

Resilience and Vulnerability Indicators

Thomas Jefferson Planning District
Commission

Draft component of the Comprehensive Economic
Development Strategy



Oct. 5, 2023



RESILIENCE & VULNERABILITY

Overview

This section examines county, regional, state, and national level data to examine the resilience and vulnerability of the Thomas Jefferson Planning District Commission (TJPDC) and GO Virginia's Region 9. A collection of indices has been created based on a variety of measures. The objective is to explore the factors associated with economic resilience and vulnerability, shedding light on the performance of the region and its counties across various measures. These indices include social, economic, infrastructure, and environmental aspects which are examined for both resilience and vulnerability. The aim is to gain a comprehensive understanding of the region's and counties' performance in vital areas related to sustainability and economic well-being. Additionally, this analysis seeks to identify opportunities for enhancing resilience and reducing vulnerability in the region. This resilience and vulnerability plan works in conjunction with the TJPDC Hazard Mitigation Plan¹², as this document works in tandem to identify and address regional resilience and vulnerability. As a result, strategies presented in this plan will not perfectly align with those identified in the hazard mitigation plan and any prior recommendations and findings should still be implemented. The data presented in this report works to help identify weaknesses that could be supported through strategies in the CEDS³.

Community Resiliency Assessment Tool⁴

This study makes use of the Community Resiliency Assessment Tool developed at the Institute of Public Policy at the University of Missouri. It includes 45 variables across four categories to capture community resilience and vulnerability. These four categories are:

¹ [1. Rappahannock-Rapidan Hazard Mitigation Plan - 20181205 Update.red.pdf](#)

² [Haz-Mit-Report-Jan-2023-Full-Res-FEMA-Approved.pdf](#)

³ Strategies to address tying hazard mitigation plans with CEDS strategies have been outlined here: [fema_ceds-hmp-alignment-guide_2022.pdf](#), and explored in conjunction with the provided analysis

⁴ Data Notes regarding further explanations of selected measures are included in the Data Notes Appendix at the end of this report.

1. **Social:** Measures the degree to which a community has a strong set of social and human capital

Social Measures

Resilience Measures	Vulnerability Measures
Number of Nonprofits per Capita	Share of Population age 65+
Number of Associations per Capita	Share of Population Under the age of 18
Voter Participation Rate	Share of Population Disabled
Share of Population with a Bachelors Degree or Higher	Violent Crime Rate
Life Expectancy	Income Inequality (GINI Index)
Share of Housing Units that are Owner Occupied	Number of Jurisdictions
Share of Population Living in Same County as one year prior	Share of Households that are Linguistically Isolated
	Share of Population Living below 100% of Poverty
	Share of Population without Health Insurance

2. **Economic:** Measures the economic strength and vulnerability of the community

Economic Measures

Resilience Measures	Vulnerability Measures
Average Nonfarm Proprietor Income	Business Vacancy Rate
Proprietors as a Share of Total Nonfarm Employment	Share of Households Spending 30% or More of Total Income on Housing Costs
Establishment Births	Unemployment Rate
Employment Sector Diversity	Share of Population Employed in Extractive Industries or Manufacturing (including Agriculture and Forestry)
Labor Force Participation	

3. **Infrastructure:** Measures the capacity of a community to withstand a natural disaster and manage evacuations and immediate repairs following a disaster event

Infrastructure Measures

Resilience Measures	Vulnerability Measures
Number of Persons in Emergency Response Occupations as a Share of Total Population	High-Detour Bridges
Share of Population within 1 mile of a Grocery Store	Share of Homes Built before 1960
Share of Population within 10 miles of Hospital or Emergency Room	Share of Housing Units that are Mobile Homes
Evacuation Routes (lane miles)	Share of Population within 5 Miles of a Dam
Number of Primary Care Physicians per Capita	Share of Population with no Motor Vehicle
Per Capita Expenditures on police and Fire	Share of Population within 10 miles of a Nuclear Facility
	Unsafe Drinking Water

- 4. **Environmental:** Measures the likelihood of a disaster befalling the community

Environmental Measures

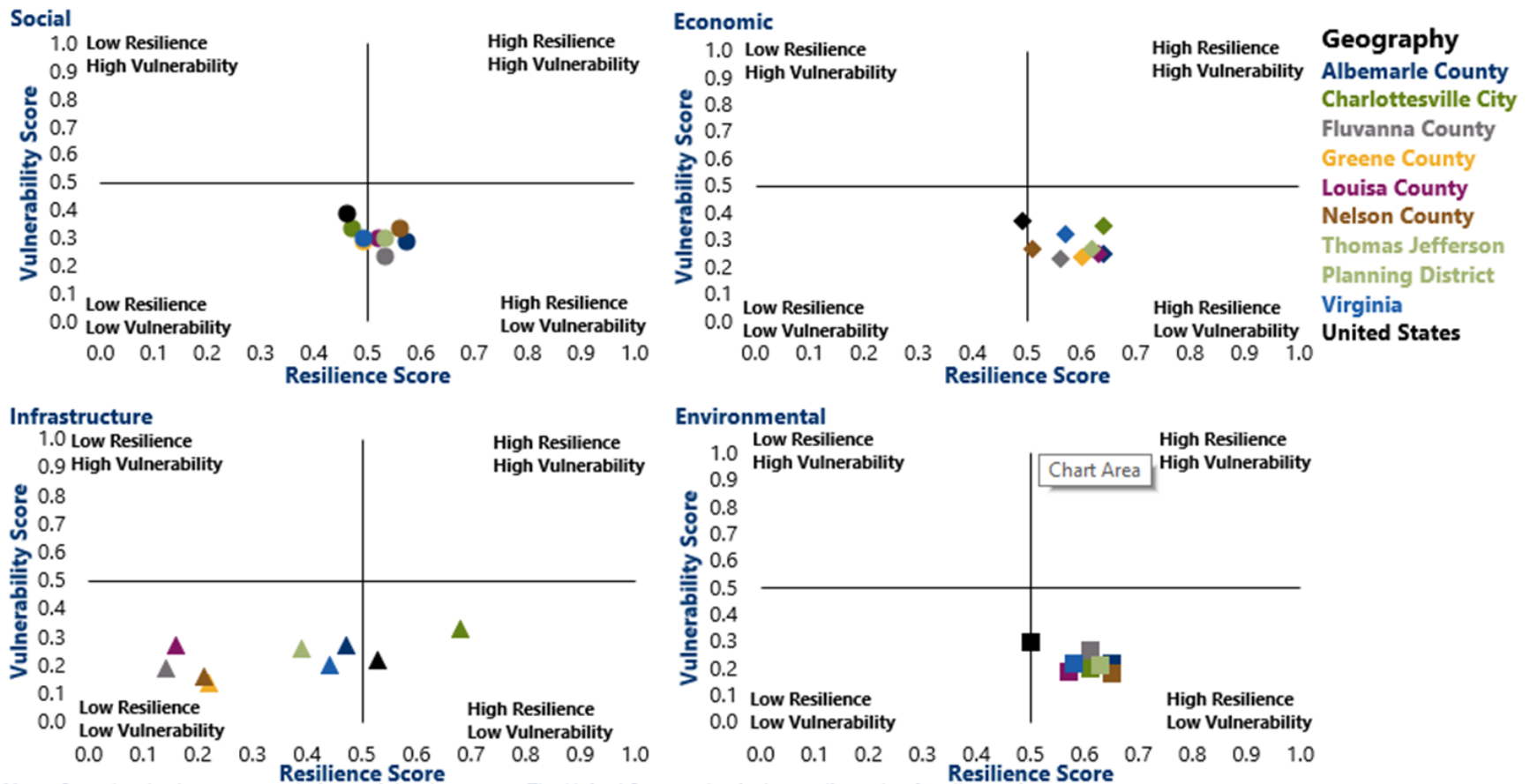
Resilience Measures	Vulnerability Measures
Environmental Diversity	Drought
	Seismic Hazard
	Proximity to Levees
	Number of Severe Storm Events
	Diversity of Storm Events

The indices rank all counties into four quadrants based on their relative resilience and vulnerability to national median scores across these four dimensions. Each dimension has its own set of indicators used to determine relative resilience (indicators that increase capacity for resilience) and vulnerability (indicators that are a liability for resilience) for that specific dimension. Each of the regional metrics are compared to the state metric to determine what indices need to be further addressed within each region. Any measure performing worse than the state will be highlighted as needing addressed while measure performing better than the state will be seen as strengths in the region.

