreation and a holding space for stormwater in extreme rainfall events. This was made possible because it was designed to flood. After a severe event, the trail system is submerged as Mill Creek reaches its flood stage. The interruption of leisure services during extreme weather is a low-cost tradeoff that allows recreational spaces to absorb floodwaters - minimizing damage to homes and critical infrastructure (NGA).

Jones County in Middle Georgia received land and water conservation funding for green space improvements to help preserve a buffer around the reservoir. Along the Ocmulgee River itself, Macon County created additional floodplain storage through the installation of the Ocmulgee Heritage Trail, which is designed to run the entire length of the river through Macon.

By investing in hybrid infrastructure solutions, which combine the natural infrastructure benefits of a floodplain with the added benefits of built infrastructure, such as the trail, the community has created a buffer that contains flooding within an area where risks to property are decreased.

This includes a park on the side of the old water treatment facility and boat ramps that help make the river an asset while managing where the river flows and what it floods when waters rise (NE/MGA).

Educational stormwater management

The nexus between natural infrastructure and education can benefit student learning and well-being and provide green space for recreation. At the same time, green spaces in educational settings can help buffer schools through the absorption of stormwater and offer protection from extreme temperatures. This link was mentioned in the convenings as an important multi-benefit of natural infrastructure.

Georgia has several examples of elementary schools with outdoor learning environments that double as avenues to water stewardship, food production and habitat.

- Roswell Elementary School installed an outdoor classroom complete with rain barrels and gardens in 2021 (Edible Schoolyard Project, 2025).
- Carrollton Elementary School used a Georgia Outdoor Learning Demonstration (GOLD) grant to install an observation deck and boardwalks to allow students to safely interact with nearby Buffalo Creek in 2025 (Carrollton City Schools, 2025).
- Acworth Elementary School has an Outdoor Learning Lab complete with weather instrumentation, gardens and a compost bin (Acworth Elementary School, 2025).

These programs can educate the next generation about resilience and serve as a tool to address knowledge gaps and buy-in.

Incentivized stewardship of private land

Natural infrastructure grants tend to focus on public property. However, there is immense potential for impact in retrofitting private property with natural infrastructure features to maximize multi-benefits, including stormwater retention and habitat, as well as for encouraging stewardship of the forests, wetlands and floodplains on private properties.

Members of the Southeast Georgia convening advocated for creating new programs –in addition to existing conservation tax credit incentives–that would promote protection of floodplains, wetlands and forested land. As one participant explained, “I think there needs to be some kind of funding mechanism[...] that gives property owners incentives–through ecosystem service payments or watershed protection payments–there’s got to be that [financial incentive] or we’re never going to reach our goal of protecting our watersheds and protecting our floodplains, which benefits everyone” (SEGA).

In Macon, a program is in place to incentivize green infrastructure (a type of natural infrastructure specific to stormwater management) on private property to support homeowners integrating retrofits into their own backyards. The Macon Water Authority provides a Stormwater Service Fee Credit, which ties stormwater fee reductions to green infrastructure improvements that reduce stormwater runoff or improve water quality (e.g., retention ponds, rain gardens) (NGA; NE/MGA; MWA, 2025).

Ecological benefits through the Better Back Roads project

Dirt roads, which are pervasive throughout rural Georgia, are a source of sedimentation that directly impacts human and ecological health. Rain events cause runoff from dirt roads, which degrades water quality, road functionality and (Golden Triangle RC&D, 2025; Clinton & Vose, 2003).

Although these roads provide critical linkages between communities and rural areas, they frequently wash out during heavy rainfall. A strategic alliance between the Golden Triangle RC&D, the Georgia EPD and the local soil and water conservation districts, Better Back Roads project, launched a multi-year, multi-jurisdictional collaboration to implement a field-tested suite of erosion control strategies, including erosion matting, roadbed stabilization, culvert repair and ditch shaping. This effort began by assessing two counties and expanded to 16, resulting in a coordinated process to identify, prioritize and improve dirt roads (Golden Triangle RC&D, 2025; SWGA).

GAPED 319(h) funded the project and improved 2,368 linear feet of road around Gill Pond and 888 linear feet along Fox Creek, two vital water bodies located within the Kinchafoonee Watershed in Webster County. This project symbolizes a successful integration of watershed-based planning and interagency multi-jurisdictional collaboration with strategic interventions to restore natural landscapes and integrate resilient transportation planning in rural Georgia (SWGA).

Image 1. *An image of Jack Pierson Mitchell County crush and run installation and ditch work from the Better Back Roads project.*

5. Resilient Georgians for a resilient state

Throughout every meeting, members emphasized the foundation for a resilient community: trust and mutual respect. As a representative from Tybee Island said, “You have to start the journey, then you build a rhythm, you build relationships, you build trust” (Ad hoc meetings).

Even with the absence of much-needed formal communication channels, the strength of relationships across sectors enables communities to collaborate and function under duress. These relationships form organically when parties possess credible, field-tested expertise and aligned interests to achieve positive outcomes in the face of adversity.

This opens a rich set of opportunities to support the human factor of resilience. The following are guiding principles for supporting communities as they address resilience, drawn from statements made throughout the convenings:

- **Center local expertise input in planning and policy:** Build resilience plans and supporting legislation with local input instead of around it.
- **Support sustained professional capacity:** Invest in the development and retention of skilled subject-matter experts in planning for resilience and emergency management. This includes funding support and regular scenario-based training programs to keep knowledge and protocols fresh.
- **Prevent burnout and prioritize well-being:** Improve working and living conditions for public sector professionals to reduce their workload during emergencies, sustain their engagement during recovery, and refresh them for planning and adaptation following disasters. This will pave the way for institutional knowledge transfer and better prepare communities by providing space to implement lessons learned.

CONCLUSION

The opportunities outlined in this section reflect the breadth of pathways available to Georgia as it strengthens its resilience. Georgia is not starting from scratch: much has already been accomplished to bolster the state’s infrastructure, ecosystems, funding, governance and the professional capacity of its people.

The state is now positioned to build upon a growing body of local successes, targeted interventions and cross-sector partnerships already delivering tangible results. The diversity of these approaches underscores an important reality: resilience is not a single solution, but an evolving practice that can be tailored to the unique needs of each community.

The following section discusses a series of exemplary projects that illustrate how these opportunities are already being translated into comprehensive plans, offering models that can inform and inspire further efforts across the state.

EXEMPLARS

Georgia is already home to several examples of innovative and informed resilience planning at the local and regional level. With communities increasingly facing the impacts of extreme weather, sea level rise, and aging infrastructure, some municipalities have begun to develop cohesive resilience plans that provide a roadmap for others to follow.

This section will highlight six exemplars of resilience planning within the state of Georgia:

1. Camden County Resiliency Implementation Workplan
2. Chatham County Resilience Plan
3. Albany and Dougherty County Resiliency Playbook
4. Tybee Island Natural Infrastructure Master Plan
5. Mapping Flood Vulnerability in the Savannah Metro Area
6. Atlanta Regional Commission Regional Resilience Plan

While there are many exemplary resilience planning projects in Georgia, these particular efforts were chosen because of their differing geographies and approaches.

Finally, this section will discuss the commonalities between each exemplar for replication in developing a statewide resilience plan.

A statewide resilience initiative should catalyze community and regional efforts to evaluate and map future risks, spur local hazard planning, coordinate activities across local and regional actors, and prioritize natural infrastructure approaches.

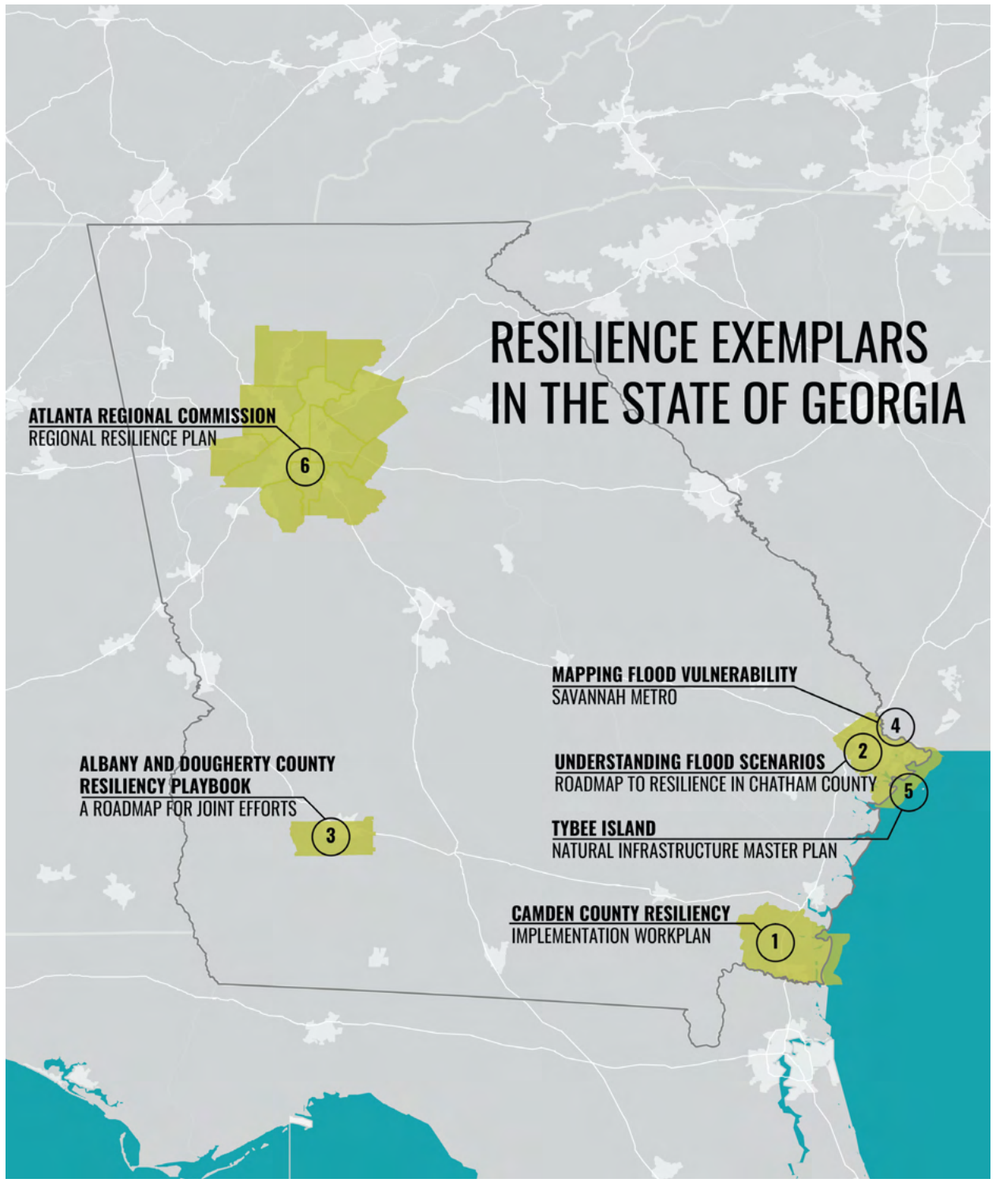


Figure 13. *Map of exemplars by location.*

1. Camden County Resiliency Implementation Workplan

Summary

The Camden County Resiliency Implementation Workplan was developed between 2019 and 2022 in response to concerns over flooding from storm surges, particularly in areas with concentrated development. Between Hurricane Matthew in 2016 and Irma in 2017, hundreds of homes were left with flood damage.

