

State Strategies for Measuring Resilience: A Comparative Study of South Carolina and Washington's Approaches

March 2025



UNIVERSITY OF
South Carolina



UNIVERSITY *of*
WASHINGTON

ACKNOWLEDGEMENTS

We extend our sincere gratitude to the reviewers of this paper for their time and invaluable insights, Jimmy Kralj and Jen Hennessey at the Washington State Department of Ecology, Alex Butler and Andrew White at the South Carolina Office of Resilience, Dr. Susan Cutter at the Hazards Vulnerability and Resilience Institute, and Ellen Ward, PhD at The Pew Charitable Trusts.

Contact Information

Margot Habets, PhD Candidate, Hazards Vulnerability and Resilience Institute, University of South Carolina; mhabets@email.sc.edu

Carlie Stowe, Climate Resilience Specialist, Climate Impacts Group, University of Washington; stowec@uw.edu

Kristiane Huber, Officer, State Resilience Policy, The Pew Charitable Trusts; khuber@pewtrusts.org

Crystal L. Raymond, Deputy Director, Western Fire and Forest Resilience Collaborative, University of Washington; clrfire@uw.edu

Suggested Citation

Habets, M., C.Stowe, K. Huber, and C.L. Raymond 2025. "State Strategies for Measuring Resilience: A Comparative Study of South Carolina and Washington's Approaches". <https://doi.org/10.6069/METG-EH02>



TABLE OF CONTENTS

Executive Summary	1
Introduction	2
Origins of South Carolina and Washington’s Resilience Initiatives and Metrics	4
Why Measure Resilience?	5
Considerations for Developing a Resilience Measurement Framework	8
Practical Considerations	8
What is your directive and context?	8
How much time do you have?	9
How much funding do you have?	9
Do you have the staff capacity and expertise needed in-house?	9
Do you develop a new framework or adapt an existing framework?	10
Is the framework being developed as part of a larger planning process, or is it an independent effort?	11
Conceptual Considerations	11
Defining resilience	11
Scale of measurement: What are you measuring?	12
When and how to consider data limitations	13
Who is involved	13
Timeframe for measurement	14
The values being communicated by the metric(s)	15
Qualities of a successful metric/measurement framework	16
Resilience measures depend on place	16
Practicality over perfection	16
Evergreen indicators	17
Conclusion	18
Appendix A: Additional Readings	19
Appendix B: State Metric Descriptions	20



EXECUTIVE SUMMARY

Increasingly, communities throughout the U.S. are facing threats and uncertainty from hazards exacerbated by climate change, population shifts, and land-use changes. States are on the front line of responding to these hazards and are tasked with mitigating risk and building resilience to impacts. A necessary step to building resilience is understanding the efficacy of existing and planned actions. Doing so can help to justify investments, demonstrate accountability, improve learning, and adaptively manage approaches to building resilience. Measuring resilience is an emerging practice, especially at the state level, with no standard approach. This paper aims to contribute to the growing conversation about state-level resilience measurement by providing a comparative analysis of South Carolina and Washington State’s resilience metrics and the approaches these states took to begin measuring resilience.

While the two approaches taken by the states differ, similar considerations underpin the measurement frameworks used. These include practical factors such as time, funding, and capacity, as well as conceptual aspects like the definition of resilience, measurement scale, and the values reflected in the metrics. These considerations are examined in light of the questions that state-resilience planners might face when developing their own measurement frameworks and metrics.

Additionally, this paper highlights the qualities of successful resilience measurement as identified by South Carolina and Washington. These qualities include:

1. **Metrics are place-based.** Resilience is inherently place-based, meaning resilience priorities change depending on the location and scale of measurement. Metrics should reflect the aspects of resilience that are important to the geographic and cultural contexts of a given place.
2. **Measurement frameworks prioritize practicality over perfection.** Prioritizing a short list of thoughtful, representative metrics will be more impactful and easier to communicate than a long list and are more likely to be implemented.
3. **Indicators of resilience are ‘evergreen’.** Resilience is both a dynamic process that manifests over long timeframes, and a continuous process that requires adaptability to rapid events (e.g. hurricanes, earthquakes) and gradual changes (e.g. sea level rise, drought). Actions states take to build resilience can and will change over time as they respond to acute events and gradual changes. While resilience is an ongoing process that evolves with emerging risks and changing actions, meaningful progress can be seen and measured over time. Use of ‘evergreen’ indicators, those that act as fixed markers of success overtime, can capture the long timeframe of resilience.

This paper distills the lessons learned from two states that tackled the challenge of developing a resilience measurement framework. Though the results differ, the considerations and challenges that each state faced are similar. As more governments at all levels develop approaches to measuring resilience, this paper aims to provide some guidance for the process.

INTRODUCTION

Communities today face a combination of stressors and threats due to population growth, development and land-use changes, and increasingly frequent and catastrophic events such as floods, wildfires, heatwaves and drought, which are exacerbated by climate change. The consequences of extreme weather events and other hazards include loss of life, destruction of homes, businesses, and critical habitat and ecosystems, infrastructure damage, and disruption to public services such as energy utilities, hospitals, and schools. State governments play a significant role in mitigating, responding to, and recovering from extreme weather events and ensuring that development does not put more people in harm's way. They direct federal as well as state hazard mitigation funding and guide how national resilience and hazard mitigation policy is applied at the local level. As the costs to address disasters rise, the cost burden on state and local governments has increased.¹

Many states are meeting this challenge by developing statewide comprehensive resilience plans, establishing dedicated state resilience offices and chief resilience officers, and targeting funding for resilience actions. As of March 2024, eighteen states have guidelines or a directive for the development of a statewide resilience plan, twelve states have an official resilience office, and thirteen states have a dedicated chief resilience officer, with five states having both a resilience office and chief resilience officer.² As more states consider developing resilience initiatives, lessons can be learned from looking at how other localities, states, and nations have approached the challenge of building resilience.

There are numerous resources on best practices for developing resilience plans that consider projected changes in climate, engage vulnerable communities, prioritize projects, and yield actionable policy recommendations. As state resilience programs and projects are implemented nationwide, there is an increasing need to understand their effectiveness. An emerging practice across resilience initiatives is to measure progress on implementation through evidence-based resilience metrics and measurement frameworks.³ This complements efforts to establish measurement frameworks for communities and natural systems, and indicators to measure progress towards the targets of the Paris Climate Agreement's Global Goal on Adaptation.

While there is no standard approach for measuring resilience, foundational research that has shaped the application of metrics at the local, state, federal, and international levels is documented in Appendix A.