Resilience vs. Vulnerability, Thomas Jefferson Planning District

The graphic below displays an overview of the resilience and vulnerability performance of each of the region’s geographies benchmarked to the state and national performance. Each of the four categories is also displayed with some key takeaways being that all geographies are least resilient in their infrastructure and most resilient in their environment. None of the geographies were highly vulnerable across any of the categories.

Community Resilience and Vulnerability Scores, Thomas Jefferson Planning District

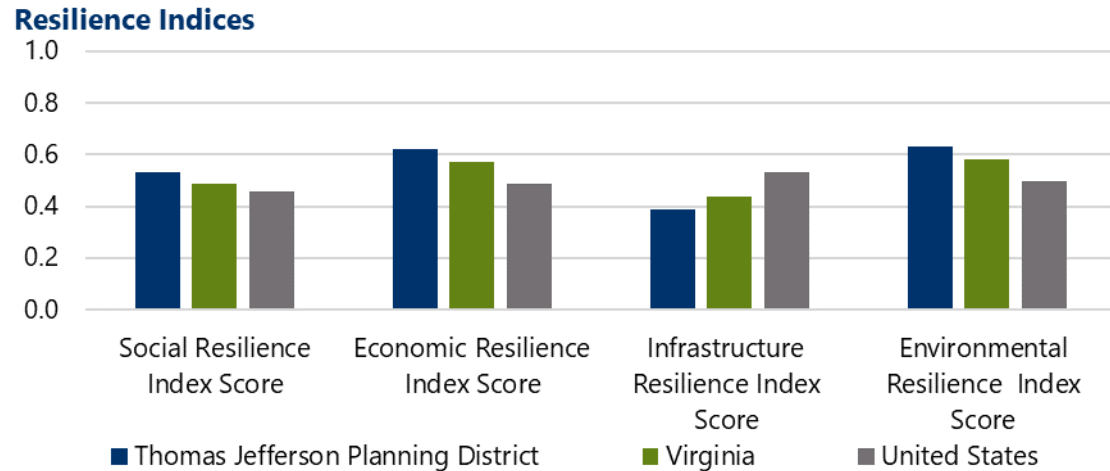


Note: State-level values are population-weighted averages. The United States value is the median value for all counties.

Source: University of Missouri Community Resilience Assessment Tool

Thomas Jefferson Planning District Resilience

The graph on the right indicates the relative performance of the Thomas Jefferson Planning District’s resilience in comparison to the State of Virginia and US as a whole. The region is more resilient than the state across all metrics except for infrastructure resilience.



Source: University of Missouri Community Resilience Assessment Tool

The table to the right explores the determinants of the region’s resilience, allowing us to see the drivers of the four categories. The region would benefit from improving access to emergency facilities and increasing emergency responders. The region could also look to find ways to incentivize labor force participation to improve the resilience of the region.

Thomas Jefferson Planning District Resilience

Indicator	More Resilient	Less Resilient
Social	Higher Share with College Degrees	Lower Share lived in the Same County a Year Ago
	More Non-Profits per Capita	
	Higher Voter Participation Rate	
Economic	More Employment Diversity	Lower Proprietor Income
	Higher Proprietor Employment	Lower Labor Force Participation Rate
	More Establishment Births	
Infrastructure	More Access to Medical Professionals	Less Access to Emergency Facilities
	More Evacuation Routes	Less Access to Grocery Stores
		Fewer Emergency Response Occupations
Environmental	Greater Environmental Diversity	

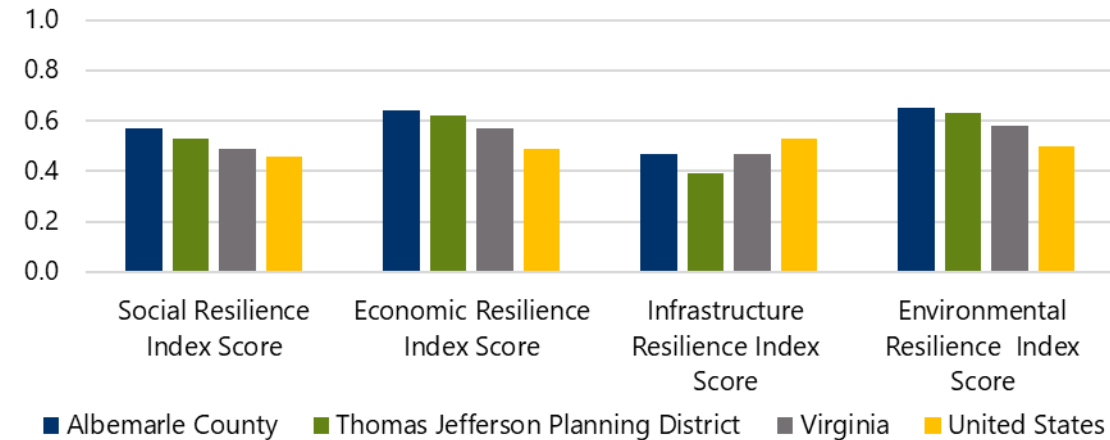
Note: Region is compared to Virginia

Source: University of Missouri Community Resilience Assessment Tool

Albemarle County Resilience

The graph on the right indicates the relative performance of Albemarle County's resilience in comparison to the Thomas Jefferson Planning District, State of Virginia, and the US as a whole. The county is more resilient than the state in social, environmental, and economic resilience. For infrastructure, the county matches the state on the resiliency index.

Resilience Indices



Source: University of Missouri Community Resilience Assessment Tool

The table to the right explores the determinants of the county's resilience, allowing us to see the drivers of the four categories. The county would benefit from increasing emergency response occupations and investment in police and fire. The county could also look to find ways to incentivize labor force participation to improve the resilience of the county.

Albemarle County Resilience

Indicator	More Resilient	Less Resilient
Social	Higher Share with College Degrees	Lower Share lived in the Same County a Year Ago
	Higher Voter Participation Rate	Lower Home-ownership
	Higher Life Expectancy	Fewer Associations per Capita
Economic	More Employment Diversity	Lower Labor Force Participation
	Greater Access to Medical Professionals	Fewer Emergency Response Occupations
Infrastructure		Less Access to Grocery Stores
		Lower Share of Expenditures on Police and Fire
Environmental	Greater Environmental Diversity	

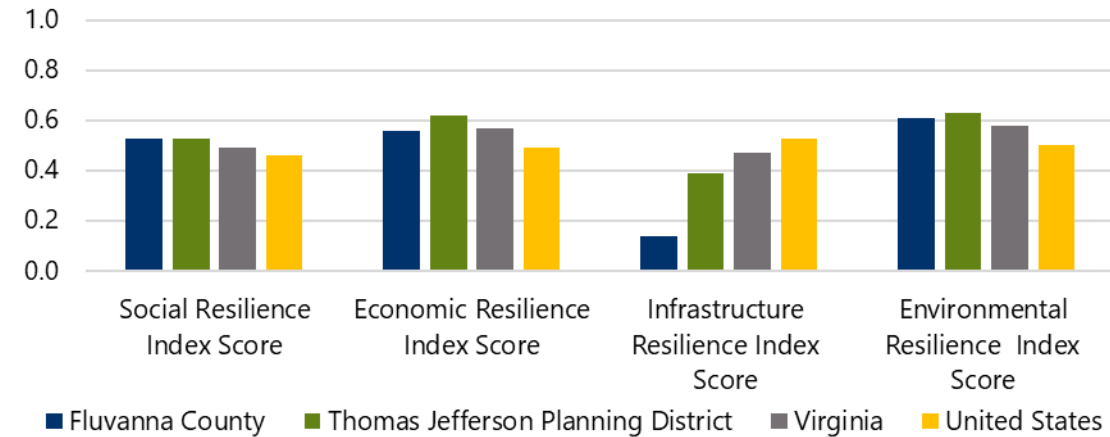
Note: Region is compared to Virginia

Source: University of Missouri Community Resilience Assessment Tool

Fluvanna County Resilience

The graph on the right indicates the relative performance of Fluvanna County's resilience in comparison to the Thomas Jefferson Planning District, State of Virginia, and the US as a whole. The county is more resilient than the state in social and environmental resilience. The county is less resilient than the state in its economic measure and most especially in its infrastructure.

Resilience Indices



Source: University of Missouri Community Resilience Assessment Tool

The table to the right explores the determinants of the county's resilience, allowing us to see the drivers of the four categories. The county would benefit from improving access to emergency facilities and medical professionals. The county could also look to find ways to increase labor force participation to improve the resilience of the county.