Additionally, hazards from sea level rise were labeled as critical in a recent Hazard Mitigation Plan–potentially compromising the function of the only naval base capable of supporting ballistic missile and guided missile submarines in the Atlantic: Naval Submarine Base, Kings Bay. Resilience leaders built this Implementation Workplan on a foundation of other resilience work in the area.

They laid out the long-term goals of increasing community capacity for resilience, awareness of adaptation needs, and planning and implementation of resiliency projects. The broader goals are supported by the execution of seven key outputs:

1. A stakeholder group to steer and inform the project
2. A community resiliency inventory of existing plans and findings
3. A sea level rise and flooding vulnerability assessment
4. Stakeholder engagement through interviews and a public survey
5. A resiliency infrastructure prioritization tool
6. Shoreline/resiliency management practices
7. The Resiliency Implementation Workplan

Core Project Team:

The Nature Conservancy

Goodwyn Mills Cawood, LLC

Carl Vinson Institute of Government at the University of Georgia/Georgia Sea Grant Legal Program

Stakeholder Committee:

Camden County

Georgia City of Kingsland

Georgia City of St. Marys

Georgia City of Woodbine

Georgia Naval Submarine Base Kings Bay

National Park Service– Cumberland Island National Seashore

Little Cumberland Island Homes Association

Southeast Regional Partnership for Planning and Sustainability (SERPPAS)

Georgia Sentinel Landscape Partnership

Georgia Department of Natural Resources– Coastal Resources Division

U.S. Army Corps of Engineers

Georgia Conservancy

St. Marys Riverkeeper

UGA Marine Extension and Georgia Sea Grant

UGA Camden County Cooperative Extension

Green Infrastructure Center, Inc.

Community Resiliency Inventory

The resilience planning process began with a review of existing documents, tools, data and other local plans to use as a foundation for a more comprehensive document. It also listed relevant hazards as included in prior plans. Concerns included sea level rise, flooding, development in flood-prone areas, erosion and water contamination. They also identified vulnerable areas and listed ongoing resilience projects and mitigation strategies.

Sea Level Rise and Flooding Vulnerability Assessment

Following the inventory, report authors ran analyses of the following areas in Camden County: Unincorporated Camden County Mainland, Cumberland Island, City of St. Marys, Little Cumberland Island, City of Kingsland, Kings Bay and City of Woodbine.

They utilized the NOAA Digital Coast Tool for county snapshots of how hazards could impact the economy and population. They also examined historical precipitation changes and sea level measurements and sea level rise projections.

Stakeholder Engagement

Resilience planners held targeted interviews with staff from each jurisdiction, administered a public survey, hosted an open house and met with other stakeholders to inform the process, build support for the plan and identify high-priority projects and vulnerable areas.

Project Prioritization and Implementation Plan

To prioritize projects and areas, the report authors developed a matrix using datasets from the Georgia Coastal Hazards Portal and then organized the resulting projects by prioritization level.

They also ranked infrastructure types by highest to lowest priority, starting with major roads, critical facilities and historical structures and ending with trails. Once they had ranked projects and areas, they listed potential funding sources for implementing these projects and included area-specific maps demarcated with project locations and descriptions.

Camden County Resiliency Implementation Workplan

2. Understanding Flood Scenarios: A Roadmap to Resilience in Chatham County, Georgia

Summary

The Understanding Flood Scenarios: A Roadmap to Resilience plan was developed in 2025 to provide a comprehensive flood resilience analysis for Chatham County. The analysis, which used the Interdependent Networked Community Resilience Modeling Environment (IN-CORE) platform, included future flood risk, identified vulnerable areas and communities, and developed a plan to help policymakers and stakeholders navigate climate impacts. The Roadmap was developed in response to risks from storm surges, tidal inundation and extreme precipitation.

Flood Hazard Scenarios and Damage Analysis

One of the key products of this roadmap was the generation of area-specific maps that overlay community resilience with flood risk using the IN-CORE platform and Climate Risk and Resilience Portal (ClimRR). To gain an accurate understanding of damage to buildings in different scenarios, the team used a building data inventory from the National Structures Inventory and then projected flood scenarios to the mid-2000s (2045-2054).

Following the modeling of different scenarios, the team estimated damage levels to buildings during the various flood simulations. They then generated housing units based on social data for each household, including data such as tenure status, race and household income, which are all linked to whether a household is able to evacuate during a flood event. Finally, the team comprehensively analyzed the economic impacts of flooding using Computable General Equilibrium (CGE) models.

Examining Current Planning Initiatives

Following this analysis, the roadmap listed the current flood resilience initiatives that pertained to the area and reviewed the key plans and ordinances that relate to flood resilience throughout the county. This included over 10 plans that date from 2015 to 2024, as well as flood damage prevention ordinances from surrounding areas with high risk of moderate to severe flooding.

They also looked at future land use to identify areas with a high likelihood of moderate to severe flood damage, and identified several key takeaways:

- Future land use in the most affected areas was dependent on the specific region
- Each of these vulnerable areas was expected to be designated for:
  - Future residential or commercial use,
  - Proximity to communities that rely heavily on transportation to and from their homes, or
  - Residential suburban single-family neighborhoods.

Recommendations

Based on analysis of flood hazard scenarios, economic impacts, damage estimations and future land use, the team compiled a list of recommendations. Key goals include preventing development in high-risk areas, integrating risk assessments into planning processes and prioritizing those actions over attempting to implement mitigation strategies.

Actions include:

1. Use studies to establish base flood elevation standards in building codes and a floodplain damage prevention ordinance.
2. Retrofit buildings at high risk of complete, severe and moderate damage.
3. Use the current report to enhance the Community Rating System (CRS) rating.
4. Revise future land use for high-risk areas in unincorporated Chatham County, Savannah, Thunderbolt and Tybee Island.
5. Discourage development in high-risk areas.

Finally, the team included a list of potential funding sources for communities to consider as they seek funding for resilience projects.

Understanding Flood Scenarios: A Roadmap To Resilience for Chatham County, GA

3. Albany and Dougherty County Resiliency Playbook: A Roadmap for Joint Efforts

Summary

The Albany and Dougherty County Resiliency Playbook was developed in August of 2024 in response to damage to public and private infrastructure. Hazards included tornadoes and high winds in June of 2023, which caused widespread power outages and damage to buildings, increasingly common flash flooding in downtown streets that causes both economic and safety concerns, and finally, recurrent thunderstorms that cause damage to structures and threaten safety. Additional concerns include the need for updated wastewater and stormwater infrastructure.

The playbook identifies actionable items as "plays" and lists each one with a description of the actions and key actors involved. These plays are intended as a starting place, not as the sole resilience-building actions taken by the community.

Plays include:

Play 1: ***Build a Resiliency Coalition***

Figure out who needs to be involved.

This play identifies the various agencies, community members and other individuals that need to be involved in maintaining the resilience of Albany and Dougherty County, their specific roles, and the resources required to respond to resilience needs. It includes a structure, next steps and roles required to create a successful resilience team.

Play 2: ***Provide Resiliency Communication Strategy***

Develop efficient communications procedures and norms between everyone involved.

The ability to communicate effectively across key actors is a foundation for any successful resilience strategy. This play involves opening the channel of communication between public agencies and grassroots community members and providing necessary resources. The play also includes recommended steps that will help members of the Resiliency Coalition communicate as they prepare for, respond to and recover from incidents.

Play 3: ***Prepare Local Infrastructure***

Figure out the current state of infrastructure and resources in the community.

This play will inventory Albany and Dougherty County land parcels and document their age, condition and impacts from disasters over time. It draws on the current zoning, building status, existing infrastructure and capacity for managing resources (including water, forestry and physical infrastructure). It includes recommendations for planning and zoning changes based on past resiliency experience.

Play 4: ***Targeted Resiliency Initiatives***

Identify resilience-building initiatives based on current infrastructure and exemplar communities.

This play develops goals and actions that agencies and partners can take based on the issues identified throughout the resiliency planning process. It draws from "peer communities" throughout the country, with similar sizes and populations, geographic characteristics, economic structures and resilience challenges.

Play 5: ***Building Economic Resilience***

Assess other sectors that may be causing vulnerabilities within the community; in this case, economic vulnerability.

This play addresses the pressing issue of economic resilience in Albany and Dougherty County. Natural disasters have caused the loss of businesses and workforce when workplaces, homes, infrastructure and private assets are unable to recover. Addressing this problem requires the incorporation of resilience into economic development and business strategies. d

4. Tybee Island - Natural Infrastructure Master Plan

Summary

The Tybee Island Natural Infrastructure Master Plan was developed in 2023 in response to the impacts of frequent storms and worsening flooding. A survey administered by the research team found that 76% of residents expected rising sea levels and a worsening of flooding (79%), erosion (79%) and coastal storms (68%); 84% of respondents felt that coastal infrastructure required fortification against these challenges; and many (68%) also felt that the coast needed to embrace a retreat adaptation strategy. The master plan sought to address these concerns through projects developed in conjunction with community members and tailored to the unique culture of Tybee Island.