1 Jay, A.K., A.R. Crimmins, C.W. Avery, T.A. Dahl, R.S. Dodder, B.D. Hamlington, A. Lustig, K. Marvel, P.A. Méndez-Lazaro, M.S. Osler, A. Terando, E.S. Weeks, and A. Zycherman, 2023: Ch. 1. Overview: Understanding risks, impacts, and responses. In: Fifth National Climate Assessment. Crimmins, A.R., C.W. Avery, D.R. Easterling, K.E. Kunkel, B.C. Stewart, and T.K. Maycock, Eds. U.S. Global Change Research Program, Washington, DC, USA.(Figure 1.7).

2 Morley, David. (2024). Planning for State Resilience: A 50-State Breakdown . [Story Map]. American Planning Association. <https://planning.org/research/planning-for-state-resilience-a-fifty-state-breakdown/>.

3 Global Goal on Adaptation." *Unfccc.int*, United Nations Climate Change, unfccc.int/topics/adaptation-and-resilience/workstreams/gga. Accessed 24 Feb. 2025.



Resilience measurement, supported in part by extensive academic research, is increasingly developed in partnership with policymakers and officials focused on climate and disaster resilience. For example, South Carolina's Office of Resilience (SCOR) led the planning process and contracted metric development from the Hazards Vulnerability and Resilience Institute (HVRI) at the University of South Carolina. Their approach adapted an existing US metric, Baseline Resilience Indicators for Communities (BRIC) to the state's context.⁴ In Washington, the University of Washington's Climate Impacts Group (CIG) was directed by the state legislature⁵ to work with an interagency group (led by the Department of Ecology) to develop resilience metrics as part of the process for updating the state's Climate Resilience Strategy.⁶ An introduction to the metrics used in each state is included in Appendix B and further context on the origins of the two states' resilience initiatives is provided on the next page.

This paper contributes to the growing conversation on state-level resilience metrics by comparing the planning and metric development processes in South Carolina and Washington. It aims to distill these processes into a set of questions applicable to various resilience contexts. Although the motivations for building resilience programs and the resulting metrics differ between the two states, the steps each took share key similarities, offering valuable insights for other states undertaking analogous efforts.

Text Box 1. *This paper uses the term “resilience” broadly, but the term can have many different meanings. Some key resilience approaches are outlined here.*

Resilience Approaches: Resilience can be approached in many ways, depending on who or what is being considered—whether it's an individual, community, or system—and what type of stressor is being addressed, such as specific hazards, climate change, economic shocks, or other challenges. Different disciplines, including social work, engineering, ecology, and sociology, offer distinct conceptual frameworks for resilience. The choice of approach can significantly shape the perspective and metrics used, and some may be more suited to particular contexts than others.

Engineering: A focus on designing and building structures and technology that can withstand and recover from shocks, emphasizing robustness, redundancy, and rapidity.

Ecological: Ecological science uses the term resilience to describe an ecosystem's ability to maintain its functioning in the face of change.

Social science: The ability of an individual, group, or community to cope with and recover from disturbances or shocks due to social (e.g. economic recession) or environmental (e.g. flooding) change.

Social-ecological systems: Ideas of resilience converge under this concept, which recognizes the linked nature of humans and the environment to inform more sustainable development and defines resilience as “the capacity to adapt or transform in the face of change in social-ecological systems, particularly unexpected change, in ways that continue to support human well-being”.⁷

4 Cutter, S. L., Ash, K. D., & Emrich, C. T. (2014). The geographies of community disaster resilience. *Global Environmental Change*, 29, 65–77. <https://doi.org/10.1016/j.GLOENVCHA.2014.08.005>.

5 RCW 70A.05, <https://app.leg.wa.gov/rcw/default.aspx?cite=70A.65&full=true>.

6 Washington State Department of Ecology, Washington State Climate Resilience Strategy, Olympia, Washington, Department of Ecology, 2024, <https://apps.ecology.wa.gov/publications/SummaryPages/2401006.html>.

7 Folke, C., Biggs, R., Norström, A. V., Reyers, B., & Rockström, J. (2016). Social-ecological resilience and biosphere-based sustainability science. *Ecology and Society*, 21(3). <http://www.jstor.org/stable/26269981>.

ORIGINS OF SOUTH CAROLINA AND WASHINGTON'S RESILIENCE INITIATIVES AND METRICS

South Carolina: Following extensive and catastrophic flooding in 2015, 2016, and 2018 South Carolina Governor Henry McMaster established a Floodwater Commission to assess the state's flood management systems and recommend strategies to reduce the risk of future flooding. Out of these recommendations, the state passed the Disaster Relief and Resilience Act (SC Code §48-62-10)⁸ forming South Carolina's Office of Resilience (SCOR) to create a central office dedicated to coordinate resilience efforts, ensure that resilience-building strategies were integrated into broader state and local planning, and lead the creation of a Strategic Statewide Resilience and Risk Reduction Plan. Due to the focus on flooding as motivating events, initial funding and activities were focused on flooding. Through the planning process, SCOR expanded the state's approach to resilience to consider all hazards, while still highlighting floods and flood resilience. While developing a resilience metric was not required within the Disaster Relief and Resilience Act, it was identified by the office as an important tool to report on and track not only flood resilience, but community resilience to natural hazards.

Washington: Recognizing the intensification of climate-related hazards and the risk this poses to people, the economy, and natural resources, Washington published its first Climate Response Strategy in 2012.⁹ The strategy complemented existing resilience and preparedness planning efforts for other types of hazards but differed in its specific focus on climate hazards and changes. The strategy included nearly 290 resilience actions to be implemented by state agencies, but did not include a measurement framework. Since the initial strategy was published, Washingtonians have increasingly experienced catastrophic impacts related to a changing climate, including major floods and rainstorms, droughts, large and severe wildfires and smoke events, and extreme heat. At the same time, the executive and legislative branches of government have championed additional policies to mitigate climate change and adapt to its impacts. For example, in 2021 the Climate Commitment Act (RCW70A.65),¹⁰ also known as the state's cap-and-invest program, was enacted. This act reduces emissions from the state's largest sources through a market-based program and directs the investment of revenues specifically for climate mitigation and adaptation activities.

In 2020, Washington's Office of Financial Management published a report identifying the need for an update to the state's climate strategy as a way of providing a framework for making decisions on what to prioritize and how to coordinate dispersed state efforts to build resilience.¹¹ This report set the stage for the Department of Ecology to initiate agency-request legislation in 2023 requiring an update to the state strategy (RCW 70A.05.010).¹² The legislation specified a process and priorities for the update, including which state agencies needed to be involved, how to engage communities, which climate hazards to consider, and guiding principles for any actions to be included in the strategy. The legislation explicitly required that a measurement framework be included. Because this process was legislatively directed, it ensured that funding and staffing was provided to facilitate the development and implementation of the measurement framework.

8 2019-2020 Bill 259: South Carolina Resilience Revolving Fund Act. Accessed February 24, 2025. https://www.scstatehouse.gov/sess123_2019-2020/bills/259.htm.

