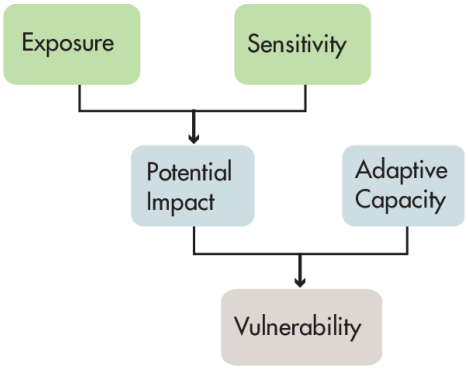
Appendix V – Watershed Vulnerability Assessments Methods

A Rapid Vulnerability Assessment is a short-term version of the vulnerability assessment process that is focused on local interests, primarily uses data and resources that are already available, together with metrics to rank or quantify vulnerability. A given area's vulnerability to changes in climate is typically measured by 3 elements: **exposure, sensitivity**, and **adaptive capacity** (See Section 2 and the US Climate Resilience Toolkit for more detail). Collectively, these elements can measure vulnerability, and therefore guide steps to resilience.

We used a rapid vulnerability assessment approach to address vulnerability and risks to the five asset categories (infrastructure, agriculture, forests, waterways and wetlands, and biodiversity) to determine the relative risk of each watershed in the county. Watersheds are important because the streamflow and the water quality of a river are affected by the things happening in the land area "above" the river-outflow point. Therefore, a watershed is an interconnected landscape, in which ecological processes are driven by interacting land and water features. Watersheds are useful for assessing and managing ecological systems, land use practices, and weather driven events such as floods.



Identify Assets

Resource sectors critical to the county: Infrastructure, Agriculture, Forests, Waterways & Wetlands, Biodiversity

Evaluate Exposure

Use climate and landscape data to determine degree to which assets and resources may be harmed from weather and climate-related hazards.

Assess Sensitivity

Use climate and landscape data to determine degree to which assets and resources may be harmed from weather and climate-related hazards.

Estimate Adaptive Capacity

Evaluate a region's resources, systems, and processes to gauge an area's ability to cope in the face of rapid or extreme change.

Watersheds in the county vary in their resilience to climate change, based on both current ecological conditions and anticipated future conditions. Watersheds that are more ecologically intact and have fewer stressors are more resilient under extreme conditions. For example, in many cases, conditions in intact watersheds will enable plants and animals to recover or move in response to climate impacts. Watersheds that have more stressors will be more vulnerable and less resilient.

To conduct this watershed-level analysis, we developed a method for converting both expert knowledge and on-the-ground watershed-level data into a metric of overall vulnerability. This Watershed Vulnerability Assessment (WVA) tool was adapted from an existing IUCN tool, while also being informed and modified by the WDNR Integrated Watershed Health study and The Resource Innovation Group's *Toward a Resilient Watershed* approach. This

approach combines baseline non-climate stressors (current ecological conditions) data, projected climate data, and the expert knowledge of climate specialists, ecologists, agricultural specialists, and more.

This analysis had two main goals: 1) provide a spatial (geographic) component to identify the most vulnerable watersheds in Monroe County; and 2) identify the most critical areas of concern specific to each locale (watershed) contributing to ecological and climate stress. Using this analysis allowed us to identify the areas of the county most at-risk, and also identify the particular stressor(s) within watersheds that are most in need of attention.

A critical component of assessing current (non-climate) ecological conditions and baseline stressors was the use of Watershed Health Indices from the US EPA (found here). The EPA data uses a compilation of ecological information that is measurable, comparable and consistent across the area of the assessment, and relevant to assessing a watershed's condition. Data within the ecological index include percent forest in the watershed, percent wetlands, mean aquatic condition score, habitat condition index and more. Categories of data within the EPA's stressor index include measures of soil erosion, percent cultivated crop in the riparian zone, stream-road crossing density, percent ag on slopes, percent non-buffered agriculture, percent imperviousness (impervious surfaces), and more.

Data inputs used in the climate change vulnerability component of the analysis included forest diversity, existing forest species adaptability to climate change (based on Northern Institute of Applied Climate Science Climate Change Field Guide), presence of invasive species (plants only), number of toxic sites in the watershed (e.g. Brownfield sites), and more. These components were chosen as they tend to increase the sensitivity of a watershed to extreme weather events. For example, a toxic site could become especially problematic during a large-scale flood even that could carry harmful chemicals downstream. Measures of adaptive capacity included percentage of the landscape in natural vegetation (which tends to be more resilient to extreme events), measures of resiliency from The Nature Conservancy's Resilient and Connected Landscapes, and the ability for an area to tolerate (or even benefit from) flood, fire, drought, and other extreme conditions.

Scores for each index in the WVA tool were ranked 1-3, categorized by minimum, mean, and maximum values throughout the county. The results of the WVA tool, therefore, should be used in a comparative or relative sense: a watershed's rank indicates how it scored when compared to all other watersheds in the county. The results can be used as a broad-level evaluation and planning tool to compare watersheds to one another and begin guiding appropriate monitoring and management actions for specific watersheds and locations.