Planning Framework

This project employed the nationally recognized planning framework first developed on Tybee Island:

1. Solicit input from local stakeholders.

2. Educate policymakers and residents on the risks of coastal hazards and potential ways to build resilience.

3. Build support for climate adaptation alternatives through virtual and in-person events.

Project Goal

To design an integrated, community-centered system that increases resilience to flooding on Tybee Island, protects and improves fish and wildlife habitat, acknowledges community values, considers cost and time to implementation and recognizes regulatory requirements and constraints.

Project Vision

To utilize green, gray, blue and hybrid infrastructure and adaptation measures to provide increased resilience to flooding, preserve natural habitat and improve connectivity throughout the island.

Green infrastructure: *natural land spaces and systems*

Blue infrastructure: *water resources*

Gray infrastructure: *human-made spaces and systems*

Hybrid infrastructure: *integrates green and gray systems*

Advisory Groups

The project sought advice from a range of professionals and residents through the project phases, which ultimately informed the project's methods, analyses and findings.

Two groups advised on the project:

Technical Advisory Group

- **Federal employees** from the U.S. Army Corps of Engineers, National Fish and Wildlife Foundation (NFWF), NOAA and Representative Buddy Carter's Savannah Office
- **State employees** from the Georgia Department of Natural Resources Coastal Resources Division and the Georgia Emergency Management Agency
- **Local agents** from Chatham County-Savannah Metropolitan Planning Commission, Chatham Emergency Management Agency, Chatham County, City of Savannah and the City of Tybee Island
- **NGO representatives** from the Georgia Conservancy and One Hundred Miles
- **Private Sector representatives** from Goodwyn, Mills and Cawood and Thomas and Hutton
- **Academic faculty and staff** from the University of Georgia and Georgia Institute of Technology

Resident Advisory Group

Tybee Island...

- Residents
- Business leaders
- Planning commission
- Beach Task Force
- City Staff

Emily Kenworthy, UGA

Design Charette

The team invited advisory members to participate in a five-hour virtual design charette to develop a shared vision for the project using mapping and collaborative design tools. Specifically, they sought a unified vision that would increase Tybee Island's resilience to flooding while addressing the priorities of community members and boosting ecological health. Designs included different areas of the island and considered policy recommendations, natural and conventional infrastructure solutions and land use modifications.

Natural Infrastructure Design

The community of Tybee Island specifically wanted to find solutions that would reduce flood risk while also providing an array of ecological co-benefits, like supporting fish and wildlife populations. For this reason, they focused on adding natural infrastructure elements and improving conventional infrastructure.

On the low-lying western side of the island (where the worst impacts of inundation are taking place), they wanted to support the already existing marsh, which was facing threats from "coastal squeeze," or when marshes reach vertical structures and so are unable to migrate further onto land as sea levels rise, they eventually drown. This included enhancing marsh habitat, controlling erosion, increasing marsh connectivity, improving water quality and providing pathways for the marsh to migrate. They also planned to construct living shorelines in areas adjacent to the marsh.

Hybrid solutions on the western side of the island included installing a horizontal levee along one of the main thoroughfares, raising the road's elevation, enlarging culverts and installing bike and walking paths.

Another important element in improving the resilience of Tybee Island was ensuring access to the sole entrance road to the island—Butler Avenue. The author suggested building on updates to the road by the Georgia Department of Transportation already underway, including "curb-cut" rain gardens planted with native vegetation, which would capture pollutants and connect habitat from the north and south ends of the island.

Additional elements included encouraging residents to participate in rainwater harvesting and creating a pocket park that would support conventional infrastructure by reducing water volumes.

In models, the project team found that natural infrastructure provided more benefits during large storm events. While conventional infrastructure was able to handle influxes of stormwater during smaller events, in intermediate and large storms, natural infrastructure provided a 3.5% improvement island-wide and 87% of the total reduction that the implemented solutions provided. These findings suggest that natural and conventional infrastructure work best in conjunction with each other.

Outcomes

The resulting plan, which was co-developed by a project team that included community members, AWR Strategic Consulting and the University of Georgia, sought to provide a range of options to residents, from small changes (like using permeable pavers and installing rain gardens to offset stormwater), to landscape-scale changes (such as raising the main thoroughfare and installing a berm, or constructing a living shoreline that would stabilize the shoreline while providing a pathway for marsh migration).

The development of these options went through multiple steps, including:

1) Preparing conceptual project designs,
2) Assessing potential project sites,
3) Evaluating risk reduction benefits, and
4) Beginning preliminary engagement with permitting agencies

Models based on these design alternatives were ground-truthed through review of baseline data from water level sensors, marsh cores, rain gauges and groundwater wells that provided information on hydrodynamic, infiltration and marsh accretion processes.

Next Steps

The project team listed several next steps, including collaborating with partners, educating residents about natural infrastructure features, providing training on swale maintenance, seeking funding to incentivize adoption of rain storage practices and engaging residents in the projection of the marsh.

They also listed additional steps for forwarding research efforts, including updating modeling, assessing functionality of added features and analyzing optimal locations for buy-outs of repetitive loss properties.

On the funding side, the project team suggested applying for specific grants, investigating creative ways to secure matching funds for project proposals, leveraging the plan to access state, federal and private sector funding, building relationships with permitting and regulatory agencies, and integrating natural infrastructure into current and future planning.

Tybee Island Natural Infrastructure Master Plan

5. Mapping Flood Vulnerability in the Savannah Metro Area

Introduction

In 2023, the Savannah Metro Area collaborated with University of Georgia researchers to develop a plan for improvements to transportation infrastructure in response to rising sea levels and more frequent and intense storms. This region is of particular interest because of two critical infrastructure areas: Fort Stewart and Hunter Army Airfield, which are jointly operated out of the Savannah metropolitan area and serve over 65,000 people–including over 15,000 active-duty military members whose functions are critical to national security. The communities worked with researchers to compile data from FEMA's flood risk analyses, the Centers for Disease Control and Prevention's (CDC) Social Vulnerability Index and geospatial data regarding roads and critical infrastructure to map flood risks

Assessing risks to the community

The report begins by assessing threats to the community from natural hazards like flooding and storms. The main threats identified included:

- Pluvial flooding (what happens when rainfall intensity overcomes the infiltration capacity of the ground)
- Fluvial flooding (when water overflows from a river or stream bank)
- Coastal storms (which can cause high winds and storm surges)
- Groundwater rise (a function of sea level rise that pushes freshwater higher into the water table and causes pooling water, destabilized roadways and reduced infiltration for stormwater).

Communities at risk

After assessing hazards, the researchers looked at community demographic information that might impact vulnerability to hazards. While the area was highly diverse across many factors, including employment, income, health status and education, specific features were relevant to resilience from flooding. The researchers found that capacity for resilience could decrease due to dependence on vehicles both for transportation to resources and employment and across an economy dependent on shipping and tourism. The presence of the two military installations also complicates matters; the military installations and surrounding communities rely on each other for personnel, employment and various other resources.

Social Vulnerability Index

After an overall assessment of the community at large, researchers used the Social Vulnerability Index to map areas where residents required more intervention from government and social institutions to prepare for and recover from flood events.

They found that in the Savannah Metro area, the main drivers of social vulnerability were socioeconomic status, housing type and transportation access.

Important questions:

Following the Social Vulnerability Index, the researchers turned their attention to two key questions: what will the future require, and how do we plan for it? In this section, they discuss how transportation planners can strive to incorporate hazards and social vulnerability into their transportation system planning.

They highlight the Savannah metropolitan area as an example of how complex modern and future transportation systems will need to be–with rail lines, roads, airports, bicycle paths and oceangoing vessels all connecting people to vital resources.

They recommend leaning on natural infrastructure to help support resilient transit systems, including protecting and restoring marshes and engineering stormwater wetlands to help absorb the impacts of flooding and storms. They also explore traditional approaches, such as utilizing novel materials for roadbed and surface construction, increasing the capacity of ditches and culverts and installing flood barriers.

In terms of how to plan for future transportation systems, they nod to the cooperative, comprehensive and continuing approach first recommended by the Federal Highway Act of 1962 and explain how metropolitan planning organizations (MPOs) work with state departments of transportation to develop long-range plans.

Finally, the report discusses how the 2021 Infrastructure Investment and Jobs Act created new funds for resilient transportation systems and encourages the adoption of protective features, including raising roadway grades, relocating roadways away from floodplains, installing properly sized drainage structures and culverts and utilizing natural infrastructure to mitigate risk of recurring damage to roadways and other transportation structures.

[*Mapping Flood Vulnerability in the Savannah Metro Area*]

Mapping vulnerability (Figure 14)

The team also identified the most vulnerable roadways by using the formula Flood Risk = Hazard x Vulnerability x Exposure, basing their hazard variable on data from FEMA's Flood Insurance Rate Maps to capture a range of potential conditions.

Additionally, they used data from the CDC's Social Vulnerability Index for their vulnerability variable and locally available data on roadways and other infrastructure for their exposure variable. They then combined those variables into a rapid risk assessment for the Savannah Metropolitan area, which could be used as a starting point for future transportation plans.