Fluvanna County Resilience

Indicator	More Resilient	Less Resilient
Social	Higher Home-ownership	Fewer Non-Profits per Capita
	Higher Life Expectancy	Fewer Associations per Capita
Economic	Higher Voter Participation Rate	Lower Share with College Degrees
	Higher Proprietor Employment	Lower Labor Force Participation Rate
	More Establishment Births	Lower Proprietor Income
Infrastructure	More Employment Diversity	Less Access to Emergency Facilities
		Less Access to Grocery Stores
		Less Access to Medical Professionals
Environmental	Greater Environmental Diversity	

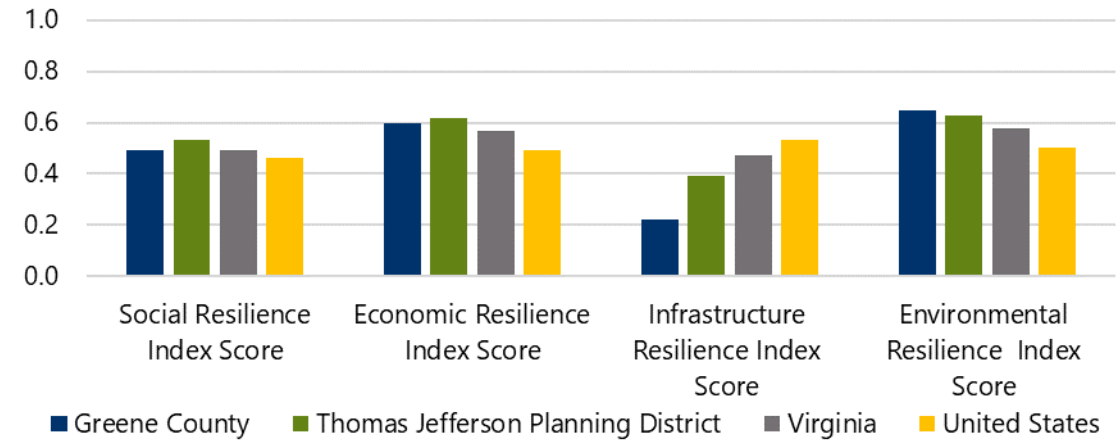
Note: Region is compared to Virginia

Source: University of Missouri Community Resilience Assessment Tool

Greene County Resilience

The graph on the right indicates the relative performance of Greene County's resilience in comparison to the Thomas Jefferson Planning District, State of Virginia, and the US as a whole. The county is more resilient than the state in environmental and economic resilience but is significantly less resilient than the state in its infrastructure. For social resiliency, the county rates at the same index level as the state.

Resilience Indices



Source: University of Missouri Community Resilience Assessment Tool

The table to the right explores the determinants of the county's resilience, allowing us to see the drivers of the four categories. The county would benefit from improving access to emergency facilities and medical professionals.

Greene County Resilience

Indicator	More Resilient	Less Resilient
Social	Higher Home-ownership	Lower Share with College Degrees
	Higher Share lived in the Same County a Year Ago	Fewer Associations per Capita
	Higher Voter Participation Rate	Fewer Non-Profits per Capita
Economic	Higher Proprietor Employment	
	More Establishment Births	
	More Employment Diversity	
Infrastructure	More Emergency Response Occupations	Less Access to Emergency Facilities
	More Evacuation Routes	Less Access to Medical Professionals
		Less Access to Grocery Stores
Environmental	Greater Environmental Diversity	

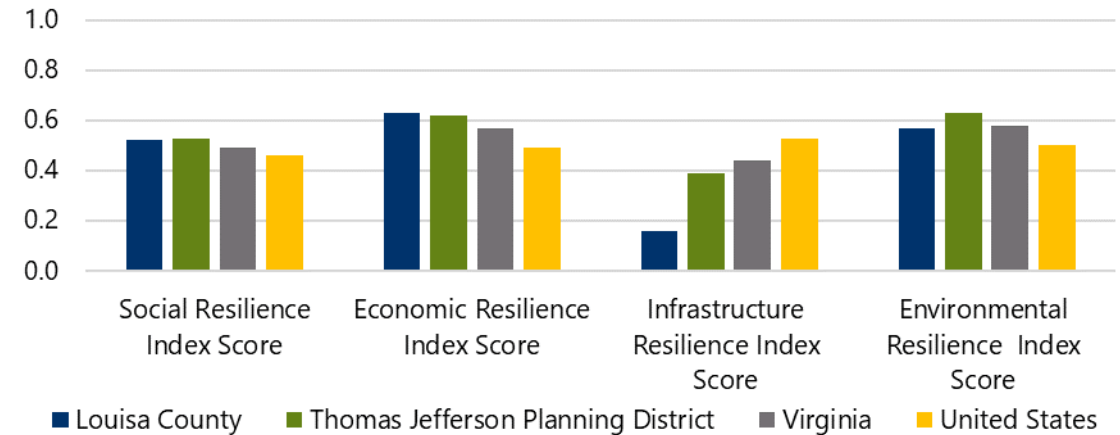
Note: Region is compared to Virginia

Source: University of Missouri Community Resilience Assessment Tool

Louisa County Resilience

The graph on the right indicates the relative performance of Louisa County’s resilience in comparison to the Thomas Jefferson Planning District, State of Virginia, and the US as a whole. The county is more resilient than the state in social and economic resilience but is far less resilient than the state in its infrastructure. The environmental resilience index value is nearly the same for Louisa County and the state.

Resilience Indices



Source: University of Missouri Community Resilience Assessment Tool

The table to the right explores the determinants of the county’s resilience, allowing us to see the drivers of the four categories. The county would benefit from improving access to emergency facilities and medical professionals. The county could also look to find ways to increase establishment births, incentivize labor force participation to improve the resilience of the county.

Louisa County Resilience

Indicator	More Resilient	Less Resilient
Social	Higher Home-ownership	Lower Share with College Degrees
	Higher Share lived in the Same County a Year Ago	Lower Life Expectancy
	Higher Voter Participation Rate	Fewer Non-Profits per Capita
Economic	Higher Proprietor Employment	Fewer Establishment Births
	Higher Proprietor Income	Lower Labor Force Participation Rate
	More Employment Diversity	
Infrastructure	More Evacuation Routes	Less Access to Emergency Facilities
		Less Access to Grocery Stores
		Less Access to Medical Professionals
Environmental		Less Environmental Diversity

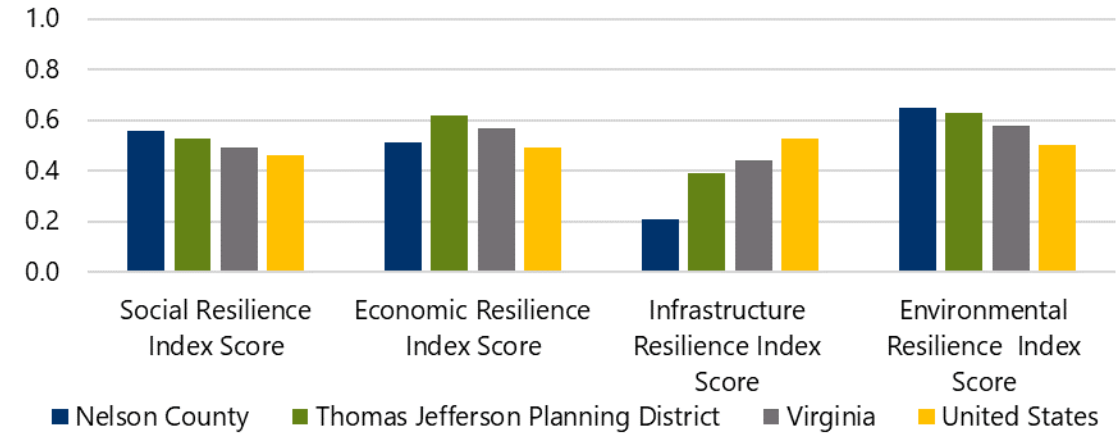
Note: Region is compared to Virginia

Source: University of Missouri Community Resilience Assessment Tool

Nelson County Resilience

The graph on the right indicates the relative performance of Nelson County's resilience in comparison to the Thomas Jefferson Planning District, State of Virginia, and the US as a whole. The county is more resilient than the state in social and environmental resilience but is less resilient than the state in its economic measure and infrastructure.

Resilience Indices



Source: University of Missouri Community Resilience Assessment Tool

The table to the right explores the determinants of the county's resilience, allowing us to see the drivers of the four categories. The county would benefit from improving access to emergency facilities and investing more in police and fire. The county could also look to find ways to incentivize labor force participation to improve the resilience of the county.

