Evolving the U.S. Climate Resilience Toolkit to Support a Climate-Smart Nation

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Acknowledgments: James Fox, LuAnn Dahlman, Nina Hall, Ned Gardiner, Jamie Herring, Toni Parham, & John Keck

David.Herring@noaa.gov
Our society will not make decisions based **solely** on Climate Threats

- People must be able to integrate climate information with their other **value drivers** (things they care about)
- Information must be **relevant** to their values & motivations
- They must **trust** the information source
- Adaptation is easiest understood through a **resilience** frame and successful **paths** walked by others
Adaptation isn’t totally a linear process

- **Assets and Resources**
  - What do we care about?

- **Climate Data**
  - What do we know about what has happened?

- **Risk**
  - What people & assets could be impacted?

- **Future Projections**
  - What could happen?

- **Action**
  - What are **we** willing to do about it?

- **Stakeholders**
We are adding a Regions Section to the CRT

Heat waves, extreme precipitation, coastal flooding

Reduced water availability, more powerful hurricanes

Constrained fresh water supplies, higher temperatures, stressed ecosystems

Drought, warming, wildfires, water scarcity

Increased demand for water

Earlier snowmelt, reduction in summer water availability, major ecological changes

Longer growing season, extreme events (heat waves, floods, droughts)

Receding summer ice and glaciers, thawing permafrost, major changes to ecosystems

Source: Adapted from NCA3
5-Step Adaptation Workflow (Getting Started Steps) 
from the U.S. Climate Resilience Toolkit

Step 1 : Identify the Problem

Step 2 : Assess your vulnerability

Step 3 : Identify options to build resilience

Step 4 : Evaluate the risk and choose the best option

Step 5: Implement – Take Action!

Did you know?

Why should we care?

What can we do about it?
toolkit.climate.gov

The CRT v1.0 was first published in Nov 2014. The front page offers multiple entry points for finding & exploring climate-related decision-support tools, information, & subject matter expertise.
The CRT addresses nine climate-related topics & sub-topics.

This page acts as a table of contents & point-of-entry for topic-based exploration of climate-related hazards.

There’s an interagency virtual team of subject experts behind each of these topic sections.
Each Topic section has a main narrative page, excerpted from the 3rd U.S. National Climate Assessment, to help people understand where, how, & why our nation is experiencing climate-related stressors.

The purpose of the topic section is to provide science-based information to help people identify, understand, & communicate about climate stressors in their communities & businesses.

Coastal Flood Risk

Key points:

- The risk of flooding has increased in most coastal regions of the United States and its island territories since 1900, and that risk is projected to grow even more this century.
- Coastal lifelines, such as water and energy infrastructure, and nationally important assets, such as ports, tourism, and fishing sites, are increasingly vulnerable to sea level rise, storm surge, erosion, flooding, and related hazards. Socioeconomic disparities create uneven vulnerabilities.
- Coastal ecosystems are particularly vulnerable to climate change because many have already been dramatically altered by human stresses; climate change will result in further reduction or loss of the services that these ecosystems provide, including potentially irreversible impacts.
- There is no one-size-fits-all solution to reduce risk and improve resilience. Every community should develop its own plan of action, but can learn from other communities about effective approaches.

Adapted from the Third National Climate Assessment.

Increased Impacts

Every year, at multiple locations along the coast of the United States, events such as storm surges, high tides, strong waves, heavy precipitation, increased river flow, and tsunamis cause damaging coastal floods. As global sea level rises, higher water levels will exacerbate the impacts of these incidents, resulting in deeper floods that last longer and extend further inland. Additionally, as climate changes, some coastal hazards are projected to increase. For instance, coasts may see more severe or more frequent storms and heavier rainfall events.

Average global sea level rose eight inches during the last century, and scientists are highly confident that it will continue rising in the future. By 2100, global sea level is projected to be between 8 inches and 6.6 feet higher than it was in 1992. At regional and smaller scales, relative sea level is also affected by vertical land movement and ocean currents, but any amount of global sea level rise will increase the frequency and magnitude of coastal flooding impacts, posing an increasing threat to people, infrastructure, and coastal...
Subtopic pages provide additional information about a particular facet of the topic.

Note the ‘Taking Action’ and ‘Tools’ sections in the righthand navigation, where all of our case studies and tools are cross-walked with all of our subtopics throughout the CRT — i.e., a “no wrong door” approach to navigation.
The **Taking Action** section now has 96 case studies relating to every CRT topic, and from every region in the United States.

Use the menus (upper right) to quickly filter by climate stressor, parent topic, the 5 steps to resilience, and/or by region.
Decisions are driven by **Assets** *(Resources and Services)*

When these assets are impacted, those impacts effect our quality of life and livelihoods.

Remember, stressors are both climate and non-climate related.
A Conceptual Model for Building Resilience

- In Step Two, we start quantifying the model.
- For each Asset, look at primary Threats that are impacting. We want to look at each “Impact Pair” Separately.
- Do we have data to quantify the relationships? Are there indicators or thresholds?
- Based on understanding of cause-and-effect relationships, we can assess costs & benefits of possible actions.
Flooding

Roads & Bridges

Drainage Bottlenecks

Impervious Surfaces

Heavy Precipitation

Considering culverts

Laura Sager is the Executive Director of the Soil and Water Conservation District in Columbia County, New York. Among a range of important topics that occupy her days, Sager spends an increasing amount of time on a topic that many people consider mundane: she’s thinking about culverts.