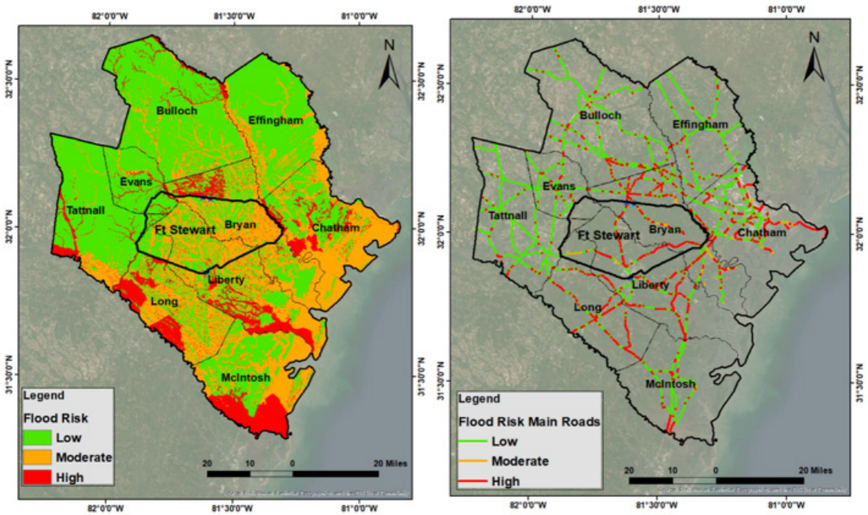
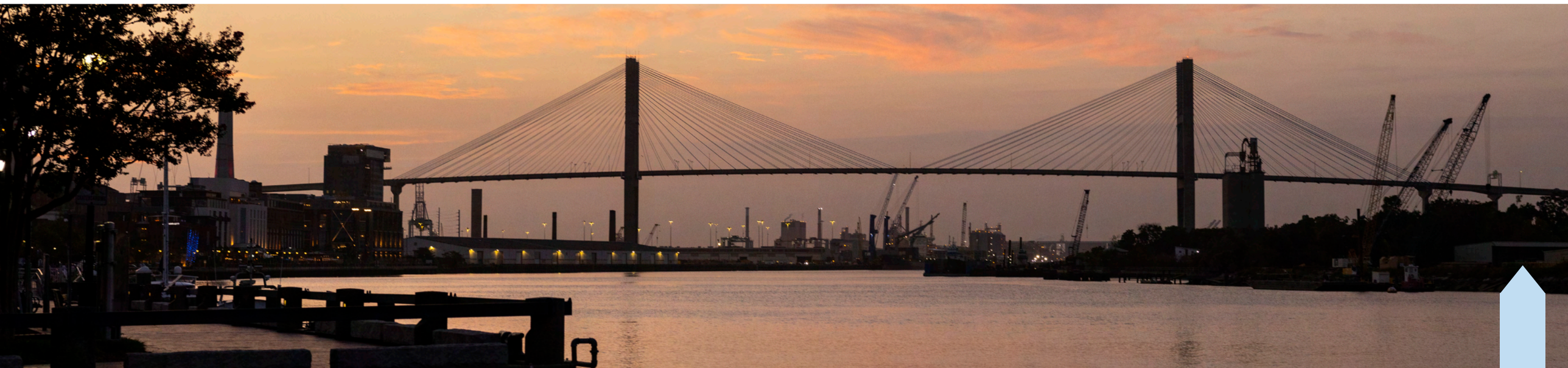


Figure 14. *Maps showing the results of the rapid risk assessments demonstrating high, intermediate and low flood risk across the study area (left) and main roads (right).*



6. Atlanta Regional Commission (ARC) Regional Resilience Plan

Summary

While not yet published at the time of reporting, this plan merited inclusion due to the vital role that it will play in preparing Georgia's largest metropolis for hazards. According to the ARC, "This plan would comprehensively assess Metro Atlanta's vulnerabilities to extreme weather. This extends across all of ARC's planning areas, including transportation, water, natural systems, health care and workforce development." Plan completion is anticipated in 2027.

The ARC Regional Resilience Plan spans five focal areas:

1. **Transportation**: Addressing disruptions caused by weather events like flooding, snow and extreme heat
2. **Water Management**: Improving water conservation and flood mitigation efforts
3. **Natural Systems:** Protecting and restoring natural lands to enhance resilience
4. **Energy:** Promoting clean energy solutions and energy efficiency
5. **Health**: Ensuring the health and safety of communities in the face of climate change

Finally, the plan will identify both short and long-term investments in infrastructure and other areas to improve resilience, building on existing initiatives like the Metro Atlanta Climate Action Plan (MACAP) and leveraging existing data from ARC and GDOT to inform analysis and recommendations. ARC is actively engaging with communities and stakeholders to gather input and ensure the plan reflects regional needs.

COMMON FEATURES

Resilience comes from more than just physical changes to communities; it spans social, ecological and technological systems. Each of these exemplars showcases the ways that communities can build resilience and includes elements of the four actions identified by a National Academy of Sciences, Engineering and Medicine (NASEM) workshop series in 2011: prepare, absorb, recover and adapt (*Figure 13*) (NASEM, 2012).

This workshop, and its resulting report, had the goal of "providing a rich foundation of information to help increase the nation's resilience through actionable recommendations and guidance on the best approaches to reduce adverse impacts from hazards and disasters" (NASEM, 2012).

The NASEM report also diagrammed a "continuous and reinforcing process of disaster risk management," which included the establishment of goals, hazard identification, risk assessment, risk strategies and decisions, implementation, review and evaluation, policy development and adjustment—all of which are utilized throughout each of these exemplars to move the needle on resilience in their communities.

The following section will describe how this process applies to the above exemplars in order to help elucidate how other communities can apply them in their own resilience planning.

Goals

It is important to set specific, measurable, achievable, relevant and time-bound goals as the first step in any planning process. Goal setting, paired with ensuring that planners share a clear vision, is crucial to successful resilience planning.

Several of the exemplars had explicitly stated goals and visions, wherein report authors laid out the intentions of the resilience planning process alongside a broad-scale vision. Others started with hazard identification before deciding on the direction and scope of actions. Goal setting aligns with the "preparation" phase of the prepare, absorb, recover, adapt cycle.

Hazard Identification

Hazard identification is the process of determining the most pressing challenges facing a region. This can include examining current hazards as well as future risks and threats. Each of the exemplars included multiple hazards of concern, shaped in part by lived experience with both acute and chronic challenges; many of the introductions named specific weather events and commonly occurring issues that their communities had recently faced. The "Mapping Flood Vulnerability in the Savannah Metro" report also included a section devoted to assessing future hazards.

Risk Assessment

Risk assessment includes assessing hazards spatially and socially to better understand the risks that they pose to specific areas and populations within a community. The above exemplars used a combination of modeling, input from community members and ground truthing to create a working picture of how hazards impact their communities, which can then be used to guide risk management.

Risk Strategies and Decision making

Resilience decision-making involves thinking strategically about risks in order to guide actions to ameliorate them. While there were many similarities between the exemplars, each made strategic decisions catered to their goals and community needs, weighing factors like social vulnerability, land use, economic drivers, evacuation routes and access and other factors.

Implementation

Each of these exemplars lays the groundwork for implementation actions, which can include creating designs, accessing local codes and governance and suggesting sources for funding in-ground projects.

However, each of these planning documents leaves off at the implementation stage, leaving contractors and local leaders to follow through after the report has been completed. This is an important consideration to include in resilience planning and programs: is there a plan for after the report has been completed to ensure follow-through?

That is not to say that none of the above exemplars are progressing through implementation: convening participants in Camden County, Tybee Island, and Savannah all reported on the progress of their plans, both in terms of built infrastructure and in gathering valuable resilience data.

Review and Evaluation

The review and evaluation process allows project leaders to assess both the methodologies used in resilience planning and the function of resulting projects. By gathering this data, resilience programs will have a better understanding of their vulnerabilities and risks.

Further, they will be able to adapt to future risks through improved processes and implementation. Because it can be challenging to obtain funding and support for long-term evaluation of project performance, this important process should be built into resilience plans from the beginning.

This step is crucial: review and evaluation serve as a crucial feedback mechanism for successful adaptation to hazards.

Policy Development and Adjustment

Finally, the information collected through this process can be applied to develop policies that support resilient communities, while policies that restrict resilient programming can be adjusted at local and statewide scales. Many of the exemplars suggested adjustments to existing policy on the local scale, including updates to codes and governance that would support resilience instead of restricting it.

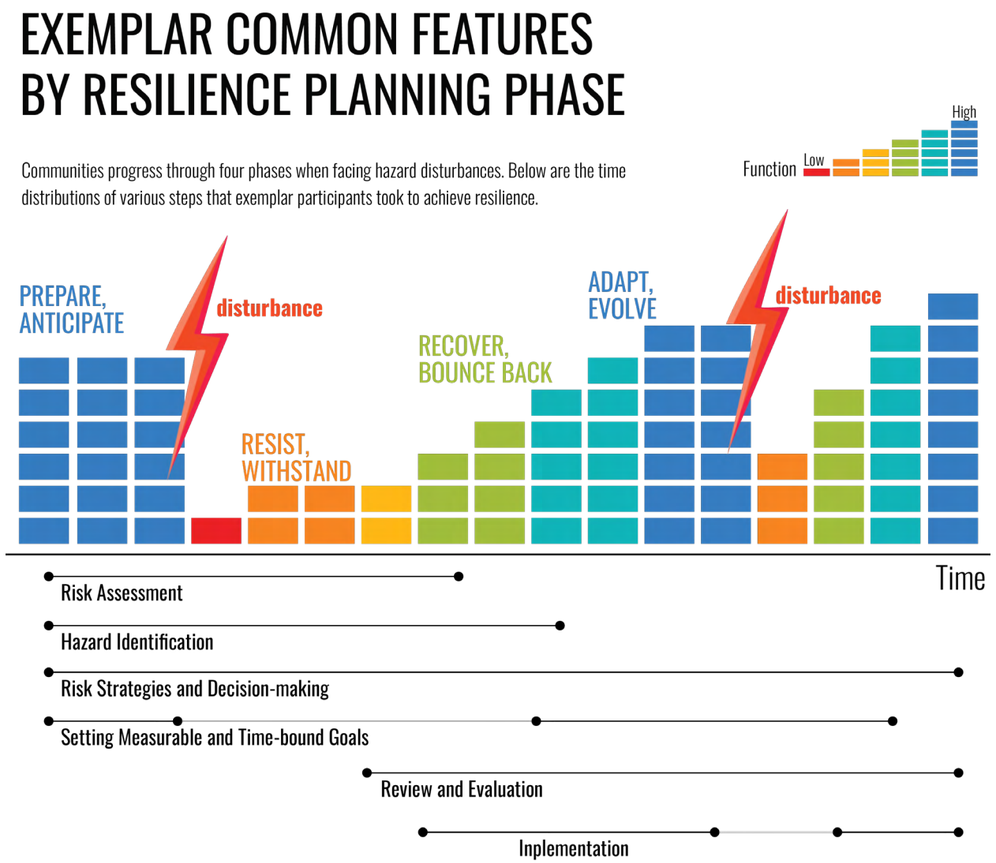


Figure 15. *The resilience curve illustrates how communities progress through four phases facing hazard disturbances. Above are the time distributions of various steps exemplar stakeholders are taking to achieve resilience.*

RECOMMENDATIONS FOR A RESILIENT GEORGIA

Throughout this assessment, participants identified persistent challenges and clear opportunities for building resilience within their communities and across Georgia. The challenges communities face are well-defined, from capacity constraints and outdated governance structures to limited data access to the strain of maintaining aging infrastructure. Further, opportunities exist to enhance coordination among existing local, regional, and state resilience programs.