Nelson County Resilience

Indicator	More Resilient	Less Resilient
Social	Higher Share lived in the Same County a Year Ago	Lower Life Expectancy
	More Non-Profits per Capita	Lower Share with College Degrees
	Higher Voter Participation Rate	
Economic	Higher Proprietor Employment	Lower Labor Force Participation Rate
	More Establishment Births	
	More Employment Diversity	
Infrastructure	More Evacuation Routes	Less Access to Emergency Facilities
		Less Access to Grocery Stores
		Lower Share of Expenditures on Police and Fire
Environmental	Greater Environmental Diversity	

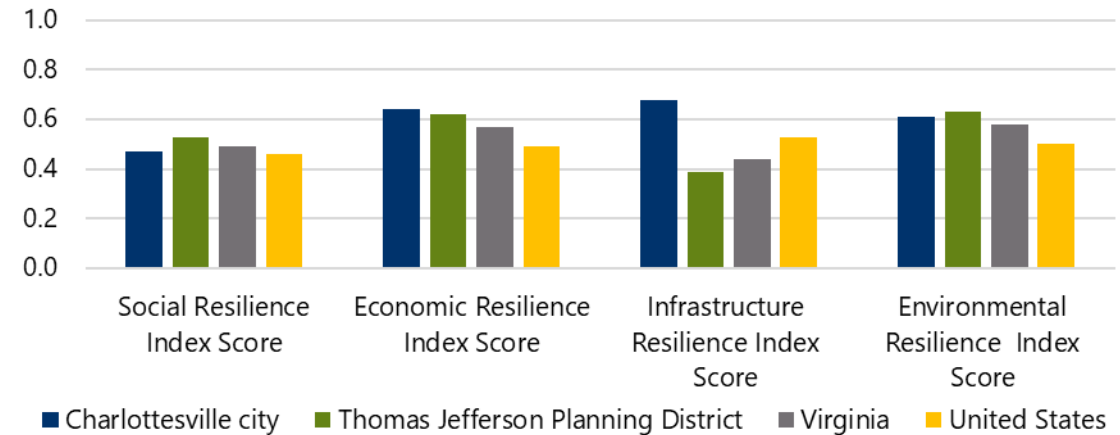
Note: Region is compared to Virginia

Source: University of Missouri Community Resilience Assessment Tool

Charlottesville City Resilience

The graph on the right indicates the relative performance of Charlottesville City’s resilience in comparison to the Thomas Jefferson Planning District, State of Virginia, and the US as a whole. The city is more resilient than the state in infrastructure, environmental, and economic resilience but is less resilient than the state in its social resilience.

Resilience Indices



Source: University of Missouri Community Resilience Assessment Tool

The table to the right explores the determinants of the city’s resilience, allowing us to see the drivers of the four categories. The city would benefit from increasing evacuation routes and emergency responders. The city could also look to find ways to incentivize labor force participation and increase establishment births to improve the resilience of the county.

Charlottesville City Resilience

Indicator	More Resilient	Less Resilient
Social	Higher Share with College Degrees	Lower Share lived in the Same County a Year Ago
	More Associations per Capita	Less Home-ownership
	More Non-Profits per Capita	Lower Life Expectancy
Economic	More Employment Diversity	Fewer Establishment Births
		Lower Labor Force Participation
Infrastructure	Greater Access to Medical Professionals	Fewer Emergency Response Occupations
	Higher Share of Expenditures on Police and Fire	Fewer Evacuation Routes
	Greater Access to Grocery Stores	
Environmental	Greater Environmental Diversity	

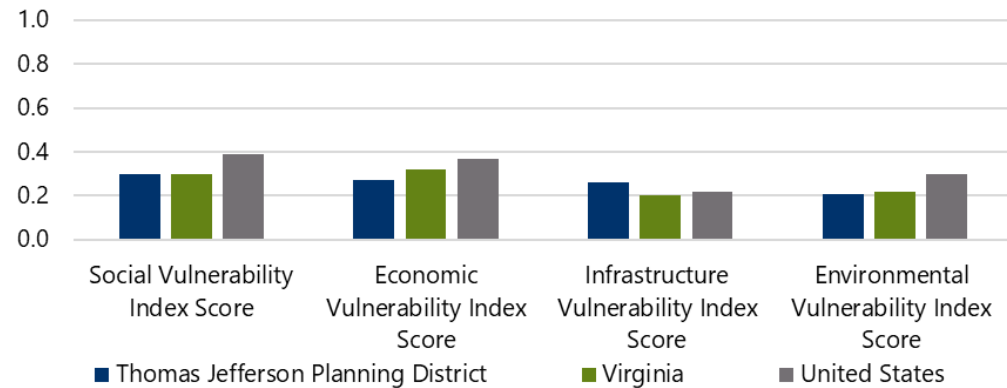
Note: Region is compared to Virginia

Source: University of Missouri Community Resilience Assessment Tool

Thomas Jefferson Planning District Vulnerability

The graph on the right indicates the relative performance of the Thomas Jefferson Planning District’s vulnerability in comparison to the State of Virginia and the US as a whole. The region is less vulnerable than the state on the economic and environmental scales but more vulnerable concerning infrastructure. The region and the state score similarly for social vulnerability.

Vulnerability Indices



Source: University of Missouri Community Resilience Assessment Tool

The table to the right explores the determinants of the region’s vulnerability, allowing us to see the drivers of the four categories. The region would benefit from improvements to drinking water safety to decrease the vulnerability of the region.

Thomas Jefferson Planning District Vulnerability

Indicator	Less Vulnerable	More Vulnerable
Social	Lower Share of Population Under 18	Higher Income Inequality
	Lower Linguistic Isolation	Higher Share of Population 65+
	Lower Violent Crime Rate	Higher Poverty Rate
Economic	Lower Unemployment Rate	Higher Share of Employment in Extractive Industries
	Lower Business Vacancy Rate	
	Fewer Cost-Burdened Households	
Infrastructure	Fewer High-Detour Bridges	Close to Major Dams
	Fewer Older Homes	Close to Nuclear Power Facility
	Higher Share with Motor Vehicles	Higher Share of Unsafe Drinking Water
Environmental	Less Diversity of Storm Events	Higher Likelihood of Seismic Hazards
	Far From Levees	Higher Likelihood of Droughts
	Fewer Severe Storm Events	

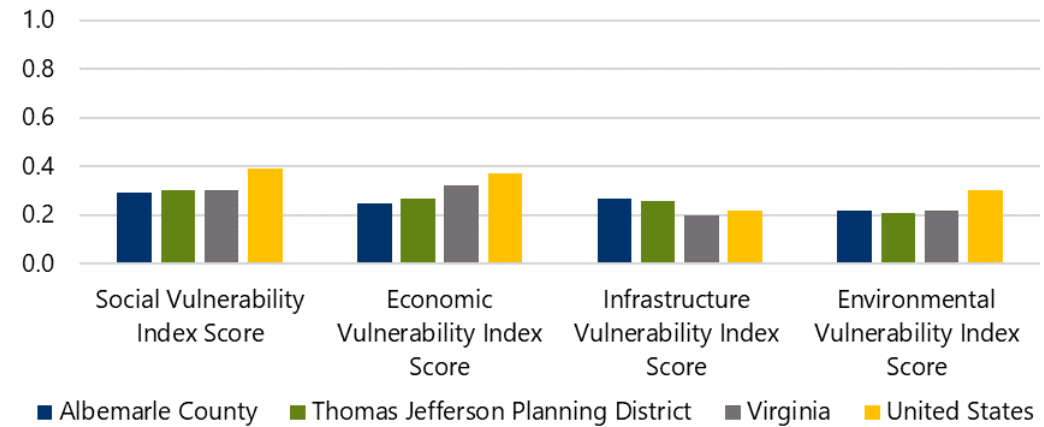
Note: Region is compared to Virginia

Source: University of Missouri Community Resilience Assessment Tool

Albemarle County Vulnerability

The graph on the right indicates the relative performance of Albemarle County’s vulnerability in comparison to the Thomas Jefferson Planning District, State of Virginia, and US as a whole. The county is less vulnerable than the state in social and economic vulnerability but more vulnerable in infrastructure vulnerability. For environmental vulnerability, the county and state receive the same index value.

Vulnerability Indices



Source: University of Missouri Community Resilience Assessment Tool

The table to the right explores the determinants of the county’s vulnerability, allowing us to see the drivers of the four categories. The county would benefit from decreasing its jurisdictions and high-detour bridges to decrease the vulnerability of the county.