9 Washington State Department of Ecology, Preparing for a Changing Climate: Washington State's Integrated Climate Response Strategy, Olympia, Washington, 2012, <https://apps.ecology.wa.gov/publications/documents/1201004.pdf>.

10 RCW 70A.65, <https://app.leg.wa.gov/rcw/default.aspx?cite=70A.65&full=true>.

11 Budget Division, Office of Financial Management Washington State, Prioritizing Actions and Investments for Climate Resiliency in Washington, Olympia, Washington, 2020 https://ofm.wa.gov/sites/default/files/public/publications/OFM-Climate-Resiliency-Report-2020_0.pdf.

12 RCW 70A.05.010, <https://app.leg.wa.gov/RCW/default.aspx?cite=70A.05.010>.

WHY MEASURE RESILIENCE?

Plans are more likely to be implemented successfully if they have clear, measurable objectives and progress towards those objectives can be documented over time. A measurement framework can help states do this. Including a measurement framework in statewide resilience efforts can have numerous benefits.¹³ Measuring and evaluating efforts to build resilience can help state governments to:

- **Communicate a vision of and progress toward success.** A carefully constructed measurement framework can distill a vision of resilience for a wider audience, including the state legislature and the public (their constituents). Resilience is a broad concept; breaking resilience into measurable components can help make it more concrete for elected officials and the public, enabling them to connect it to what they value.
- **Justify investments to taxpayers.** Whether the initial source of funding for statewide resilience efforts is internal (e.g. state budget) or external (e.g. grants), the funder may require metrics for tracking success to acquire the funds initially. Particularly when legislatively appropriated state funds support resilience efforts, a measurement framework can be used to demonstrate what will be accomplished with the funding, and return on investment to the state legislature and public. Using the measurement framework to track progress over time can make a case for continued funding, especially from state budgets, to further support the same investments when metrics show progress, or different investments when they do not.
- **Understand if investments are moving the needle on resilience.** Once funding is acquired, metrics are critical for showing progress toward achieving objectives and ultimately the vision of resilience for a place. Metrics should be designed in a way that shows progress towards long-term vision, and near-term accomplishments that establish the enabling conditions for resilience. Similarly, metrics can show when existing strategies are not working and point towards the need to reevaluate strategies and change course.
- **Demonstrate accountability.** A measurement framework can help state governments stay accountable to their stakeholders and the public. It can serve as an effective engagement tool to keep stakeholders informed about the process over time, especially when it includes reporting timeframes. A measurement framework increases transparency about what progress is, where it is being made, and where efforts are falling short. Together, this can build trust and increase social license for resilience efforts.

Washington state legislature identified resilience measurement as a need in the enabling legislation and required **a report** on how the climate resilience strategy would demonstrate return on investment.

¹³ Resiliencemetrics.org

- **Make strategic decisions over time and align plans.** A critical stage of any planning cycle is evaluation and adaptive management. Without a defined measurement framework, these steps are not possible. A measurement framework can be used to identify where more capacity and investment are needed. It can be used to prioritize actions that are most effectively building resilience according to metrics thereby improving the effectiveness of resilience efforts.
- **Facilitate interagency coordination.** A measurement framework can also be used to align the efforts of different state agencies, departments, or branches of government. State-level resilience efforts can be viewed by some as random acts of resilience by different agencies or departments. How do these disparate resilience efforts combine to collectively build resilience for a state? A framework that measures a suite of resilience efforts demonstrates how any single action contributes to the broader vision of resilience. Implementing a measurement framework across state government can help state agencies align their efforts and avoid duplicating work or working across purposes.

South Carolina's index organizes resilience into six themes which can be used to communicate resilience needs to partner agencies. These themes are social, community, economic, environmental, infrastructural & institutional.

Despite these benefits, there is no standard resilience measurement framework. Those that exist vary in their complexity, the inclusion of baselines (what is the current state of resilience?), targets (what is the desired future condition?), and more. Developing an approach to measure resilience presents unique challenges for states. It is complex to define resilience across different geographies, hazards, community features, state agency functions, and over the long timeframes required to achieve outcomes. This process is daunting and often made more so by limited resources and capacity to support planning.

Consequently, establishing a measurement framework is often viewed as a “next step” or relegated to an implementation plan. However, treating metrics as an afterthought in resilience planning can make it difficult or even impossible to demonstrate the impact of what is being implemented, or result in a lack of implementation altogether. Developing a measurement framework as an integrated part of resilience planning from the beginning can benefit the process by setting expectations and establishing accountability from the onset. Whether required through legislation or identified internally as a need – metrics should be considered as early as possible and be incorporated into planning conversations. The following section outlines a series of practical and conceptual considerations distilled into a series of questions that state-resilience planners might face when developing their own measurement frameworks and metrics.

One of the reasons identified for limited implementation of Washington's 2012 resilience strategy, was that it lacked metrics. This finding contributed to the Washington state legislature directing an update to the strategy that included a measurement framework.

Text Box 2. *This paper uses the term “resilience metrics” to describe many elements of a complex measurement process. Some key metric terminology is defined here.*

Metric Terminology

Measurement Framework: A systematic approach to associating indicators and metrics with the objectives that resilience efforts are designed to achieve and regularly measuring and reporting on these metrics.