We organized these nine challenges into five distinct themes:

1. Coordination

1.1 Lack of coordination across fragmented landscape of local, regional and state agencies

2. Capacity

2.1 Limited access to relevant data and outdated public sector resources

2.2 Emerging academic and scientific knowledge not integrated into planning and practice

2.3 Barriers to effective grant applications and funding opportunities

3. Vulnerable Infrastructure

3.1 *Existing infrastructure not designed to withstand emerging extremes*

3.2 Perceived uncertainty in timelines for return on investment for resilient infrastructure

4. Implementation

4.1 Dated governance and risky development

4.2 Lack of enforcement and implementation limits the effectiveness of regional resilience plans

5. Education and Awareness

5.1 Limited public understanding of resilience and hazard preparedness and uncertainty in human systems

While challenges exist, so does a strong foundation of innovation, leadership and collaborative efforts that offer proven pathways forward. Across regions, communities are adopting new technologies, piloting multi-benefit natural infrastructure projects, building local capacity and developing funding and partnership models that can be adapted and expanded statewide.

The recommendations that follow are informed by stakeholder discussions, examples of successful work already underway, and existing and emerging best practices. They offer a practical framework for connecting existing efforts, filling persistent gaps and building the coordination and capacity needed to support resilience at scale across Georgia.

RECOMMENDATION 1: DEPLOY A STATEWIDE RESILIENCE PROGRAM - COORDINATE AND SCALE EXISTING LOCAL AND STATE CAPACITY

Georgia has many of the core elements for statewide resilience already in place. This recommendation proposes establishing a statewide program to build upon these existing assets through an interagency resilience hub, a regional technical transfer network and refined funding policies.

Convening members cited a lack of capacity, disconnected agencies, difficulty accessing relevant data and dated governance as some of the primary deterrents to building resilience. A statewide resilience program should adopt a three-pronged strategy to set the foundation for overcoming these challenges through enhanced data collection and sharing, interagency communication, knowledge-sharing and funding.

1.1 Establish a Statewide Interagency Resilience Data Hub

Reliable, accessible information remains a core need for communities as they plan for future hazards and make informed resilience investments. A statewide interagency resilience hub would build upon Georgia's existing data systems to create a coordinated platform that curates, standardizes and integrates resilience-relevant data across jurisdictions for resilience planning and emergency response. Based on existing federal and statewide datasets and information produced by counties and cities, key functions of the hub should include:

1. Ensuring consistency across state, regional and local datasets to facilitate cross-jurisdictional analysis and planning.

2. Establishing versioning protocols to keep datasets current and aligned with emerging risk conditions. Data and its resolution must match both the purpose and the scale of the resilience analysis and the scale of the hazard (for example, wind, fire, storm surge and sea level rise each have different inherent scales at which they operate).

3. Improving and standardizing statewide vulnerability and prioritization models, including flood hazard, heat risk and other hazard-specific data layers.

4. Providing a publicly accessible hazard and resilience map portal to support planning, community awareness and public decision-making.

Georgia's existing data infrastructure provides a strong foundation for this hub. The Georgia Geospatial Information Office (GIO), which already supports GIS services for agencies such as the Georgia Emergency Communications Authority (GECA), manages tools and processes that can serve as models for broader resilience applications.

GIO's internal DIVA platform (Data Integration, Validation, Aggregation) applies state standards to local data and generates reports identifying gaps and inconsistencies (GIO, 2024). These tools will also be important for supporting major modernization efforts such as the NextGen 9-1-1 system transition. The NG911 system, a digital, internet protocol-based system, would replace the analog 911 infrastructure that has been in place for decades, allowing improved communication during disasters (NHTSA, 2025).

Another effort out of the Skidaway Institute of Oceanography is the Georgia Coastal Hazards Portal, which includes 25 publicly available datasets ranging from sea level rise to coastal marsh classification (UGA SKIO, 2022). This portal could help in the development of a statewide, interagency data hub.

Additional agreements between agencies, such as memoranda of agreement (MOAs), could allow local jurisdictions to join a data program to share their latest datasets (streets, parcels, addresses, etc.) and receive free access to state-purchased high-resolution imagery. Expanding access to these resources would give local governments, emergency managers and planners greater visibility into local vulnerabilities and support more data-driven resilience planning at the community level.

GIO's expertise in setting statewide and cross-jurisdictional policies, data standards and governance positions the agency as a key partner in developing this interagency resilience hub (Ad hoc meetings). Working with GIO to develop a statewide, interagency resilience hub, will help break down communication barriers between agencies and give communities access to reliable, precise data for making resilience decisions.

1.2 Create a Regional Technical Transfer Network

As expertise grows across Georgia's government, academic and private sectors, a formal technical transfer network would become the vehicle through which knowledge and best practices are shared statewide. This network would operationalize the knowledge in the resilience data hub mentioned in Recommendation 1.1, through the following services:

- Facilitate training, technical assistance and peer learning opportunities for local governments and agencies.
- Support coordination on region-wide challenges such as wildfire risk, drought and watershed-scale flood management.
- Provide targeted grant-writing and vulnerability assessment support by connecting local governments with academic and industry experts.
- Develop shared toolkits and planning templates that can be housed in the data hub. These would streamline resilience assessments and funding applications for local communities and build a blueprint for resilience planning beyond jurisdictional boundaries.

1.3 Refine and Expand Resilience Funding Policies

Sustained investment will be essential for building long-term resilience in Georgia. Georgia can build on existing funding structures by creating a programmatic approach that balances investments across all phases of resilience: preparation, absorption, recovery and adaptation.

Simplifying application processes and revising eligibility requirements can improve access for smaller communities that often struggle to compete for state and federal funding. In addition to public funding sources such as FEMA/GEMA and USDA, expanded use of special-purpose local option sales taxes (SPLOSTs), dedicated fees and public-private partnerships can diversify the state's resilience funding base.

In addition to refining resilience-related funding processes, resources should also be allocated to provide assistance to communities in obtaining and utilizing this funding. The groundwork for effective grant administration has already been laid across the state through services provided by the regional commissions.

However, these grant administration services are often spread thin across regions, and grant administrators are already understaffed and overburdened. By allocating more resources, through funding and education, to the grant administration efforts already in place, communities will receive the funding they need to execute resilience projects and the assistance to navigate the funding acquisition and implementation process.

*Recommendation 1 addresses **Challenge 1.1,** Lack of coordination across fragmented landscape of local, regional and state agencies; **Challenge 2.1,** Limited access to relevant data and outdated public sector resources; **Challenge 2.3,** Barriers to effective grant applications and funding opportunities.*

RECOMMENDATION 2: BUILD A MULTI-AGENCY AND MULTI-LEVEL COALITION

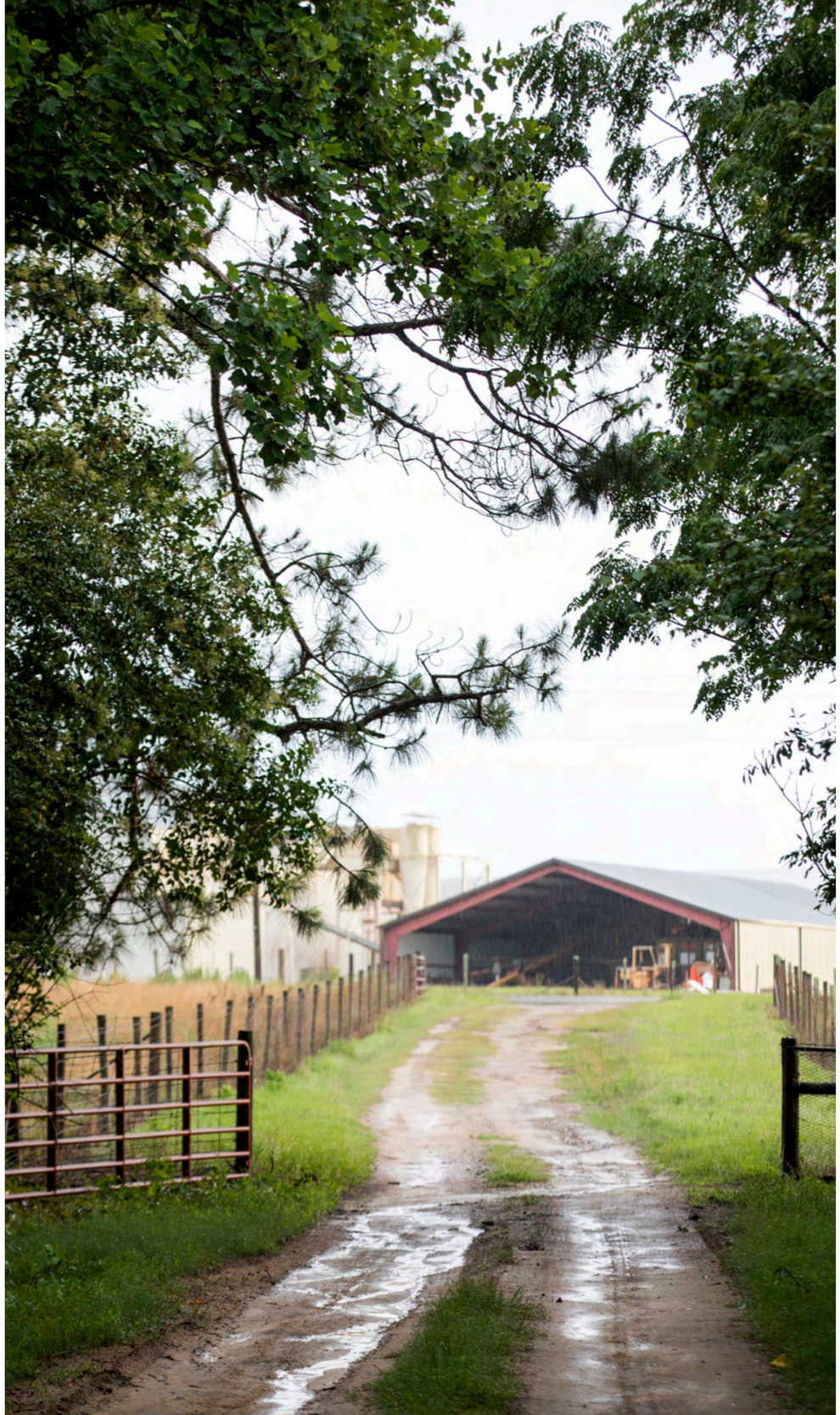
Throughout the convenings, participants emphasized that hazards do not stop at city limits, military installations, or agency boundaries, and resilience planning must look beyond those boundaries as well.