Albemarle County Vulnerability

Indicator	Less Vulnerable	More Vulnerable
Social	Lower Uninsured Population	Greater Income Inequality
	Lower Violent Crime Rate	Greater Share of Population 65+
	Lower Share of Population Disabled	More Jurisdictions
Economic	Lower Unemployment Rate	
	Fewer Cost-Burdened Households	
	Lower Business Vacancy Rate	
Infrastructure	Fewer Older Homes	Close to Major Dams
	Higher Share with Motor Vehicles	More High-Detour Bridges
	Far From Nuclear Facility	
Environmental	Less Diversity of Storm Events	More Severe Storm Events
	Far From Levees	Higher Likelihood of Seismic Hazard
		Higher Likelihood of Drought

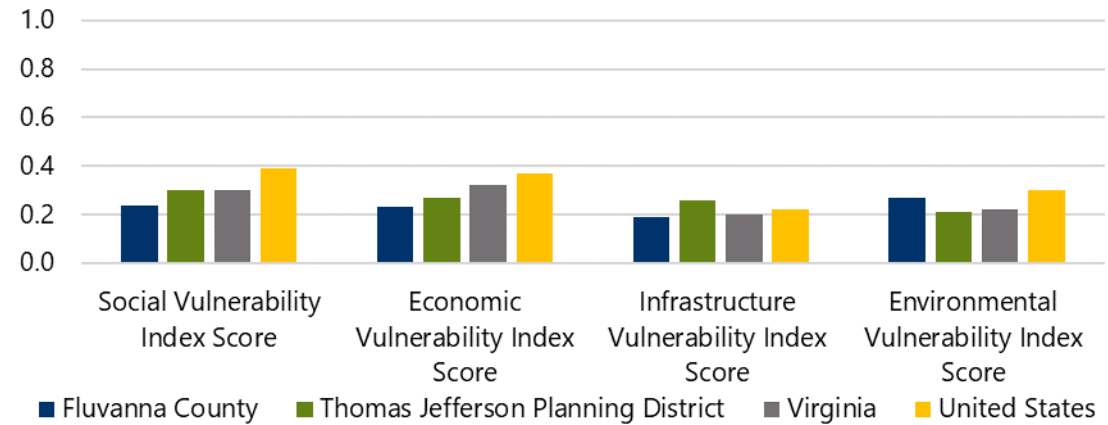
Note: Region is compared to Virginia

Source: University of Missouri Community Resilience Assessment Tool

Fluvanna County Vulnerability

The graph on the right indicates the relative performance of Fluvanna County's vulnerability in comparison to the Thomas Jefferson Planning District, State of Virginia, and US as a whole. The county is less vulnerable than the state across the social, economic, and infrastructure categories. The county rated higher than the state for environmental vulnerability, however.

Vulnerability Indices



Source: University of Missouri Community Resilience Assessment Tool

Fluvanna County Vulnerability

Indicator	Less Vulnerable	More Vulnerable
Social	Lower Income Inequality	Higher Share of Population Over 65
	Lower Violent Crime Rate	Higher Share of Population Disabled
	Lower Linguistic Isolation	
Economic	Lower Business Vacancy Rate	Higher Share of Employment in Extractive Industries
	Fewer Cost-Burdened Households	
	Lower Unemployment Rate	
Infrastructure	Fewer High-Detour Bridges	Close to Major Dams
	Higher Share with Motor Vehicles	More Mobile Homes
	Fewer Older Homes	
Environmental	Fewer Severe Storm Events	Higher Diversity of Storm Events
	Far From Levees	Higher Likelihood of Seismic Hazard
		Higher Likelihood of Droughts

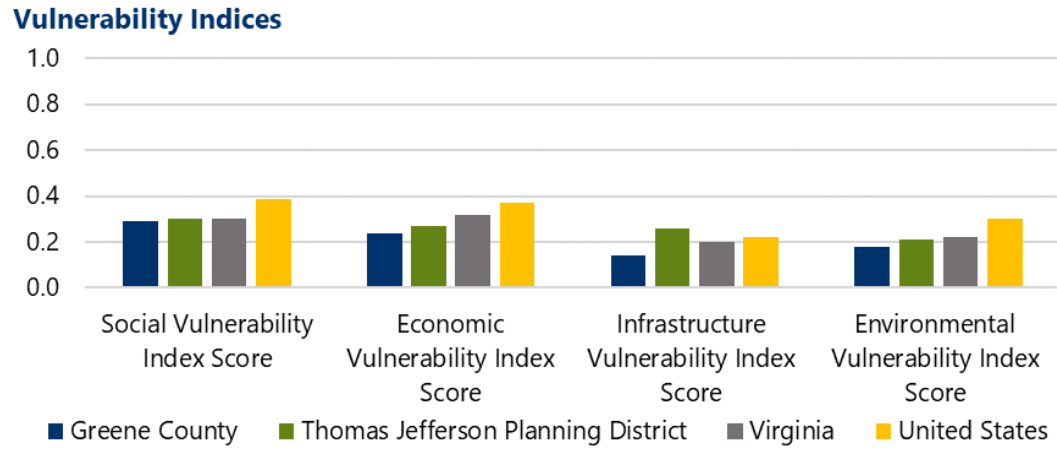
Note: Region is compared to Virginia

Source: University of Missouri Community Resilience Assessment Tool

The table to the right explores the determinants of the county's vulnerability, allowing us to see the drivers of the four categories. The county would benefit from exploring ways to prepare for environmental disasters like storms and droughts.

Greene County Vulnerability

The graph on the right indicates the relative performance of Fluvanna County's vulnerability in comparison to the Thomas Jefferson Planning District, State of Virginia, and US as a whole. The county is less vulnerable than the state across all categories.



Source: University of Missouri Community Resilience Assessment Tool

The table to the right explores the determinants of the county's vulnerability, allowing us to see the drivers of the four categories. The county would benefit from exploring ways to decrease the unemployment rate and unsafe drinking water to decrease the vulnerability of the county.

Greene County Vulnerability

Indicator	Less Vulnerable	More Vulnerable
Social	Lower Income Inequality	Higher Share of Population Uninsured
	Lower Linguistic Isolation	Higher Share of Population Under 18
	Lower Poverty Rate	Higher Share of Population Over 65
Economic	Lower Business Vacancy Rate	Higher Unemployment Rate
	Fewer Cost-Burdened Households	Higher Share of Employment in Extractive Industries
Infrastructure	Fewer High-Detour Bridges	More Unsafe Drinking Water
	Fewer Older Homes	More Mobile Homes
	Higher Share with Motor Vehicles	Close to Major Dams
Environmental	Fewer Severe Storm Events	Higher Likelihood of Seismic Hazards
	Less Diversity of Storm Events	Higher Likelihood of Droughts
	Far From Levees	

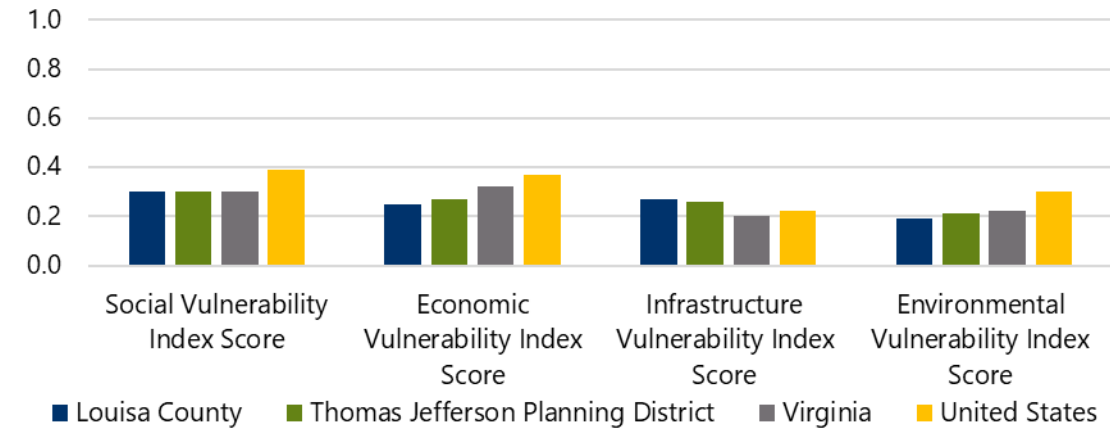
Note: Region is compared to Virginia

Source: University of Missouri Community Resilience Assessment Tool

Louisa County Vulnerability

The graph on the right indicates the relative performance of Louisa County's vulnerability in comparison to the Thomas Jefferson Planning District, State of Virginia, and US as a whole. The county is less vulnerable than the state in the economic and environmental categories but registers a greater degree of infrastructure vulnerability as compared to the state. For social vulnerability, the county and state marked the same degree of vulnerability.