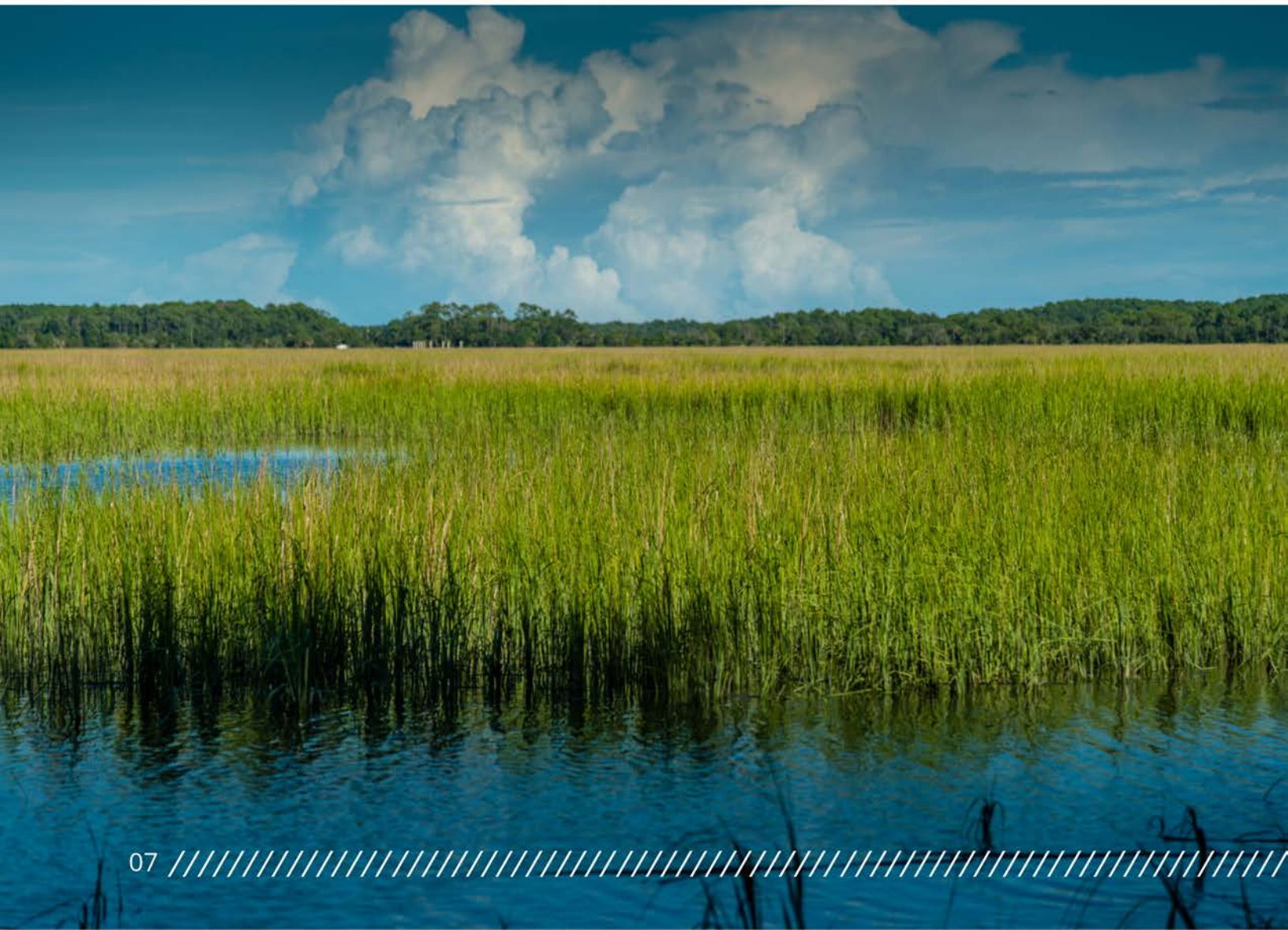
Indicator: A quality or trait that serves as a sign that a particular set of strategies or actions are yielding the desired results or making progress in the right direction.

Process indicator: Demonstrate that progress is being made toward a desired goal.

Outcome indicator: Show the extent to which a goal is achieved.

Capacity indicator: Show capacity and resources necessary to make progress towards or achieve a goal.

Metric: A variable that can be measured (quantitative) or tracked (qualitative) that represents the indicator. Metrics can focus on the outcomes of resilience plans and programs or measure the process of plan development and implementation.



CONSIDERATIONS FOR DEVELOPING A RESILIENCE MEASUREMENT FRAMEWORK

Before developing a resilience measurement framework, initial groundwork can aid the process. Making decisions about the practical and conceptual underpinnings of the framework before beginning to develop metrics will keep the process on track. While many of these decisions will be part of the larger planning process, they are equally important to consider when developing metrics. The process should be viewed as iterative, and often many of these considerations will happen concurrently, influencing thinking about the others (e.g. the timeline of the project might influence who is engaged and how). Below is a list of practical and conceptual considerations useful to clarify before developing a resilience measurement framework and subsequent metrics.

PRACTICAL CONSIDERATIONS

Resilience measurement frameworks take time, resources, and a lot of thought and reflection to develop. This can be an intensive process that is often enabled or constrained by practicalities such as time, budget, staff capacity and expertise, and political will and influence. Below is a list of guiding questions that can be useful to ask as one begins the process of creating a resilience measurement framework:

What is your directive and context?

Many states' resilience planning efforts are at the directive of state legislation or through a governor's executive action to establish a resilience governance body, planning process, or both. The text in legislation or executive orders varies from being very broad, providing little guidance or direction, to being too specific. In addition, experience with certain hazards or acute stress due to population growth and land-use changes can be a motivation and a limitation when scoping a resilience plan. In South Carolina and Washington, legislation, informed by experience of hazards and other efforts happening in the states, set the framework within which resilience planning and metric development could take place. South Carolina's measurement framework (and larger resilience planning effort) focuses on a wide variety of hazards, which was expanded from an initial emphasis on flooding. Washington's recent resilience planning and measurement framework focuses explicitly on climate change and aims to complement existing resilience initiatives in the state.

How much time do you have?

Developing a meaningful and thorough framework will require significant time and concessions will likely need to be made to reach a scope of work that is feasible. There are trade-offs between thorough, lengthy planning processes and faster ones that prioritize implementation, particularly when the next steps for expanding and refining resilience metrics are clearly documented. Time allocated to develop the framework will in part shape the path pursued for the framework. A longer timeframe time will allow you to engage more partners, gather more feedback, and develop data sources for your metrics. Less time allows you to implement and begin learning from the resulting metric more quickly.

How much funding do you have?

Developing a measurement framework can also require substantial funding. Depending on whether you are completing the framework in-house (requiring significant staff time), or contracting external parties, this effort should be adequately budgeted for. Once the framework is completed, implementation and reporting will also require considerable resources that should be accounted for upfront.

South Carolina: HVRI was contracted to produce the customized BRIC over a year-long period as part of a larger project consisting of six deliverables, including the synthesis of existing resilience metrics, and a survey tool. This contract budgeted for a project director, a part-time graduate assistant, data and materials, and university-required fringe for one year. The total costs for SCOR to contract HVRI was \$65,000.

Washington: CIG was named in the legislation to provide scientific and technical support to the year-long interagency process to update the state's climate resilience strategy. As a piece of this work, CIG was directed to participate in "Developing a process for identifying metrics and measuring progress and success towards statewide resilience goals." The measurement framework was developed alongside the larger strategy update process by a two-person research scientist team equating to approximately 1.0 FTE of effort for 10 months. The researchers consulted with state agencies five times on the development of the indicators and metrics. The draft measurement framework was also made available for public comment/feedback once during this period.

Do you have the staff capacity and expertise needed in-house?

Creating a robust and thoughtful resilience measurement framework will require staff time and capacity as well as expertise not only for the initial development of the framework but also through the implementation and reporting phases. If the necessary staff expertise or capacity is unavailable, partnering with an institution that specializes in monitoring and evaluating resilience may be a viable option. External partners (academic institutions, consulting firms, etc.) can reduce the burden on staff, help facilitate discussions around metric selection (especially useful when there are a variety of partners involved), facilitate learning from peer states and planning efforts, and provide outside expertise and perspectives on resilience.

South Carolina: The state has an office of resilience but due to a pre-existing relationship they approached local expertise in HVRI to create the metric, rather than diverting SCOR from existing projects.

