

Successes In Stewardship

New Tool Helps Agencies Manage Transportation Assets in the Face of Climate Change

Climate change poses serious challenges to transportation systems. Transportation assets are particularly susceptible to climate change stressors, such as flooding, drought, extreme temperatures, and wildfires, which present significant risks to safety, reliability, effectiveness, and sustainability of transportation systems. In order to facilitate climate change-related strategic transportation investments, the Federal Highway Administration (FHWA) partnered with two Federal Land Management Agencies (FLMAs), the National Park Service (NPS) and the Fish and Wildlife Service (FWS), to develop a new resource, the [FLMA Southeast Region Climate Change Transportation Toolbox](#). The tools in the toolbox help agencies identify and assess climate vulnerabilities, develop adaptation strategies, and make long- and short-term decisions based on existing, pertinent data.

Equipping Practitioners to Assess and Reduce Vulnerabilities

The goal of the toolbox is to help agencies manage their transportation assets, such as roads, bridges, boat ramps, parking lots, and trails, in the face of climate change. The toolbox provides land managers with best practices for incorporating proactive climate change adaptation strategies into Long Range Transportation Plans.

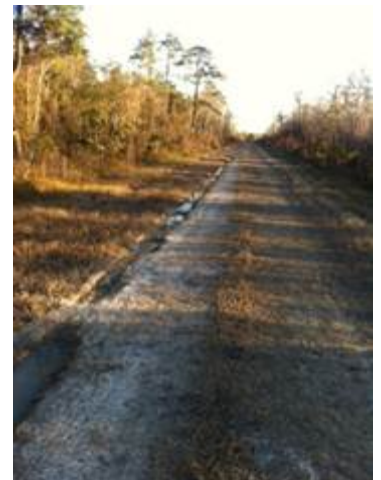
The agencies created the toolbox in response to the lack of a process for using existing data to inform strategic transportation investments and short- and long-term policy decisions for parks and refuges. In order to develop the toolbox, the project team sought to understand and synthesize climate change mitigation and adaptation best practices already being deployed by FWS, NPS, and FHWA. The team conducted a series of interviews and detailed research to identify existing work and best practices within FLMAs for assessing climate change-related vulnerability, conducting scenario planning, developing and evaluating adaptation strategies, and reducing greenhouse gas emissions.

The toolbox includes the following components:

A synthesis report that details FLMA climate change efforts and current best practices.

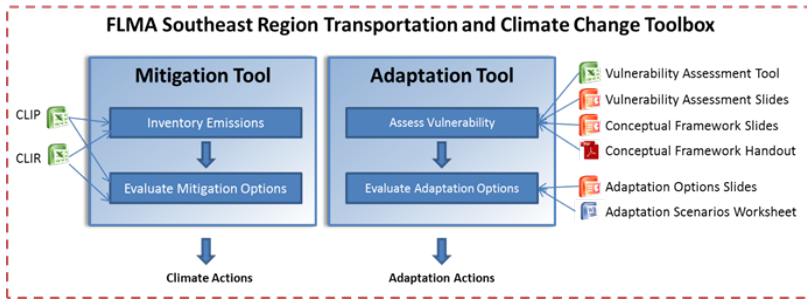
A vulnerability assessment tool that generates default vulnerability scores for all transportation assets in Southeast Region parks and refuges based on national datasets and existing FWS and NPS asset databases. This tool requires no data collection by the unit staff and users can apply their professional judgment to refine the default ratings to ensure the assessment relates to and informs local decisionmaking. The climate stressors included inland flooding, coastal flooding, and wildfire, which were selected based on existing, readily available exposure data and the wide range of units they affect.

The tool evaluates data on asset characteristics (condition, material, etc.) that are indicators of whether the asset may be vulnerable to climate hazards, which are relative to its location. There are three components of vulnerability: *exposure* (whether the asset experiences a stressor); *sensitivity* (whether the asset may be damaged or disrupted by the stressor); and *adaptive capacity* (the ability of the system to cope with damage or disruption to the asset). Derived from a weighted average of indicator ratings, the tool calculates a default vulnerability score on a scale of 1-4, where 4 represents the highest vulnerability. Scores are then assigned a qualitative term (low, medium, or high) to simplify discussions.