Georgia is already implementing innovative efforts, many of which are highlighted in the exemplars and opportunities sections of this report. These efforts demonstrate Georgia's ability to mobilize creative, field-tested solutions that reflect local knowledge and practical experience. However, multiple participants also identified a consistent gap: the people responsible for leading these efforts often lack the sustained support, technical assistance and coordination needed to maintain and scale their work.

While the tech transfer networks in the previous recommendation build a statewide body of knowledge, the coalition supports practical implementation. This occurs through coordinated steps at the local, regional and state levels:

2.1 Strengthen Resilience Through Stronger Networks

Georgia's greatest resilience assets are its people and trusted institutions, including local government staff, state agency staff, regional planners, utility crews, watershed leaders, academic institutions and conservation professionals. Strengthening statewide resilience will require investing not only in infrastructure, but also in the workforce and partnerships that support and sustain resilience planning across regions.



Several practical strategies emerged from the convenings to strengthen this network:

- **Mutual aid agreements for infrastructure** can formalize how communities support one another in maintaining, restoring and rebuilding both conventional and natural infrastructure systems across jurisdictional lines.
- **Watershed-wide memoranda of understanding (MOUs), or integrated watershed management,** can promote upstream and downstream coordination for flood mitigation and water quality, ensuring that local actions are aligned with broader regional priorities.
- **Formalized federal-state-local communication channels** can better integrate municipal input into state and federal decision-making, allowing agencies such as FEMA, GEMA, NOAA and the U.S. Army Corps of Engineers to deploy resources more strategically.
- **Cross-sector working groups** organized through the state program can align agencies and jurisdictions to share information and integrate technical expertise. This would set up task forces to oversee short-term resilience goals and quantify resilience successes and needs across the state.
- **Extension offices, modeled after agricultural extension programs,** can serve as a bridge between emerging research and on-the-ground implementation, field testing new approaches and translating science into practice. This would also mitigate against challenges posed by changing government administrations and the impact of shifting priorities on past resilience efforts. Extension offices would maintain resilience at the forefront by connecting community needs with knowledge generated by academic institutions and liaising with administrations.
- **Rotating internship and fellowship models** can strengthen local capacity while developing Georgia's resilience workforce. Placing students and resilience fellows in municipal offices, hosting short-term university-based training programs for local staff and creating peer exchange opportunities between jurisdictions can foster multi-directional learning and long-term technical partnerships.

2.2 Bolster Further Partnerships Between Military Installations and Communities

Military operations are a central component of Georgia's economy. The state is home to nine major military bases, with the Department of Defense providing over 150,000 jobs directly and indirectly employing over 340,000 Georgians.

As of 2024, military operations across Georgia have an estimated impact of $22 billion annually. Despite this being only ~2.5% of Georgia's overall GDP, military installations provide an estimated average of 30% of the GDP of each of the local communities in which they are situated (Hub Chamber Council, 2024)

All military installations and their adjacent interconnected communities are threatened by changing environmental conditions – heavier rainfall, increased flooding, growing wildfire risks, prolonged droughts, excessive temperatures and combinations of these hazards. Threats and opportunities vary depending on:

- The nature of the mission of the specific installation
- The geographic and ecological setting in which it operates
- Age and design of local infrastructure systems
- The interconnections the installation has with the surrounding community

Further bolstering of existing relationships between military installations provides unique opportunities not only to provide a platform for technology transfers between the Department of Defense and state and local entities, but also to achieve a more holistic approach to building resilience to these universally shared challenges.

An exemplar of regional collaboration between local government and military installations is the Military Installation Resiliency Review (MIRR) executed by the Emerald Coast Regional Council in Florida and funded by the Office of Local Defense Community Cooperation's Military Installation Sustainability program. The MIRR aims to assist the Northwest Florida region "with assessing, planning, prioritizing and implementing resilience actions and projects that provide critical services and infrastructure to support and maintain mission assurance and essential functions" (Emerald Coast Regional Council, 2024).

The MIRR spanned five counties and six installations, evaluating the interconnections between infrastructure systems inside and outside military installations for vulnerabilities and developing actionable projects that could mitigate these vulnerabilities (Emerald Coast Regional Council, 2024).

Actionable strategies to help support the military mission within Georgia–and its collaborations with other agencies–include:

- Encourage planning efforts that explore how military installations and their adjacent communities are interconnected and facilitate more collaborative projects. This can be supported through better communication of existing funding opportunities, such as the Readiness and Environmental Protection Integration (REPI) Program, which can be utilized to accomplish multi-jurisdictional goals.
- Provide technical assistance to planners, engineers and other professionals tasked with building more resilient infrastructure systems that support the military mission in each locality.
- Build improved models of stormwater, utility, transportation, energy and other systems that can be stress-tested with plausible future conditions. Improved models will aid in understanding vulnerabilities in the installation and adjacent communities.
- Pursue funding to implement resilience projects that provide critical services and infrastructure while maintaining mission-essential functions.
- Perform resilience assessments, such as a MIRR, that do not focus solely within the boundary of the installation but incorporate the full system through expanded models and stakeholder coordination and engagement.
- Translate these risk and vulnerability assessments into decision-making processes to define priorities for resource allocation and implementation.
- Integrate natural infrastructure with conventional infrastructure upgrades to ensure that responses and adaptations reduce vulnerabilities to hazards.

As one example of an existing effort, the University of Georgia is developing a new rapid risk assessment methodology that can be used to better understand the flood risks to transportation infrastructure, taking into account social vulnerabilities of the local population, with a focus on the area surrounding Fort Stewart and Hunter Army Airfield near Savannah, Georgia.

The methodology is designed to produce maps that clearly depict geographic areas and roadways that deserve transportation planners' attention. This military complex is a major "power projection platform," meaning that it operates under a requirement that significant numbers of personnel and equipment must be able to move out to anywhere in the world on a moment's notice.

Combined with the Port of Savannah's critical importance as a major (and growing) international deep-water port, tourist destination, and logistics hub, resilient transportation planning is vital to the region, state and nation both now and into the future.

*These actions address **Challenge 1.1:** Lack of coordination across fragmented landscape of local, regional and state agencies; **Challenge 2.2:** Emerging academic and scientific knowledge not integrated into planning and practice; **Challenge 4.2:** Lack of enforcement and implementation limits the effectiveness of regional resilience plans.*

RECOMMENDATION 3: QUANTIFY AND COMMUNICATE ECONOMIC BENEFITS FOR RESILIENCE

Proactive investments in resilience and preparedness can substantially reduce the economic costs associated with disasters (USCC, 2024). National studies consistently demonstrate that investments in resilience yield positive returns. According to the United States Chamber of Commerce's 2024 Climate Resiliency Report, every dollar invested in resilience results in up to $13 in avoided disaster recovery costs (USCC, 2024).

Additional federal analyses estimate that infrastructure investments contribute approximately $700 in household savings annually and generate substantial long-term GDP growth (ASCE, 2024). These national-level findings align with Georgia's own experience, where the cumulative cost of disaster recovery continues to far exceed the upfront costs of proactive investments in hazard mitigation.

Georgia has a clear economic case for resilient infrastructure investments and statewide resilience planning; however, the ROI and broader benefits of these efforts have not been assessed and communicated to the public and decision-makers in an effective manner.

3.1 Evaluating the Cost of Disasters

Although there is a solid evidence base from around the country on how proactive investments in hazard mitigation pay for themselves, local government officials and policymakers would benefit from more evidence specific to Georgia and practical communication tools for making the business case for proactive resilience in compelling ways for Georgians.

The high cost of disasters in both the United States and Georgia is a compelling argument on its own: Between 1980 and 2024, the United States sustained 403 billion-dollar disasters (events where overall damages reach or exceed $1 billion), including drought, wildfire, flooding, freezing events, severe storms and tropical cyclones. Georgia sustained damage from 134 of these events, with 49 occurring between 2020 and 2024 (NCEI, 2025).

Hurricane Helene alone resulted in an estimated $79 billion in damage across North Carolina, Tennessee, Georgia, and Southwestern Virginia, including $6.5 billion in agricultural and timber losses in Georgia (OCM, 2025; Kolich, 2024).

In recent years, several other hurricanes, including Ian, Ida, Irma, and others, caused loss of lives, homes and regional economic losses across the region. In 2009, flooding that impacted metro Atlanta damaged thousands of homes and businesses, causing an estimated $1.3 billion in losses. Droughts between 2012 and 2024 also caused an estimated damage of over $66 billion across several states, including Georgia (NCEI, 2025).

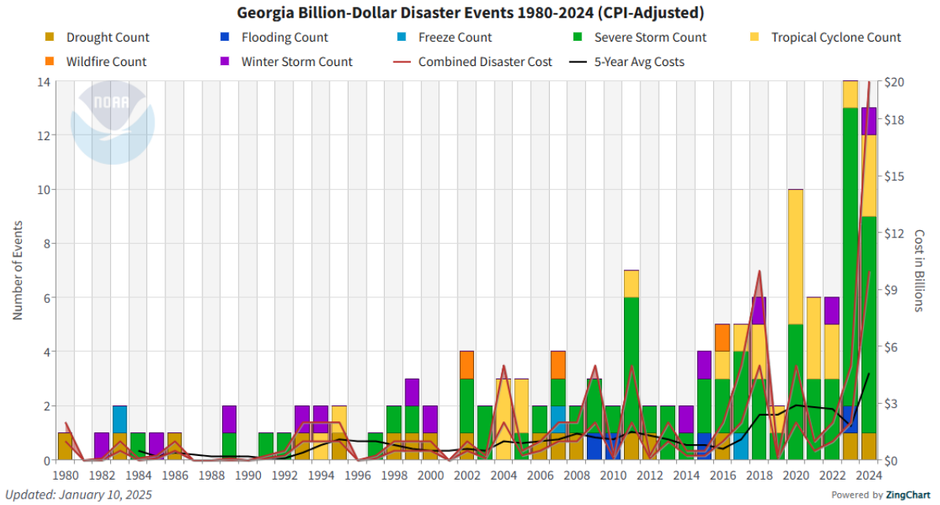


Figure 16. *Billion-dollar disaster events affecting southeast states between 1980-2024 (NCEI, 2025)*

3.2 Resilience Investments Lead to Strong Returns

Despite the scale of these impacts, Georgia has seen multiple examples of resilience investments that have the potential to deliver strong returns by reducing long-term damages, protecting industries and preserving essential public services over time. Investments made in response to these events provide a foundation for conducting Georgia-specific loss avoidance studies.