Vulnerability Indices



Source: University of Missouri Community Resilience Assessment Tool

The table to the right explores the determinants of the county's vulnerability, allowing us to see the drivers of the four categories. The county would benefit from exploring ways to decrease the unemployment rate and unsafe drinking water to decrease the vulnerability of the county.

Louisa County Vulnerability

Indicator	Less Vulnerable	More Vulnerable
Social	Lower Linguistic Isolation	Higher Share of Population Uninsured
	Lower Violent Crime Rate	Higher Share of Population Disabled
	Lower Share of Population Over 18	Higher Share of Population Over 65
Economic	Lower Business Vacancy Rate	Higher Unemployment Rate
	Fewer Cost-Burdened Households	Higher Share of Employment in Extractive Industries
Infrastructure	Far From Major Dams	Close to Nuclear Power Facility
	Fewer High-Detour Bridges	Higher Share of Unsafe Drinking Water
	Higher Share with Motor Vehicles	More Mobile Homes
Environmental	Fewer Severe Storm Events	Higher Likelihood of Seismic Hazards
	Less Diversity of Storm Events	Higher Likelihood of Droughts
	Far From Levees	

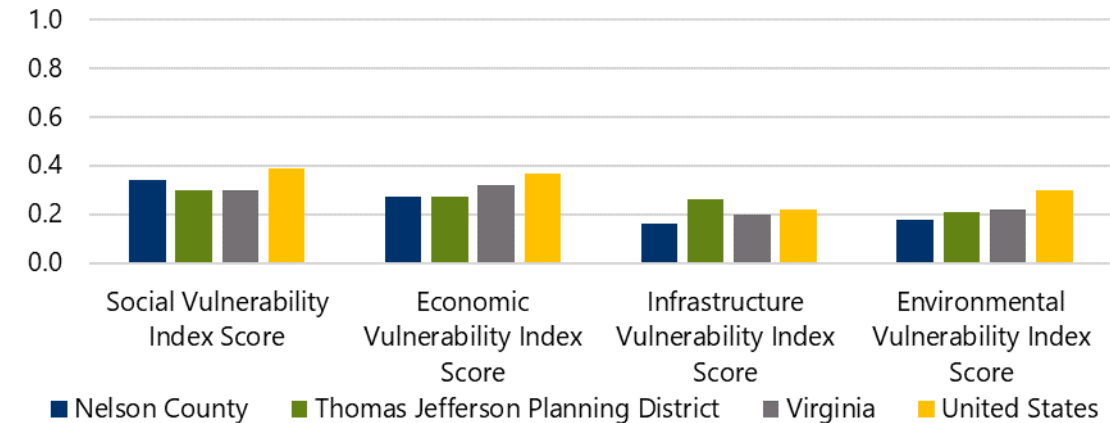
Note: Region is compared to Virginia

Source: University of Missouri Community Resilience Assessment Tool

Nelson County Vulnerability

The graph on the right indicates the relative performance of Nelson County's vulnerability in comparison to the Thomas Jefferson Planning District, State of Virginia, and US as a whole. The county is less vulnerable than the state in all categories but social vulnerability.

Vulnerability Indices



Source: University of Missouri Community Resilience Assessment Tool

The table to the right explores the determinants of the county's vulnerability, allowing us to see the drivers of the four categories. The county would benefit from exploring ways to decrease unsafe drinking water and mobile homes to decrease the vulnerability of the county.

Nelson County Vulnerability

Indicator	Less Vulnerable	More Vulnerable
Social	Lower Violent Crime Rate	Higher Share of Population 65+
	Lower Linguistic Isolation	Higher Income Inequality
	Lower Share of Population Under 18	Higher Share of Population Disabled
Economic	Lower Business Vacancy Rate	Higher Share of Employment in Extractive Industries
	Fewer Cost-Burdened Households	
	Lower Unemployment Rate	
Infrastructure	Far From Major Dams	Higher Share of Unsafe Drinking Water
	Fewer High-Detour Bridges	More Mobile Homes
	Far From Nuclear Power Facilities	Higher Share with No Motor Vehicle
Environmental	Less Diversity of Storm Events	Higher Likelihood of Droughts
	Fewer Severe Storm Events	Higher Likelihood of Seismic Hazards
	Far From Levees	

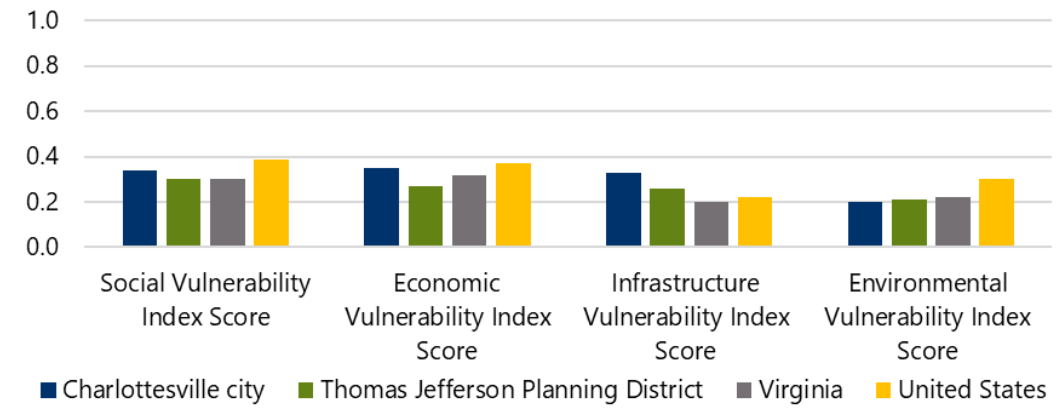
Note: Region is compared to Virginia

Source: University of Missouri Community Resilience Assessment Tool

City of Charlottesville Vulnerability

The graph on the right indicates the relative performance of Charlottesville City’s vulnerability in comparison to the Thomas Jefferson Planning District, State of Virginia, and the US as a whole. The city is less vulnerable than the state in environmental vulnerable but is more vulnerable than the state in all other categories.

Vulnerability Indices



Source: University of Missouri Community Resilience Assessment Tool

The table to the right explores the determinants of the city’s vulnerability, allowing us to see the drivers of the four categories. The county would benefit from exploring ways to decrease the business vacancy rate, violent crime rate to decrease the vulnerability of the city.