Washington: CIG was named in legislation to support the strategy update process by providing scientific and technical expertise including examining how to measure and evaluate climate change resilience.

Do you develop a new framework or adapt an existing framework?

Many resilience metrics have been developed across a variety of geographies and for several contexts.¹⁴ Adapting an existing framework can save time and money. However, it is critical to ensure that the resilience measurement framework sufficiently reflects the specific goals of your state or community. Deciding whether to adapt an existing framework or to develop a new framework depends in part on the goals and scope of the measurement framework, as well as the other practical considerations listed above. In either approach, referencing work that has already been done to develop resilience metrics can enhance learning and help identify a suitable framework.

South Carolina: South Carolina adapted an existing framework, BRIC, after reviewing existing resilience measurement frameworks and discussing scope and capacity with HVRI. Due to HVRI's state-specific knowledge, its role as a training institute, and its development of the BRIC index framework, they were able to adapt the index faster and for a lower cost than developing an entirely new approach.

Washington: Working in close partnership with the state agencies engaged in the strategy update, CIG developed an original measurement framework for Washington. This was designed specifically to align with the goals of the resilience strategy. Although the framework was original, the metrics were designed to take advantage of other metrics and measurement frameworks for similar programs among the state agencies. A discussion of the benefits and limitations of these different approaches are provided in Appendix B.

14 Sharifi, Ayyoob. (2016). A Critical Review of Selected Tools for Assessing Community Resilience. Ecological Indicators 69 (October): 629–47. <https://doi.org/10.1016/j.ecolind.2016.05.023>.

Is the framework being developed as part of a larger planning process, or is it an independent effort?

Best practice is to develop metrics concurrently with resilience strategies and actions. This helps to ensure that metrics are sufficiently connected to the resilience goals for the given context. This can also help ensure cohesion across the vision of resilience, the resilience plan, and the measurement framework. Building the measurement framework from the beginning of the process will require additional time and resources that should be planned and budgeted from the outset. Both Washington and South Carolina included metric development as part of the planning process, though South Carolina's metric was completed after the plan was published. If developing the measurement framework is an independent effort (i.e. done after the creation of a plan), considering how to connect it to existing resilience initiatives will be important to create cohesion between existing programs and implementation partners and to ensure metrics are relevant to existing and future resilience goals and strategies.

While the basic structure of the framework and an initial set of indicators and metrics were developed concurrently to the update process for Washington's Climate Resilience Strategy, given the timeline (one year), some elements of the framework were relegated to be completed after the strategy was published. These elements include:

- Setting baseline measurement
- Refining select outcome metrics
- Developing the process for state agency reporting

CONCEPTUAL CONSIDERATIONS

The metric development process is complementary to larger planning efforts as many of the same practical and conceptual considerations apply to both. While the practicalities of developing a metric are important to consider at the onset, it may also be worth considering the conceptual complexities of resilience to inform your approach.

Defining resilience

Having a clear definition of resilience is an important first step in understanding how to measure it. Resilience is a broad term with different definitions depending on the field (Text Box 1). Twenty states have an official definition of "resilience" with seven states defining the term in statute. In many cases, the term is defined through the statewide planning process and documented in a resilience plan.¹⁵

Resilience metrics can be used to describe a system's ability to maintain, cope, recover, adapt, and transform in the face of change. Natural hazards (e.g. earthquakes, hurricanes) and climate change-related hazards (e.g. increased frequency of high-intensity precipitation events) will intersect with existing social, political, environmental, and economic development issues (e.g. economically disadvantaged households living in floodplains) to create disasters and severe impacts. Increasing resilience is therefore related to addressing and reducing the structural inequalities rooted in social, political, and economic systems (i.e. vulnerability) that put people and infrastructure in harm's way and exacerbate disruptions to critical ecosystem functions. Metrics of resilience should reflect the definition of resilience being used by the state and should also consider the various social, political, environmental, and economic elements that influence resilience.

¹⁵ Morley, David (2024)

Different approaches to resilience highlight the importance of answering another set of questions: “*Resilience to what? Resilience for whom?*” (i.e. what are we making ourselves resilient to, and who will benefit from it).¹⁶ These questions are especially important to consider when developing a framework to measure resilience, as different stakeholders will have different ideas about what is important to build resilience to (e.g. earthquakes, climate impacts etc.), priorities for what is made resilient (e.g. infrastructure, ecosystems, people), and how to measure resilience and why.

South Carolina’s Resilience Definition

South Carolina defined resilience through the planning process, drawing on founding legislation and consulting a community advisory committee with drafted definitions. Resilience for the state is defined as, “The ability of communities, economies, and ecosystems within South Carolina to anticipate, absorb, recover, and thrive when presented with environmental change and natural hazards.” The state takes a holistic all-hazards approach while acknowledging and incorporating changing development needs and climate patterns when considering resilience needs and initiatives.

Washington’s Resilience Definition

Washington relied on the definition for climate resilience used in state legislation. The definition of climate resilience used is: “Climate resilience is the ongoing process of anticipating, preparing for, and adapting to changes in climate and minimizing negative impacts to our natural systems, infrastructure, and communities. For natural systems, increasing climate resilience involves restoring and increasing the health, function, and integrity of our ecosystems and improving their ability to absorb and recover from climate-affected disturbances. For communities, increasing climate resilience means enhancing their ability to understand, prevent, adapt, and recover from climate impacts to people and infrastructure.”

Scale of measurement: What are you measuring?

Consider the scale of measurement for your framework: Are you measuring the result of a resilience action or initiative? Are you measuring resilience for a specific community? Are you measuring resilience overall for the state? Or are you interested in measuring resilience at multiple scales? The scale of measurement will inform other aspects of how you develop your measurement framework. Likely, many different levels of government (local, state, federal) and private partners (businesses, NGOs) are working across the state to build resilience. To truly measure resilience at the state level, coordinating data and tracking the activities of these different actors might be necessary. Clearly communicate the limitations and boundaries of what resilience activities are being measured (e.g. outcomes of state-led actions) and which data are being used (i.e. only relying on measures at the census tract level) to ensure transparency.

16 Cutter, S. L. (2016). Resilience to What? Resilience for Whom? *The Geographical Journal*, 182(2), 110–113.
<http://www.jstor.org/stable/43868692>.

South Carolina's Scale of Measurement

South Carolina's goal for this metric was to establish a baseline of community resilience to hazards that could be recalculated over time to determine whether SCOR's actions were moving the needle on resilience in different places. By taking an explicitly sub-state scope for this index, it can measure resilience using county and census tracts capturing how resilience differs across the state. The resulting product can also be compared to the distribution of hazard risk in the state.

Washington's Scale of Measurement

Washington's measurement framework has detailed process-based metrics to measure outputs regarding the actions in the state strategy, and outcome metrics to attempt to capture progress towards overall resilience goals for the state.