Participants throughout this project noted that the long-time horizon for realizing many of these returns often inhibits stakeholder buy-in, particularly when resilience investments compete with more immediate funding priorities.

To address this gap, Georgia will benefit from a clear and consistent framework for communicating the economic value of resilience, supported by quantifiable data and targeted analysis. This begins with these steps:

Statewide Economic Messaging

Develop consistent, data-driven narratives that clearly communicate the long-term financial benefits of resilience investments. Messaging should emphasize avoided costs and how resilience investments can strengthen economic growth and critical supply chains. This would link resilience investments to protecting industries and providing economic stability. A strong relationship between resilience and economic returns will create a platform to engage the public and private sectors, including local and state officials. Brochures and presentations on co-investments should be tailored to different portions of the state and made available on a web portal for broad distribution.

Incentives for Resilience Investments

Design incentive-based policy mechanisms, such as tax credits or grant programs, which reward proactive resilience actions. These programs should prioritize outcomes such as reduced agricultural vulnerability and enhanced water-use efficiency. Critical infrastructure longevity and resilient design for the built environment are other examples of expected outcomes. Dedicating funding avenues for testing new solutions in resilience planning would encourage communities to implement technological innovations and advance collective knowledge on best practices of resilience in the state.

Regional Benefit-Cost Analysis (BCA)

Collect and maintain data on risk reduction investments and conduct detailed regional economic analyses that quantify the full range of benefits associated with resilience investments.

3.3 Capturing Direct and Indirect Returns

Loss Avoidance Studies (LAS) are an example of documenting where losses are avoided by identifying and quantifying the benefits of interventions built. An example is the impact of elevated homes in Jefferson Parish, Louisiana. An investment of $2.36 million to elevate 23 individual homes led to an estimated $5.25 million of losses avoided during Hurricanes Isaac and Ida (FEMA, 2022).

In another example in Florida in 2016, 40 projects were impacted by Hurricane Matthew with a combined capital cost of $19.2 million. It was estimated that interventions avoided approximately $81.1 million in projected loss. The aggregate ROI for the event is 422%, with an average project ROI of 97% (FDEM, 2017).

These analyses would ideally capture both direct and indirect returns: many projects are multi-purpose and deliver additional benefits, including water quality, wildlife habitat and recreation. BCAs should include long-term cost savings and agricultural productivity, but also ecosystem services and public health benefits.

*These strategies can help Georgia strengthen its statewide economic case for resilience to the public as well as lawmakers or private partners, filling gaps that convening members identified —**Challenge 3.2:** Perceived uncertainty in timelines for return on investment for resilient infrastructure and **Challenge 5.1:** Limited public understanding of resilience and hazard preparedness and uncertainty in human systems.*

RECOMMENDATION 4: SCALE UP REGIONAL RESILIENCE PLANNING FRAMEWORKS

In this section, three core actions are identified that can scale resilience efforts already underway across Georgia.

1. Asset management for natural and conventional infrastructure
2. Updates to engineering design guidance and standards for future-ready infrastructure
3. The development of local resilience plan templates

These actions directly address persistent challenges communities face, including management of aging infrastructure and ongoing development pressures in flood-prone and hazard-exposed areas. They also address the capacity barriers that keep local governments from advancing comprehensive resilience planning.

Expanding these strategies will allow Georgia to build on existing local successes while providing communities with consistent, practical tools that support both immediate planning needs and long-term resilience objectives.

4.1 Asset Management for Natural and Conventional Infrastructure

A foundation for resilience planning begins with a robust and actionable asset management strategy that shifts a community from a reactive to a proactive operational mode. Throughout Georgia, city maintenance crews are forced to run from system failure to system failure, largely due to a lack of resources to get ahead of these projects. However, if a community can better predict where the next failure is likely to occur, especially in the face of natural disturbances, it can better prepare itself to address that failure beforehand.

The economic and hazard mitigation benefits that natural infrastructure, such as forests, wetlands and aquifers, provide are rarely quantified to the same degree as conventional infrastructure, which undermines natural infrastructure's value as a true asset to communities through the services it provides. Natural assets can and should be included within asset management plans, and the resilience and other benefits of those natural assets should be accounted for in decision-making.

An effective built and natural asset management strategy must begin with an inventory and mapping effort that provides communities with a database of asset characteristics such as type, location, size and condition. This inventory provides a community with the information to begin a risk and vulnerability assessment that answers questions such as:

- Which hazards are the biggest threats to these assets?
- How likely is this asset to fail?
- What are the consequences of this asset failing?

Answers to these questions can be compared with annual operating budgets to inform a systematic prioritization and sequencing of projects. This also spotlights where additional funding sources should be obtained.

Additionally, by comparing existing asset maintenance projects with master plans and community revitalization projects, opportunities for bundling projects will become apparent, providing some cost savings in project implementation.

This systematic approach will also make it easier to integrate emerging technology such as smart sensors, GIS-driven maintenance schedules and less costly rehabilitation methods (such as cable injection and cured-in-place pipe lining). This can add to cost savings for asset maintenance costs and post-disaster recovery costs.

Completing a holistic asset management plan is resource-intensive from both a labor and financial perspective. Additionally, technical expertise is required to execute these plans effectively. Providing state-level funding and guidance for communities to perform these rigorous asset management analyses will provide a foundational plan for bolstering resilience across the state, from a grassroots level. Guidance plans can also be shared through the proposed data hub and the tech transfer network.

4.2 Engineering Design Guidance and Standards for Future-Ready Infrastructure

To further support incorporating resilience in comprehensive plans for the built environment, updating statewide engineering design guidance and standards to account for future conditions could streamline the process. Considerations include:

- Incorporating scenarios that account for how conditions might change over the lifespan of an infrastructure system (more intense rainfall, increased impervious land cover within a watershed, etc.)
- Integrating more robust design requirements for infrastructure critical to disaster preparation and recovery (such as hurricane evacuation routes)
- Infusing concepts of engineering with the environment, not against it, to help communities better prepare for and absorb hazards
- Updating building codes to integrate concepts such as:
  - flood-resistant buildings (material, architectural templates)
  - heat mitigation (tree cover)
  - wildfire-resistant landscapes

Nationally, ASCE-NOAA organized multiple workshops on leveraging modeling for extreme temperatures, intense rainfall, straight-line wind, and coastal hazards to inform civil engineering design (Ayyub et al., 2023).

A task force of experts and planning professionals can develop Georgia-specific resilience approaches that are efficient and affordable. This can coordinate efforts through the data hub and the tech transfer network.

4.3 Measuring Progress Toward Resilience: Benchmarks for Communities

Quantified benchmarks help communities assess progress throughout the “prepare, absorb, recover and adapt” phases of resilience planning. A resilience template should delineate assessment measures across sectors (government, utility, natural infrastructure), accounting for interdependencies.

These should identify specific, measurable goals that communities can use to assess progress as they implement resilience plans. Implementing measurable goals will help communities ensure that resilience measures are successful and provide a tool for enforcing measures.

Developing benchmarks can build upon existing measurement approaches. In step with capabilities-based planning (description below), the Resilience Measurement Index (RMI) developed by Argonne National Laboratory is based on the principles of decision analysis and spans preparedness, mitigating measures, response capabilities and recovery mechanisms. It emphasizes planning, coordination and critical infrastructure (electricity, gas, communications, IT, water, wastewater, transportation) (Petit et al., 2013).

Communities could also utilize the Infrastructure Survey Tool (IST) to assess security and resilience on a facility scale (CISA, 2025b). Sector-specific benchmarking tools such as the Automated Benchmarking Tool (ABT) developed by Georgia Power can generate power usage statistics (Georgia Power, 2024a) and landscape performance metrics for natural infrastructure, such as peak discharge monitoring outlet points and flood storage capacity assessment (LAF, 2018). Used in conjunction with one another, these tools can help create benchmarks toward broader resilience implementation.

4.4 Develop Local Resilience Plan Templates

Many local governments, particularly smaller jurisdictions, face challenges in developing comprehensive resilience plans due to limited staffing, technical expertise or financial capacity. Establishing a standardized, scalable planning template can lower the technical barriers to entry while promoting consistency in resilience planning across regions.

Two existing planning frameworks are well-suited for adaptation:

Watershed-based planning is effective in coordinating land, water and infrastructure management within distinct hydrological units to address pollution. This established approach offers a scalable blueprint for advancing resilience planning for multiple hazards by aligning natural systems with resource governance.

Watershed-based planning delineates six steps.

1. Building partnerships
2. Taking inventory of existing assets and vulnerabilities
3. Developing goals and implementation designs specific to the watershed
4. Implementation
5. Measuring progress
6. Adapting management

This framework aligns with resilience plans and toolkits and has been successful across the state. It could be enhanced to incorporate different hazards and reflect novel methods of building resilience.

Capabilities-based planning is defined as "planning, under uncertainty, to provide capabilities suitable for a wide range of modern-day challenges and circumstances while working within an economic framework that necessitates choice. It contrasts with developing [narrowly defined] resource capabilities based on a [singular] threat or scenario" (Davis, 2002).

This participatory framework engages stakeholder input in developing the ability to prepare, absorb, recover and adapt. This could begin by identifying hazard delineations and impacted communities and then identifying how social and infrastructural networks could be bolstered to withstand hazards.

County-Level Resilience Template

This resilience template draws from the Exemplars in the prior section and county-level resilience plans from other states and federal institutions (Ross, 2020; NCDEQ, 2024; NCORR, 2024), spanning the four actions of resiliency: preparation, absorption, recovery and adaptation. It is recommended that communities ready to engage in resilience planning review a variety of resilience plans when crafting the elements of their own plan.

The North Carolina Resilient Communities Planning guide is an example of a document that contains an abundance of resources and step-by-step checklists that can help guide communities through the planning process (NCORR, 2024). 100 Resilient Cities, a network created by the Rockefeller Foundation, also has resources to support communities throughout the resilience planning process (The Rockefeller Foundation, 2025).