Charlottesville City Vulnerability

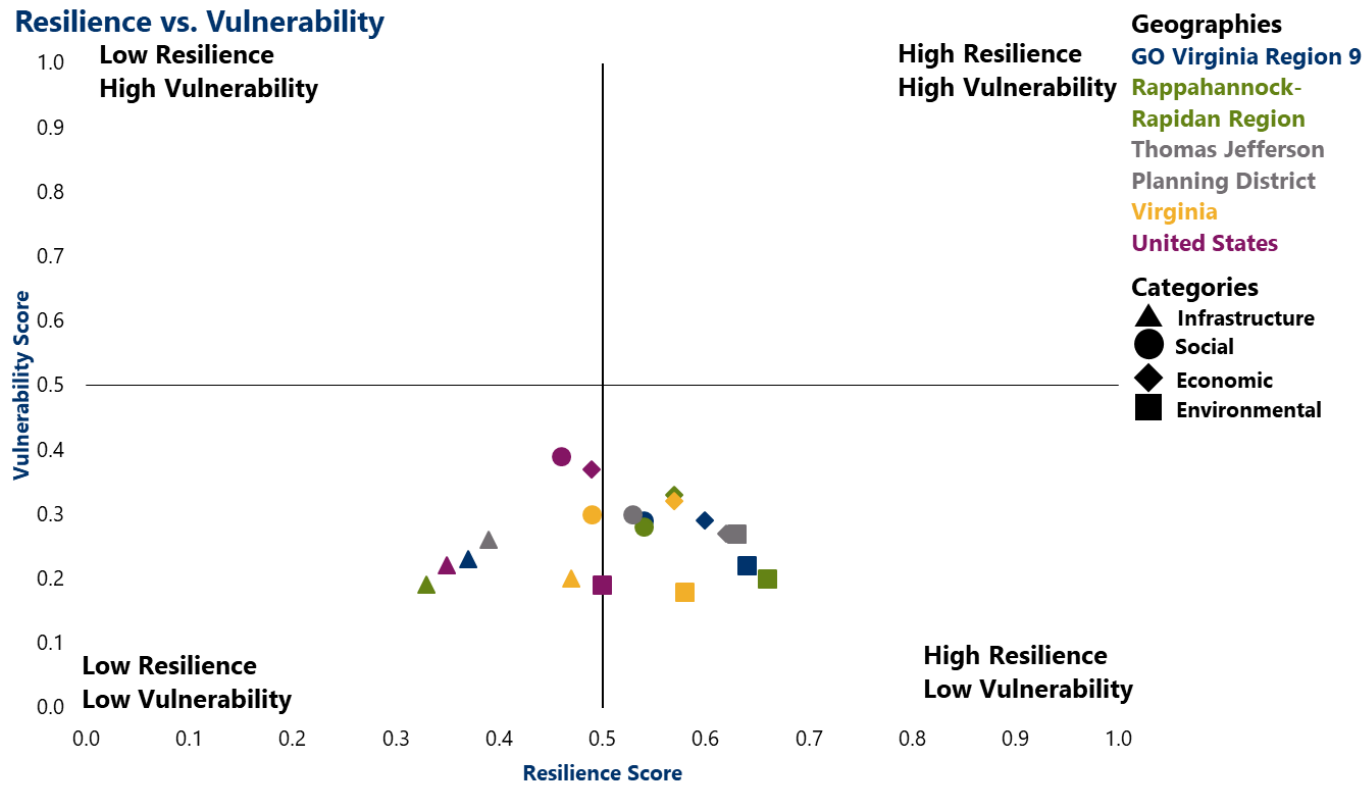
Indicator	Less Vulnerable	More Vulnerable
Social	Lower Share of Population Under 18	Higher Poverty Rate
	Lower Share of Population Over 65	Higher Income Inequality
	Lower Share of Population Disabled	Higher Violent Crime Rate
Economic	Lower Unemployment Rate	More Cost-Burdened Households
	Lower Share of Employment in Extractive Industries	Higher Business Vacancy Rate
Infrastructure	Fewer High-Detour Bridges	Close to Major Dams
	Fewer Mobile Homes	More Older Homes
	Far From Nuclear Power Facilities	Higher Share with No Motor Vehicle
Environmental	Fewer Severe Storm Events	Higher Likelihood of Seismic Hazard
	Less Diversity of Storm Events	Higher Likelihood of Drought
	Far From Levees	

Note: Region is compared to Virginia

Source: University of Missouri Community Resilience Assessment Tool

Resilience and Vulnerability, GO Virginia Region 9

The graphic below displays an overview of the resilience and vulnerability performance of each of the region’s geographies benchmarked to the state and national performance. Each of the four categories is also displayed. Key takeaways include: i) all geographies are *least resilient* in infrastructure and *most resilient* in aspects of the environment and ii) none of the geographies register as highly vulnerable across any of the categories.

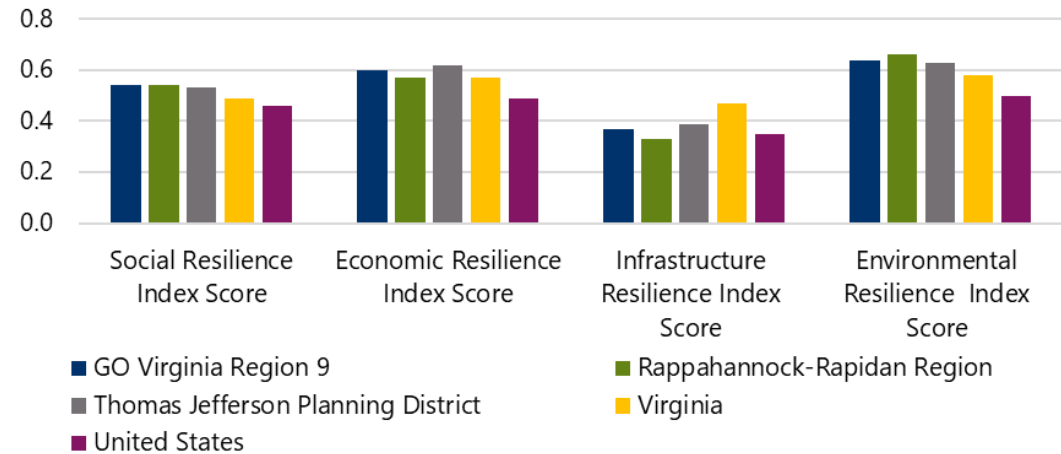


Source: University of Missouri Community Resilience Assessment Tool

GO VA Region 9 Resilience⁵

The graph on the right indicates the relative performance of the GO Virginia 9 region’s resilience in comparison to the RRRC and TJPDC regions, the State of Virginia, and the US. Note that the GO Virginia Region 9 is more resilient than the state across all metrics except for infrastructure resilience.

Resilience Indices



Source: University of Missouri Community Resilience Assessment Tool

The table to the right explores the determinants of the region’s resilience, allowing us to see the drivers of the four categories. The region would benefit from improving access to emergency facilities and increasing emergency occupations. The region could also consider finding ways to incentivize labor force participation and new establishment births to improve the region’s resilience.

GO Virginia Region 9 Resilience

Indicator	More Resilience	Less Resilience
Social	Higher Voter Participation Rate	Lower Share lived in the Same County a Year Ago
	More Non-Profits per Capita	
	Greater Home-ownership	
Economic	Higher Proprietor Employment	Lower Proprietor Income Lower Labor Force Participation Fewer Establishment Births
	More Employment Diversity	
	More Access to Medical Professionals	
Infrastructure	More Evacuation Routes	Less Access to Emergency Facilities Less Access to Grocery Stores Fewer Emergency Response Occupations
	Greater Environmental Diversity	
	Environmental	

Note: Region is compared to Virginia

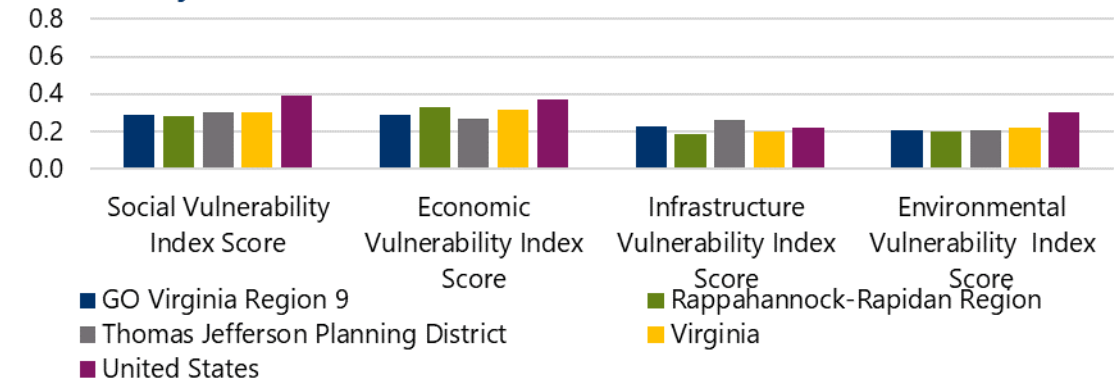
Source: University of Missouri Community Resilience Assessment Tool

⁵ To interpret the scores: a resiliency score of “1” would mean that the region is entirely resilient in that given metric, a score of “0” means that the region has no resiliency in that given metric.

GO VA Region 9 Vulnerability⁶

The graph on the right indicates the relative performance of the GO Virginia 9 region’s vulnerability in comparison to the RRRC and TJPDC regions, State of Virginia, and US as a whole. By these measures, the GO Virginia Region 9 is less vulnerable than the state across all metrics except for infrastructure vulnerability.

Vulnerability Indices



Source: University of Missouri Community Resilience Assessment Tool

The table to the right explores the determinants of the region’s vulnerability, allowing us to see the drivers of the four categories. The region would benefit from investing in water drinking improvements to decrease the region’s vulnerability.