When and how to consider data limitations

It can be tempting to focus on which data is available when beginning to develop metrics. Although the metrics chosen will depend in part on the data availability, only considering this can constrain the creative process that would otherwise help identify the most appropriate metrics to measure resilience. Limiting a metric to only what data is already available can result in a missed opportunity to identify metrics that would be most useful in your context.

How South Carolina Considered Data Limitations

The list of indicators considered for the South Carolina metric included all variables used in previous BRIC calculations and a list produced during a brainstorm session with HVRI and SCOR that asked, 'what would you ideally measure?' Only after these were compiled did HVRI determine whether the correct data was available at the right scale. Data with no established source remains on a wish list for future iterations of BRIC.

How Washington Considered Data Limitations

Washington began by developing a suite of indicators (traits of a resilient Washington) for each resilience goal. After these were compiled, agencies brainstormed metrics that could be used to quantify these indicators. Data limitations were then considered and for metrics where data did not exist, the team decided if it was worth creating a new data set or keeping it on a wish list to collect in the future.

Who is involved?

Incorporating diverse identities, perspectives, and expertise in the measurement framework creates a more holistic approach to resilience and reflects a broader range of values. Measurement frameworks may need to balance metrics developed by experts or officials that focus on broad goals and outcomes, and community-driven metrics.

Including multiple perspectives can help to ensure the qualities of resilience that are being measured are meaningful to the public, especially populations that are particularly vulnerable to hazards (e.g. economically disadvantaged, non-English speaking, those with pre-existing health conditions, or living in areas with a legacy of environmental degradation). When communities (or community advocates) are involved in resilience planning it can build public support for the process and ensure the framework and metrics selected represent community resilience priorities that may not be visible to officials or subject matter experts. Meaningful community engagement will require time and resources, not only to understand diverse interest holder perspectives but also to reconcile these perspectives with each other and expert-led planning efforts.

Who Was Involved for South Carolina

SCOR staff and HVRI researchers were the primary developers of the resilience metric. BRIC, which the South Carolina metric is based on, has been widely reviewed and replicated in peer-reviewed literature and applied broadly across the US.

Who Was Involved for Washington

The legislation that mandated the update to the State's climate resilience strategy also listed the 10 state agencies that were required to be involved. The named agencies are state departments of agriculture, commerce, ecology, fish and wildlife, health, natural resources, transportation, the Washington State Conservation Commission, the Emergency Management Division, and the Puget Sound Partnership. In addition to providing diverse perspectives on resilience, this group provided insight into the vast amount of data already being collected at the state level, helping to quickly resolve questions about data limitations.

Timeframe for measurement

Resilience is a moving target that is based on the dynamic needs of social-ecological systems in the context of a changing climate, development, population changes and more. This makes attribution (connecting an investment or action to a resilience outcome) especially challenging. It is likely that over the course of implementing a project or strategy, the systems you are working in will change, and new actions will be implemented at various scales (e.g. global, national, regional, local), so attributing an investment in the original action as the cause of a resilience outcome will become difficult or nearly impossible. It is more feasible to demonstrate how an action contributes to resilience goals (e.g. planting trees contributes to Washington's community resilience goal to: "Foster healthy, safe, equitable, and economically vibrant communities that can effectively and proactively reduce and manage their greatest climate change risks and vulnerabilities," however, it will not be the sole determinant of achieving this goal).

Using a variety of types of metrics can be useful to paint a more comprehensive picture of resilience. This includes a mix of outcome metrics, tracking of progress, and qualitative as well as quantitative measures. Another way to demonstrate near-term progress and success is to measure and track the conditions (funding, human capacity, knowledge) that are being established to enable the implementation of resilience actions or programs.

South Carolina's Approach to Determining Timeline for Measurement

The framework adopted in South Carolina uses baseline resilience metrics sorted into six themes (indicators) of resilience. If a metric no longer represents resilience, it can be replaced with a more relevant one while still measuring these six themes. BRIC will be recalculated multiple times, ideally every five years, providing a timeline of resilience changes in the state and because the metric is not directly connected to specific plan actions, it can be used with different plan updates over time.

Washington's Approach to Determining Timeline for Measurement

Washington used a combination of indicators (capacity, process, and outcome) and metrics to measure these indicators. Indicators are intended to be static, or 'evergreen', but the metrics used to measure the indicator are intended to be adaptively managed with flexibility to adjust the metrics as needed overtime. Outcome indicators and associated metrics will be measured every four years, process and capacity indicators and metrics will be measured every two years.

The values being communicated by the metric(s)

The metrics that are selected will communicate values (e.g. if all your metrics are focused on the resilience of built environments, this might communicate that the resilience of natural environments is not a priority). Considering cultural values and knowledge systems is important as different cultures value different aspects of resilience. Returning to the questions of "*Resilience for whom? Resilience to what?*", especially when asked through an environmental justice lens, can guide the incorporation of different value systems and perspectives when developing metrics.

Before developing metrics of resilience, consider how metrics can be misleading, or even misused. Metrics are necessary to show progress toward resilience, but they are often imperfect. Some are more likely to lead to perverse incentives that favor outcomes that are dissimilar from those that are intended. For example, in an education system in which a teacher's performance is measured by standardized testing, teachers are incentivized to "teach to test," potentially inflating scores with little improvement in education.¹⁷ Data and metrics also inherently reflect specific interests, values, and knowledge systems.¹⁸ This can result in unintended consequences. Risks created by imperfect metrics can be mitigated by utilizing multiple metrics to tell different pieces of the resilience story, setting targets and baselines, ensuring metrics represent multiple values, and including different types of metrics that speak to different stages of the resilience cycle (e.g. capacity, process, and outcomes).¹⁹ Pairing quantitative metrics with qualitative ones through methods like surveys or interviews can help tell a more complete story, particularly from an environmental justice perspective.

17 Hallegatte, S., and Engle, N.L., (2019). The search for the perfect indicator: Reflections on monitoring and evaluation of resilience for improved climate risk management. *Climate Risk Management*, 23, 1–6, <https://doi.org/10.1016/j.crm.2018.12.001>.

18 Loconto, A., Prudham, S., & Wolf, S. (2024). Environmental governance through metrics: guest introduction. *Science as Culture*, 33(1), 1–15. <https://doi.org/10.1080/09505431.2024.2312703>.

19 Hallegatte, S., and Engle, N.L., (2019). The search for the perfect indicator: Reflections on monitoring and evaluation of resilience for improved climate risk management. *Climate Risk Management*, 23, 1–6, <https://doi.org/10.1016/j.crm.2018.12.001>.