The FLMA Southeast Region Climate Change Transportation Toolbox helps National Parks and National Wildlife Refuges, like Alligator River National Wildlife Refuge, pictured above, make strategic investments to protect their most vulnerable transportation assets. (Courtesy of Cassandra Snow, ICF International)

An adaptation planning tool that guides units through a series of collaborative exercises designed to help them move from the assessment of vulnerabilities into the adaptation planning process. Components of the tool are designed to work alongside preexisting mitigation tools and techniques for reducing greenhouse gas emissions, as demonstrated in the image below. Adaptation planning is site- and context-specific and takes into account the value of institutional knowledge in both identifying and evaluating adaptation strategies. Considerations include lifecycle costs, expected lifetime of assets, National Environmental Policy Act implications, impacts on natural and cultural resources, and responsiveness to individual agency missions.



Exercise materials and worksheets guide the tool's users through developing and comparing proactive and reactive adaptation scenarios to protect the priority assets identified in their vulnerability assessments. Users are led through key questions and the decisionmaking process (what are the goals of the transportation system, what are the most critical assets, etc.?) to set the context for adaptation planning. The exercises also help users qualitatively evaluate adaptation strategies in terms of their relative costs, feasibility, and fit within existing systems.

Adaptation tool components are designed to work alongside existing mitigation tools to assist units with reducing greenhouse gas emissions. (Courtesy of FHWA)

Utilizing Best Practices, Testing Research

To test the toolbox and pilot best practices, the project team worked with four park and refuge units in the Southeast Region that were selected based on geographic diversity: Alligator River National Wildlife Refuge; Cumberland Gap National Historical Park; Everglades National Park; and J. N. "Ding" Darling National Wildlife Refuge. The project team hosted day and a half-long planning workshops to test the toolbox at the four units. At each workshop, unit staff used the vulnerability assessment tool to review the default vulnerability results and complete exercises to refine the vulnerability scores. Through this process, unit staff identified their most vulnerable transportation assets and gained a better understanding of factors that drive vulnerability at their unit. For example, while most assets were not exposed to coastal flooding, those that were had either high or medium vulnerability.

The team then used the exercises in the adaptation planning tool to identify and evaluate relevant adaptation strategies and consider how those strategies could fit into existing processes. Based on the feedback gathered at workshops, the project team refined the underlying methodology used in the vulnerability assessment tool to derive the default scores, including adjusting which indicators were weighted more heavily than others and how indicator values translated to scores (e.g., how to rate "poor" conditions on a scale of 1-4).

Promising Results and Feedback Will Inform Future Tool Improvements

Preliminary results, covering the transportation assets in all Southeast Region park and refuge units—5,858 assets in 58 parks and 5,197 assets in 121 refuges—show that 24 percent of assets were found to be highly vulnerable to at least one of the three climate stressors. The full vulnerability assessment results are available to Southeast Region regional and unit managers in a variety of ways. Within the vulnerability assessment tool itself, outputs include a ranked list of the most vulnerable assets, overview graphs of the total number and value of vulnerable assets, and a chart that cross-references between vulnerable assets and assets that a park or refuge has identified as extremely

Lessons Learned: Vulnerability Assessments

Research for the project uncovered tactics to effectively and efficiently assess vulnerability and increase resilience:

Premise: The tool's vulnerability assessment methodology is based on the premise that vulnerability is a function of exposure, sensitivity, and adaptive capacity. Though abstract, these components provide a useful way to think about vulnerability within a unit once explained.

Indicators: An indicator approach can quickly leverage existing data as a starting point for understanding vulnerability, minimizing staff time by eliminating the need for unit staff data collection and entry into the tool.

Evaluation: Of the three components of vulnerability—exposure, sensitivity, and adaptive capacity—exposure is the most difficult to evaluate cheaply and effectively.

Testing: There is a need to continue to test and evaluate the effectiveness of vulnerability indicators.

Scope: There is also a need to expand the tool's scope to cover more climate stressors that affect park and refuge assets.

valuable to operations. Regional and individual park and refuge unit managers can use the FLMA Southeast Region Climate Change Transportation Toolbox to gain a better understanding of the vulnerability of individual assets and their transportation system as a whole. They can also discover their park or refuge's total number, value, and types of vulnerable assets and identify units that could benefit from a more detailed assessment.

Though the toolbox is grounded in research, it is designed to be a living resource—a framework with room to grow in both functionality and scope. Moving forward, the toolbox may be modified to cover other regions and additional climate stressors, incorporate new data sources, further evaluate and test the accuracy of the default vulnerability assessment approach and selected indicators, and further develop the adaptation planning tool, including creating a cost calculator and a database of adaptation case studies.

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