Culverts—simple tubes or tunnels that channel water beneath roads, railroads, and trails—are a hallmark of the developed world. Wherever humans can engineer relatively small amounts of water to flow through a tube beneath a roadway, the road is smoother and travel speeds along it are higher. Culverts serve as miniature bridges, keeping roadways high and dry, just above flowing water that could erode them away.

Heavy precipitation

The reason culverts are commanding Sager’s attention is rain. Across the contiguous United States, and especially in the Northeast, the amount of precipitation falling in very heavy events has increased significantly over the last century. During heavy rains, huge volumes of water fill drainage systems quickly, and can overwhelm installed culverts.

When a culvert cannot convey the amount of water attempting to flow through it, water typically backs up on the upstream side, causing localized flooding. The accumulated water may overflow across the roadway, disrupting transportation and increasing erosion that can wash out the culvert. Sediment and debris from an upstream failure may cause additional failures downstream, flooding other roads, houses, and cropland. Even small-scale flooding at undersized culverts can lead to local road washout and erosion, disrupting transportation and infrastructure.

Tools:

- Precipitation Frequency Data Server (PFDS)

Steps to Resilience:

1. Identify the Problem
2. Determine Vulnerabilities
3. Investigate Options
4. Evaluate Risks & Costs
5. Take Action

Additional Resources:

- Extreme Precipitation in a Changing Climate Project

Datasets Used:

- Global Historical Climatology Network (GHCN) Daily
This image shows a screenshot from the interactive Climate Explorer tool. The map shows land cover categories for a portion of Columbia County, New York, centered on the town of Copake. To explore land use and precipitation in this region, click the image above to launch Climate Explorer in a new window. You can explore on your own, or come back to this window to read the suggestions below.

In the Climate Explorer window:

- Turn on the legend for the Land Cover map by clicking the "i" symbol to the right of the layer's name. Examine the map and the legend to get a sense of the different land uses in the area.

Note that Open Water, Woody Wetlands, and Emergent Herbaceous Wetlands surround Developed Areas in the region. Additionally, the area has many fields for Hay/Pasture and Cultivated Crops. In this area of mixed land use, culverts help keep developed areas relatively dry by giving water a path to move downhill to fields or ponds.

- To see how the area looks from above, make the Land Cover layer transparent by sliding the blue bar under the layer name to the left. Move the transparency slider back and forth to compare features in the land cover layer with the aerial view.

- Turn the Rivers and Streams layer on and examine its legend. Use the locations of the watershed boundaries (which generally follow ridges) and the pattern of streams and ponds to visualize the directions water flows across different parts of the map.

- To get an idea of how much water might fall during precipitation events in this region, click the Historical Data tab in the upper right of the Climate Explorer. The graph's dark red lines show the long-term average cumulative precipitation for each year. The red shading shows actual precipitation measured each year. Can you find evidence of heavy precipitation events in the graphs? What would you need to know to tell if larger culverts could improve the region's resilience to flooding?

- To view precipitation records for other years at Copake, click within the graph area and drag to the right. You can also view precipitation data for the last few years or record the location of the event for the precipitation dataset by clicking
CLIMATE EXPLORER

STATION DETAIL:

(1) COPAKE NY

PRECIPITATION

know to tell if larger culverts could improve the region’s resilience to flooding?

• To view precipitation records for other years at Copake, click within the graph area and drag to the right. You can also view precipitation data for the entire region by clicking on the site labeled ‘Glouster Prin’ within the lake basin, located just south of Copake.
Tools

Tools are available to help you manage your climate-related risks and opportunities, and to help guide you in building resilience. Click below, or filter by topic and/or tool functionality in the boxes above. To expand your results, click the Clear Filters link.

NJ Flood Mapper
View detailed maps and photos of New Jersey communities as they look today, and compare them to visualizations showing one to six feet of sea level rise. This tool provides information for people who need to make individual or community decisions about local flooding hazards.
Read more

OpenNSPECT
GIS users can use this open-source version of the Nonpoint-Source Pollution and Erosion Comparison Tool (N-SPECT) to investigate potential water quality impacts from development, other land uses, and climate change.
Read more

Oregon Estuary Data Viewer
This map viewer helps users find, overlay, and evaluate estuary data within the Coastal Atlas. The viewer supports tasks for statewide and local estuary management plans.
Read more

Our Coast, Our Future
Coastal resource managers and planners in the San Francisco Bay region can use locally relevant, online maps and tools to explore, visualize, and anticipate vulnerabilities related to sea level rise and storms.
Read more
Every tool has a landing page with these details:

» Summary overview
» Web address
» All relevant topics and subtopics
» Add’l documentation about the tool
» Links to training and tutorials (where available)
» Agencies & entities who provide & maintain tool
Our Funding Opportunities page presents a curated list of about two dozen grant funding mechanisms offered by the federal government and non-profit foundations.
Our semantic web search tool allows users to quickly search the CRT site; or the entire U.S. federal gov’t & grantees. Use the filters menus to winnow result sets by topic of interest and/or resources type.