QUALITIES OF A SUCCESSFUL METRIC/MEASUREMENT FRAMEWORK

Although Washington and South Carolina define and measure resilience differently, their metrics share qualities that contribute to their success. These qualities are broadly applicable and not tied to any one definition or framework. Measuring resilience is complex but these best practices can result in metrics that capture the resilience of a place and remain relevant over time. Both measurement frameworks are grounded in local context, use flexible indicators that can evolve as our understanding of resilience changes, and prioritize practicality over perfection (see Appendix B for descriptions of the frameworks/metric).

Resilience measures depend on place

First, both states focus on place-based resilience, recognizing that resilience priorities change depending on the location and scale of measurement. Risks from hazards and changes in the climate depend on geography - the characteristics of the space and place where they are located. Both South Carolina and Washington consider this local context and select metrics that reflect resilience needs and goals in their respective places. A metric that chooses local relevance over broader applicability is tailored to what resilience means in that place. South Carolina, for instance, uses metrics around flash flooding, dams, and housing in the floodplain in BRIC, but may not include metrics related to avalanche or tsunamis, which do not occur in the state. Metrics will also vary by location and scale. South Carolina uses county and census tract data to assess resilience at a sub-state level, while Washington develops statewide metrics with no sub-state comparisons. A state may adopt different kinds of metrics to assess resilience at different scales and for different places.

Practicality over perfection

While no single metric can capture all aspects of resilience, prioritizing practical and actionable measures over perfect ones is essential for meaningful progress. Metrics can serve many purposes, as outlined in this document, and the priorities for resilience will likely lead to decisions on what metrics to include and how to connect them to resilience plans and strategies. Practicality may require some compromises on how to measure resilience over time. While qualitative data (e.g. surveys, interviews) may provide more detail on progress or the real resilience of individuals, it requires more time, resources, and expertise to collect and analyze. Quantitative data (e.g. dollars spent, number of projects) can be easier to measure, but can also simplify concepts to a few numbers, missing a more nuanced view of resilience. Both states use quantitative metrics, but incorporating qualitative data might offer a richer view of successes and challenges.

Lists of potential indicators and metrics can quickly balloon; prioritizing a short list of thoughtful, representative metrics will be more impactful and easier to communicate than a long list. Although South Carolina's BRIC uses over 50 quantitative variables under six resilience themes, these are all publicly available and can be quickly updated. Washington prioritizes a smaller set of indicators and metrics that draw from existing state-level data with more time-consuming data collection taking place only every four years to decrease resource demands. These two approaches prioritize what can be measured relatively quickly and easily to balance a comprehensive but reasonable framework to track resilience over time while also demonstrating near-term accountability.

Evergreen indicators

Resilience is a continuous process that requires adaptability to both rapid events (e.g. hurricanes and earthquakes) and gradual changes (e.g. sea level rise and drought). While resilience is an ongoing process that evolves with emerging risks and changing actions, meaningful progress can be seen and measured over time. Both states use what we call 'evergreen' indicators that attempt to capture the long timeframe of resilience. Any metric is a snapshot in time that is only perfectly relevant at the time of that snapshot. Evergreen indicators remain applicable over multiple snapshots, even if the metrics that measure the indicators are adapted to new information, data, or emerging risks. States must carefully select the right indicators and metrics to track resilience and be prepared to update them as circumstances evolve. Data will change and improve over time, as will our understanding of resilience and how to best measure it. Adjustments to indicators and metrics should balance the need for consistency of metrics to measure progress over time with the need to ensure appropriate aspects of resilience are being measured.

Both states incorporate metrics that are relevant to resilience today and likely in the future and incorporate flexibility into their frameworks to account for evolving risks and values. South Carolina intends to recalculate its resilience index every five years, and through that recalculation process, SCOR and HVRI will reevaluate the relevance of the metrics included in BRIC as well as introduce new metrics if data has been created or improved since the last iteration. However, the six themes of resilience and most of the indicators will remain relevant to resilience by design. Washington intends to reevaluate the relevance of indicators and metric every four years in line with the legislatively mandated interagency process to update the state strategy.



CONCLUSION

Through the lens of South Carolina and Washington’s experiences, measurement frameworks take different forms, follow different approaches, and are applied at various scales, resulting in unique metrics. However, we find that the common qualities laid out here are essential to the initial success and adoption of the metrics in these two states. The practical and conceptual considerations outlined encompass the larger questions tackled by the respective research teams and state agencies. The answers to these questions resulted in two different measurement frameworks that originated from different contexts but that accomplish similar goals related to measuring resilience.

As is the case for all plans and metrics, their implementation is just as, if not more, important than their development. Depending on their defined function, metrics are a check-in, report card, and more, and they need to be measured at regular intervals including initial measurement to establish baseline conditions. Calculating and reporting on metrics regularly not only benefits stakeholders and the planning team as discussed in ‘Why Measure Resilience?’, it also provides the opportunity to adjust the metric based on new threats and approaches to building resilience. The resilience measurement frameworks outlined in Appendix B represent the initial iteration for each state and are likely to evolve as practical and conceptual considerations are refined and new needs arise during implementation. Metrics serve states best when they are adaptively managed beyond the planning phase to implementation. As such, resilience planners can continuously learn from one another as measurement frameworks are adapted and refined, while advancing resilience efforts across state lines.



APPENDIX A:

ADDITIONAL READINGS

The National Resilience Context

Morley, David. 2024. Planning for State Resilience: A 50-State Breakdown. [Story Map] American Planning Association, <https://planning.org/research/planning-for-state-resilience-a-fifty-state-breakdown/>.

National Academies of Sciences, Engineering, and Medicine (NASEM). 2019. Building and Measuring Community Resilience: Actions for Communities and the Gulf Research Program. Washington, D.C., DC: National Academies Press. <https://doi.org/10.17226/25383>.

NASEM. 2023. Strengthening Equitable Community Resilience: Criteria and Guiding Principles for the Gulf Research's Program Enhancing Community Resilience (EnCoRe). Washington, D.C., DC: National Academies Press. <https://doi.org/10.17226/26880>.

National Research Council (NRC). 2012. Disaster Resilience: A National Imperative. Washington, D.C., DC: National Academies Press. <https://doi.org/10.17226/13457>.

Review of Different Metrics

Habets, Margot and Susan L. Cutter. 2023. Evaluation of Existing Community Disaster Resilience Approaches and Tools to Support Resilience Planning Efforts. Columbia, SC. HVRI Report for South Carolina Office of Resilience. <https://scor.sc.gov/sites/scor/files/Documents/Appendix%20C%20HVRI%20Report.pdf>.

Sharifi, Ayyoob. 2016. A Critical Review of Selected Tools for Assessing Community Resilience. Ecological Indicators 69 (October): 629–47. <https://doi.org/10.1016/j.ecolind.2016.05.023>.