A county-level resilience template should address resilience across various sectors, including transportation, water, natural systems, healthcare and workforce development. This template is intended for counties to use as a starting point to begin efforts at the county level. When utilized throughout the state, county-level resilience templates can serve as a powerful tool for harmonizing and scaling regional resilience efforts.

ELEMENTS OF A COUNTY-LEVEL RESILIENCE TEMPLATE

1. ASSESS CAPACITY, ESTABLISH ROLES AND DEVELOP COMMUNICATION CHANNELS

- Identify areas of focus (transportation, water management, energy, health, natural systems).
- Assess county-level capacity, identify restrictions and gaps.
- Identify and engage key collaborators and stakeholders.
- Assign roles within the resilience task force, keeping capacity in mind.
- Establish communication norms and channels for the task force and outside collaborators and stakeholders.

2. DEFINE SCALE, INVENTORY, AND VULNERABILITIES

- Delineate administrative, watershed and hazard boundaries.
- Comprehensively assess regional and community vulnerabilities to extreme weather events.
- Identify data access and needs for developing vulnerability analysis, recommendation development and benchmarking.
- Take inventory of conventional and natural infrastructure assets through local government and the resilience data hub.

3. CAPACITY MAPPING AND EXPANSION

- Assess funding readiness: access to grants, matching potential and fiscal flexibility.
- Evaluate staff capability and bandwidth for grant writing and concept development.
- Scan policy landscape: zoning, building codes, design standards and enforcement mechanisms.
- Profile community context: social vulnerability, economic precarity and resilience literacy.
- Develop a plan to acquire necessary capacity through the knowledge transfer network and the multi-agency coalition.

4. DEVELOP GOALS AND ARTICULATE OUTCOMES

- Assign working groups for projects and overarching strategic goals.
- Establish local resilience priorities and how they align with state targets and concurrent regional efforts and identify short-term and long-term investments in infrastructure and other areas to improve resilience.
- Develop an intervention portfolio for built projects, regulation updates, communication and education initiatives.
- Establish benchmarking and performance metrics to measure project impact and economic benefit.
- Determine a timeline and a phasing plan for short- and long-term goals.
- Prioritize interventions by cost, feasibility and impact.
- Build a funding plan that includes federal sources, state opportunities, but also SPLOSTs, matching funds and private-public partnerships.

5. IMPLEMENT, MEASURE AND ADAPT

- Leverage data to track progress against benchmarking metrics; conduct post-event reviews and scenario exercises.
- Build in mechanisms for continuous learning—feedback loops, after-action reports, and performance dashboards.
- Regularly revise timelines, budgets and targets based on what is and isn't working.

*These recommendations address **Challenge 2.1,** Limited access to relevant data and outdated resources, **Challenge 2.2,** Emerging academic and scientific knowledge not integrated into planning and practice, **Challenge 3.1,** Existing infrastructure not designed to withstand emerging extremes and **Challenge 4.1**, Dated governance and risky development.*

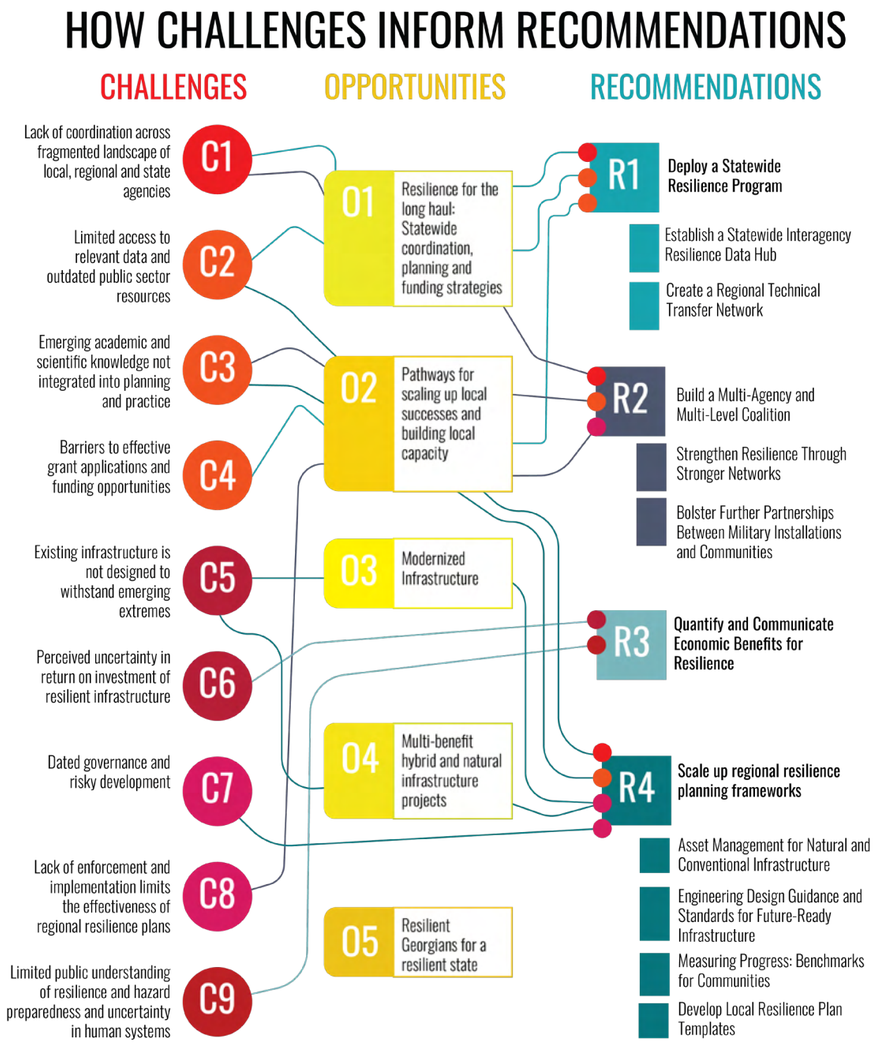


***Figure 17.** Synthesis graphic depicting how challenges and opportunities inform recommendations.*

CONCLUSION

Through a coordinated state-wide strategy, Georgia can build on its strong foundation of innovation and collaboration, harmonize smaller-scale efforts throughout the state and implement resilient programming to be better prepared to face intensifying risks head-on. These recommendations offer a practical framework for connecting existing efforts, filling gaps and building the capacity needed to support a more resilient Georgia.

CLOSING: BUILDING GEORGIA'S RESILIENCE

As outlined in the opening statements of this report and the discussion of hazards, Georgia faces resilience challenges that are increasingly prevalent, frequent, compounding and dangerous–but they are not insurmountable.

The increasing frequency and severity of hazards, aging infrastructure and capacity limitations present complex risks that will require sustained attention and investment. Yet, across every region of the state, this assessment surfaced not only widespread concern but also widespread optimism and commitment. Communities, agencies, businesses, utilities and research institutions are already stepping forward to advance resilience in ways that are collaborative, creative and grounded in local realities.

Throughout this process, more than 130 stakeholders shared insights through regional convenings, targeted interviews and statewide engagement. While each region faces unique challenges, communities across Georgia are already confronting shared vulnerabilities and compounding hazards that include resource constraints, complex funding systems, aging infrastructure and fragmented governance. The impacts of Hurricane Helene, which struck during this assessment, underscored both the scale of the challenges and the urgency of the moment.

At the same time, participants highlighted a growing set of opportunities. Local leaders are piloting natural infrastructure, advancing regional partnerships, modernizing stormwater and hazard management systems and building local expertise that can serve as a foundation for broader statewide action.

This report identifies five categories of opportunity to strengthen resilience:

1) Statewide coordination, planning and funding strategies

2) Building local capacity and scaling up success

3) Modernized and resilient infrastructure

4) Multi-benefit hybrid and natural infrastructure projects

5) Resilient Georgians for a resilient state

Building from these findings, the recommendations outline a coordinated statewide strategy organized around four integrated priorities:

1) Building statewide resilience capacity

2) Strengthening multi-agency and intergovernmental coordination

3) Demonstrating and framing the economic benefits for resilience

4) Expanding planning frameworks

The work ahead is significant, but Georgia is not starting from scratch. With strong leadership, sustained investment, and cross-sector partnership, Georgia can strengthen its resilience, better safeguard its communities and ensure that economic growth, public safety and environmental stability advance together.

The path forward is clear, and Georgia is well-positioned to lead.

Regional and Ad hoc Meeting Transcripts by Date

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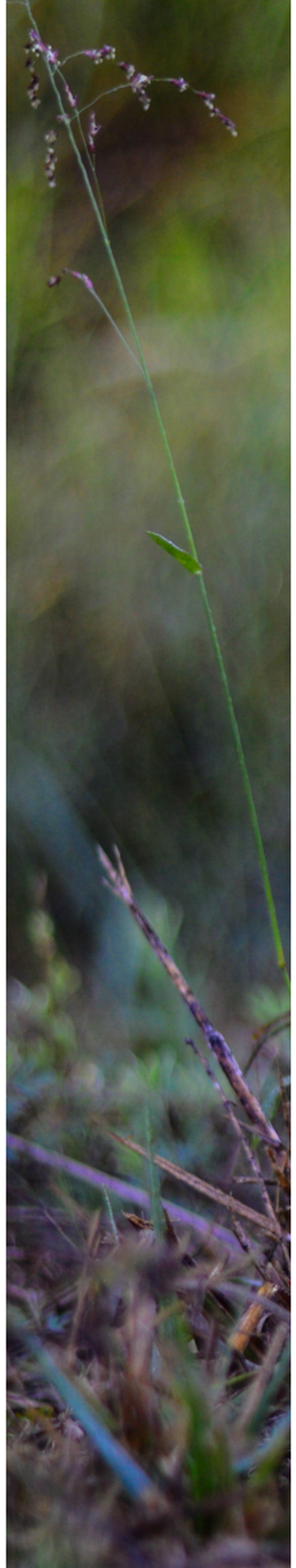

Local & State Resilience Planning in Georgia and Beyond

As this report has emphasized, there are many excellent examples of resilience planning and programming across the state in different disciplines, sectors and geographic regions. Below is a list of examples cited in this report for further reading. Please note that this is not an exhaustive list of resilience planning work across the U.S., and that there are many worthy examples of local and state coordination for hazard resilience.

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