GO Virginia Region 9 Vulnerability

	Less Vulnerability	More Vulnerability
Social	Lower Linguistic Isolation	Higher Share of Population 65+
	Lower Violent Crime Rate	Greater Income Inequality
	Lower Share of Population Under 18	
Economic	Lower Unemployment Rate	Higher Share of Employment in Extractive Industries
	Fewer Cost-Burdened Households	
	Lower Business Vacancy Rate	
Infrastructure	Fewer High-Detour Bridges	Close to Major Dams
	Higher Share with Motor Vehicles	Close to Nuclear Power Facility
	Fewer Older Homes	Higher Share of Unsafe Drinking Water
Environmental	Less Diversity of Storm Events	Higher Likelihood of Seismic Hazards
	Far From Levees	Higher Likelihood of Droughts
	Fewer Severe Storm Events	

Note: Region is compared to Virginia

Source: University of Missouri Community Resilience Assessment Tool

⁶ To interpret the scores: a vulnerability score of “1” would mean that the region is entirely vulnerable in that given metric, a score of “0” means that the region has no vulnerability in that given metric.

Sources And Data Notes

Social Resilience Index: Variables, Measures, and Data Sources

Variable	Measure	Data Source
Place Attachment	Percentage of population living in same county as one year prior	U.S. Census Bureau, American Community Survey, 2017-2021
Place Attachment	Percentage of housing units that are owner occupied	U.S. Census Bureau, American Community Survey, 2017-2021
Highly Educated Population	Percentage of population with a BS degree or higher	U.S. Census Bureau, American Community Survey, 2017-2021
Civic Engagement	Voter participation rate	Townhall.com Election Results, 2020
Social Capital	Number of 501(c)(3) organizations per capita	Internal Revenue Service, April 2021, and U.S. Census Bureau, 2020
Social Capital	Number of associations per 10,000 population	U.S. Census Bureau, County Business Patterns, 2021, and U.S. Census Bureau, 2020
Healthy Population	Life expectancy	Institute of Health Metrics and Evaluation, 2020

Educational attainment is a measure of civic engagement and social capital are based on research at Penn State University compiling a “Social Capital Index” for U.S. counties. The relationship between social capital in a community and a community’s ability to respond to unforeseen emergencies is documented in prior literature

The measure of associations included the following industry categories: bowling centers, civic and social associations, physical fitness facilities, public golf courses, religious organizations, membership sports and recreation clubs, political organizations, professional organizations, business associations, labor organizations and membership organizations not elsewhere classified.

Social Vulnerability Index: Variables, Measures, and Data Sources

Variable	Measure	Data Source
Income inequality	County Gini index	U.S. Census Bureau, American Community Survey, 2017-2021
Vulnerable population	County poverty rate	U.S. Census Bureau, American Community Survey, 2017-2021
Vulnerable population	Percentage of households that are linguistically isolated	U.S. Census Bureau, American Community Survey, 2017-2021
Vulnerable population	Percentage of population with a disability	U.S. Census Bureau, American Community Survey, 2017-2021
Vulnerable population	Percentage of population without health insurance	U.S. Census Bureau, American Community Survey, 2017-2021
Vulnerable population	Percentage of population age 65 and over	U.S. Census Bureau, American Community Survey, 2017-2021
Vulnerable population	Percentage of population under age 18	U.S. Census Bureau, American Community Survey, 2017-2021
Community erosion	FBI violent crime rate	FBI Uniform Crime Reports, 2021
Political fragmentation	Number of jurisdictions	U.S. Census Bureau, Census of Governments, 2021; 2013 Census Tiger/LINE Tribal Lands boundary file; National atlas, 2006 Federal Lands layer

Economic Resilience Index: Variables, Measures, and Data Sources

Variable	Measure	Data Source
Economic Diversity	Employment sector diversity (relative to national average)	U.S. Census Bureau, American Community Survey, 2017-2021
Entrepreneurship	Proprietors as a percentage of total nonfarm employment	Bureau of Economic Analysis, 2021
Entrepreneurship	Average nonfarm proprietor income	Bureau of Economic Analysis, 2021
Active Economy	Labor force participation rate	U.S. Census Bureau, American Community Survey, 2017-2021
Economic Growth	Establishment birth rate	U.S. Census Bureau, American Community Survey, 2017-2021

Economic Vulnerability Index: Variables, Measures, and Data Sources

Variable	Measure	Data Source
Reliance on Natural Resource Sectors	Percentage of workers employed in agriculture, forestry, fishing, mining industries	U.S. Census Bureau, American Community Survey, 2017-2021
Economic Hardship	Percentage of households spending 30% or more of total income on housing costs (mortgage/rent and utilities)	U.S. Census Bureau, American Community Survey, 2017-2021
Economic Hardship	Unemployment rate	U.S. Census Bureau, American Community Survey, 2017-2021
Potential Tax Shortfalls	Business vacancy rate	Department of Housing and Urban Development, 2021

Infrastructure Resilience Index: Variables, Measures, and Data Sources

Variable	Measure	Data Source
Medical Capacity	Percentage of population within 10 miles of a hospital with an emergency room	Centers for Medicare and Medicaid Services Provides of Service File, 2021; U.S. Census Bureau, 2020
Medical Capacity	Primary care physicians per capita	Health Resources and Services Administration, Area Health Resource File, 2021; U.S. Census Bureau, 2020
Potential First Responders	Persons in emergency response occupations as a percentage of total county population	U.S. Census Bureau, American Community Survey, 2017-2021
Investment in emergency response system	Per capita expenditures on police and fire	U.S. Census Bureau, Census of Governments, County Area Expenditures, 2021
Adequacy of roadways	Lane miles of interstates, principal arterial and minor arterial roads per 1,000 population	Federal Highway Administration, Highway Performance Monitoring System, 2021; U.S. Census Bureau, 2020
Access to food	Percentage of population within 1 mile of a grocery store	US Department of Agriculture, Economic Research Service, USDA - Food Access Research Atlas. 2019

Infrastructure Vulnerability Index: Variables, Measures, and Data Sources

Variable	Measure	Data Source
At risk infrastructure	Percentage of housing units that are mobile homes	U.S. Census Bureau, American Community Survey, 2017-2021
At risk infrastructure	Percentage of homes built before 1960	U.S. Census Bureau, American Community Survey, 2017-2021
Evacuation challenges	Percentage of population living in group quarters	U.S. Census Bureau, American Community Survey, 2017-2021
Evacuation challenges	Percentage of housing units with no vehicle available	U.S. Census Bureau, American Community Survey, 2017-2021
Evacuation challenges	Count of high detour or high traffic bridges	U.S. Department of Transportation, 2021 National Bridge Inventory
High potential loss facilities	Percentage of population within 5 miles of a dam	2021 National Transportation Atlas, Dams Dataset
High potential loss facilities	Percentage of population within 10 miles of a nuclear facility	U.S. Geological Survey, Structures Dataset
Infrastructure quality	Percentage of population served by water systems with at least one health-based violation	University of Wisconsin Population Health Institute, County Health Rankings. 2012-13

The inclusion of indicators measuring both older homes and mobile homes in disaster indicators has been established in academic literature as these housing units are considered more vulnerable to disaster due to the quality of the construction. Although there is no agreement on what constitutes an “older” home, this work uses a threshold of 1960 because that represents an even 50-year cutoff from the most recent decennial Census year. Data on both older homes and mobile homes are obtained from the U.S. Census Bureau American Community Survey.

Environmental Resilience

One Composite measure of environmental resilience has been used which quantifies the diversity of climate, lithology, land cover, and landform across the county. This measure addressed resource availability and diversity, assuming that more diverse landscapes are better able to rebound from a variety of disaster scenarios. Data from ESRI’s World Ecophysiological Diversity, 2015 dataset, created in partnership with the US Geological Survey’s Climate and Land Use Change Program and the Group on Earth Observations. The dataset consists of a 250m grid of the world, created by calculating the number of ecological facets in a 5 x 5 km square surrounding each pixel. Ecological facets are unique combinations of climate, lithology, land cover, and landform. County-level figures represent the mean value of all grid cells within the count boundary, calculated using ESRI’s zonal statistics tool.

Environmental Vulnerability Index: Variables, Measures, and Data Sources

Variable	Measure	Data Source
Flood Risk	Percentage of population within 2 miles of a levee or within a levee zone	U.S. Army Corps of Engineers, National Levees Database, 2021
Storm Severity	Number of storm events over 15 year period	National Oceanic and Atmospheric Administration, 2021
Range of Storm Types	Diversity index of storms	National Oceanic and Atmospheric Administration, 2021
Earthquake Risk	Population weighted seismic hazard zone score	U.S. Geological Survey, National Seismic Hazard Maps, 2021, 2014, 2007
Drought Risk	Percentage of weeks in drought	U.S. Drought Monitor, 2019-2021