Complexities of Measuring Resilience

Stowe, C.R. and C.L. Raymond, 2024. Measuring Resilience in Support of Effective Investment in Climate Adaptation. Legislative report prepared by the Climate Impacts Group, University of Washington, Seattle. <https://cig.uw.edu/wp-content/uploads/sites/2/2024/02/Report-to-the-Legislature-RCW-70A.05.010-UW-Climate-Impacts-Group-06042024-2.pdf>

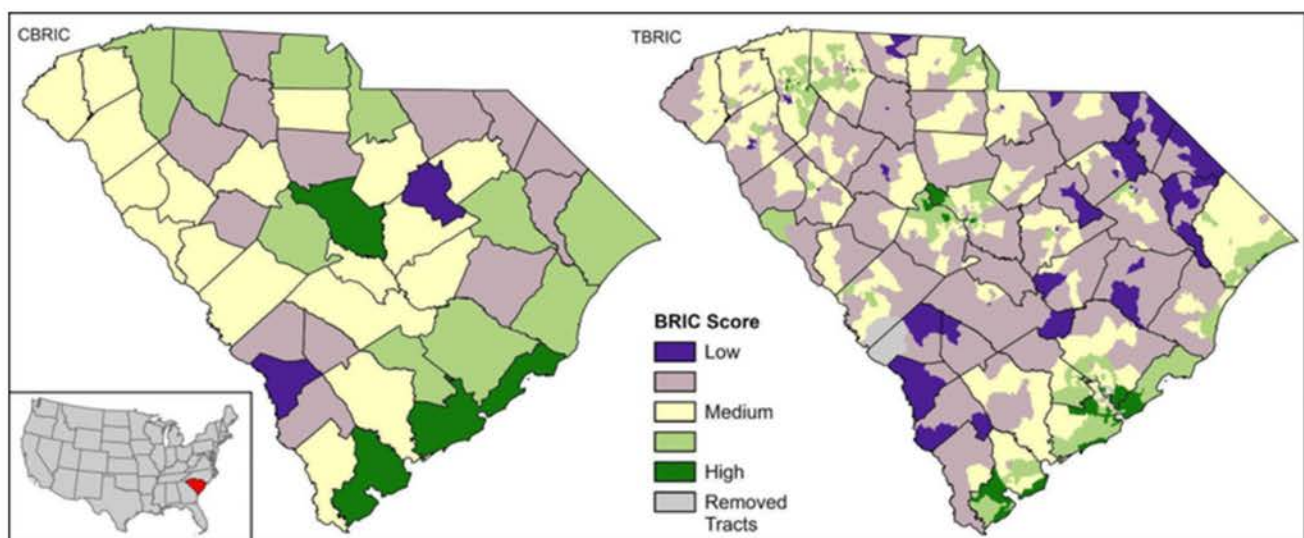
ResilienceMetrics.org

APPENDIX B: STATE METRIC DESCRIPTIONS

South Carolina Metric - Customized Baseline Resilience Indicators for Communities

BBRIC measures resilience in South Carolina using 48-52 variables sorted into six themes (social, economic, community, institutional, infrastructural, and environmental) and is calculated for South Carolina counties (CBRIC) and census tracts (TBRIC). All input variables are regularly updated and accessible by the Office of Resilience and the index can be used to track baseline resilience over time. Examples of variables include: Average Community Rating System discount rate, % labor force employed, Change in pervious surfaces, Average age of dams, and Broadband connections per capita.

BRIC can be used as a communication tool to demonstrate the different focuses of holistic resilience and identify the spatially different needs across the state. It will also be recalculated every five years and comparing BRICs over time will show whether the state is moving the needle on resilience through its various strategies and developments.



Strengths of approach: BRIC is a quantitative index that uses data that is already collected, requiring no additional reporting from SCOR or other South Carolina agencies. It measures a baseline of resilience that is not directly connected to actions in the resilience plan, but rather large themes of what a resilient South Carolina is. By calculating different iterations of BRIC over time, the state can assess whether it is addressing the theoretical drivers of resilience through the implementation of the state's resilience strategy.

What would we do differently? There are still aspects of the resilience plan that need to be tracked to measure the success of implementing South Carolina’s resilience strategy and to serve as an accountability tool to stakeholders. These need to be developed in addition to BRIC as a combination of metrics that measure both how resilient people are and progress in implementing the strategy. A suite of metrics, not just one, will best assess baseline resilience, implementation of the state resilience strategy, and community perspectives on resilience.

Detailed methods of this custom BRIC can be found in the publication [“A community resilience index for place-based actionable metrics,”](#) by Margot Habets and Susan Cutter.

Washington’s Climate Resilience Measurement Framework

The measurement framework developed for Washington’s Climate Resilience Strategy aims to provide a comprehensive view of how the actions included in the State’s Climate Resilience Strategy are collectively contributing to the stated climate resilience goals across four broad systems (communities, natural and working lands, infrastructure, and governance), while also showing how the state is moving the needle on climate resilience overall. The indicators serve as a roadmap to connect individual actions listed in the state strategy back to the overall climate resilience goals, and to demonstrate how actions are helping to advance goals. Indicators will be measured by the Department of Ecology through both quantitative metrics and qualitative narratives to capture descriptive data about the actions.

Indicator: A quality or trait that serves as a sign that a particular set of strategies or actions are yielding the desired results or making progress in the right direction.	Metric: A variable that can be measured (quantitative) or tracked (qualitative) that represents the indicator.	# of metrics (included in measurement framework)	Measurement Level	Data source	Reporting Frequency
Indicator Type	Metric Type				
Outcome Indicators <i>Show the extent to which the desired future resilient state is being achieved.</i>	Outcome	21 *more in development	State-wide	Existing data	4 years
Example outcome indicator: All communities are less exposed to, more prepared for, and able to recover from climate related hazards in a way that reduces health disparities and systemic inequities.					

Process Indicators <i>Show the process towards the desired adaptation goal, such as what is being done or spent.</i>	Output	10	Actions	State Agencies	2 years
Example process indicator: Resilience action by the state is responsive to the priorities of overburdened communities and vulnerable populations.					
Capacity Indicators <i>Show capacity and resources necessary to make progress towards or achieve a goal.</i>	Input	2	Strategy	New data	2 years
Example capacity indicator: State agency staff are quipped with sufficient knowledge to understand baseline conditions, anticipate climate impacts, and respond to risks and vulnerabilities across communities, infrastructure, and natural and working lands.					

Strengths of approach: It aims to be comprehensive while also reasonable in scope in terms of the reporting requirements placed on agency staff. It was developed alongside the state resilience strategy, so it is tied directly to the state's overall goals for climate resilience while also being sufficiently connected to the actions and strategies proposed in the plan.

What would we do differently? Measuring climate resilience overall for the state is challenged by scales of time and geography, as well as by coordination and data limitations. The outcome metrics selected are proxies and are based on data that is incomplete (i.e. not counting for the work being done by local jurisdictions, Tribes, NGOs etc.) There is more coordination to be done to understand the progress being made on resilience outcomes overall for the state.