

Understand Exposure | Identify Hazards, Climate Stressors, Social Vulnerability, and Non-Climate Stressors

WHO

This guidance is for the practitioner throughout the Understanding Exposure step.

WHAT

Exposure is the presence of people and community assets and ecosystems in places where they could be adversely affected by hazards. This resource provides information for various tools and information that can be used to understand exposure. It provides information for various tools and information that can be used to research and understand hazards, stressors, assets and social vulnerability in the community. The tools are bookmarked to sections of this guidance that briefly describe how they can be used and link out to the tool itself. This exercise will help inform the potential impacts matrix later in the Understand Exposure step.

SUPPORTING RESOURCES

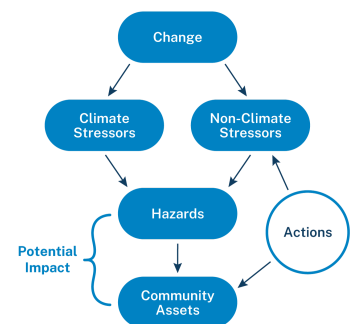
- Use the following tools and websites to answer key questions about the community and the hazards and stressors. Add your answers to [2.5 Evaluate Hazards and Stressors - Worksheet](#).
- These tools can be used to help fill in [2.6 Potential Impacts Matrix - Worksheet](#).

INSTRUCTIONS

- Read the [Key Questions](#) and use the [resources suggested](#). The links will take you to an entry within this document to learn more.

To determine exposure:

- Use the conceptual understanding of exposure that was discussed earlier as a first pass. For each community asset, ask: Does this hazard have the potential to impact the asset?
- For spatially explicit asset/ threat combinations, consider them as having potential exposure. Again, the detailed levels of exposure and vulnerability and risk can be determined in the next step.
- Consider the scale or resolution of the hazard and asset. For example, flooding may be more localized as a result of the data that is available, compared to extreme heat.
- Use [2.5 Evaluate Hazards and Stressors - Worksheet](#) to answer the questions and make notes.



Key Questions

Consider these questions while you explore the tools and sources. The tools and sources that are most relevant to answering each are listed as well. Remember to add your findings to [2.5 Evaluate Hazards and Stressors - Worksheet](#).

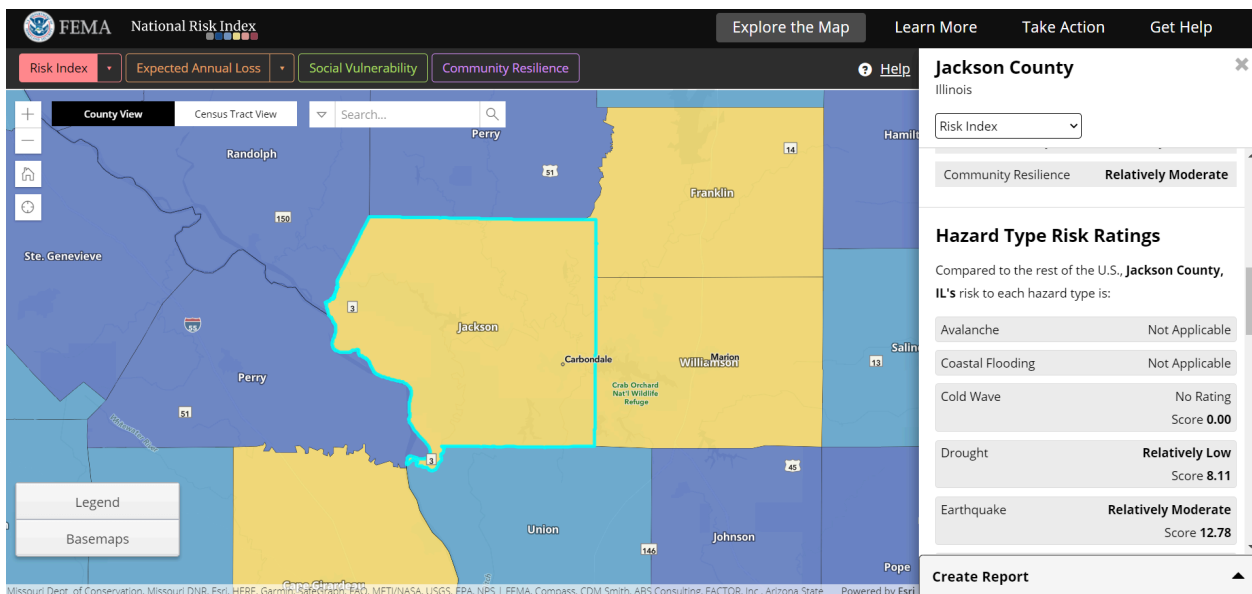
Considering hazards, climate stressors, and non-climate stressors...	
What are the main hazards for your community?	National Risk Index for Natural Hazards (FEMA) Coastal Flood Exposure Mapper Wildfire Risk to Communities Extreme Heat - Tree Equity Score Climate Mapping for Resilience and Adaptation (CMRA)
What is the normal climate for your community?	Fifth National Climate Assessment State Climate Summaries Climate Explorer Climate at a Glance (NOAA) Drought.gov (NIDIS) EJSCREEN (U.S. EPA) Community Resilience Estimates Dashboard
What is changing or likely to change in the local climate?	Fifth National Climate Assessment State Climate Summaries Climate Explorer Climate at a Glance (NOAA) NOAA National Ocean Service Tides and Currents
Where can I find information about social vulnerability and non-climate stressors?	Climate and Economic Justice Screening Tool (CEJST) EJScreen: Environmental Justice Screening and Mapping Tool (US EPA) Community Resilience Estimates Dashboard (U.S. Census Bureau)
How can I integrate some of this information?	Resilience Analysis and Planning Tool (FEMA) PolicyMap The National Map Neighborhoods at Risk

Resources and How to Use

Hazard Resources

National Risk Index

The [National Risk Index](#), created by FEMA, can be used to identify communities at risk to 18 natural hazards. The tool includes the Risk Index, Expected Annual Loss estimates, Social Vulnerability, and Community Resilience at the county or census tract levels. The [FEMA National Risk Index](#) combines several pieces of information into an overall risk index provided by the county or census tract level for the continental U.S. If needed, the data are available for download. This tool allows the user to generate a PDF summary report for the selected area (or compared to another area).



The hazards included in the Risk Index can also be viewed individually, including:

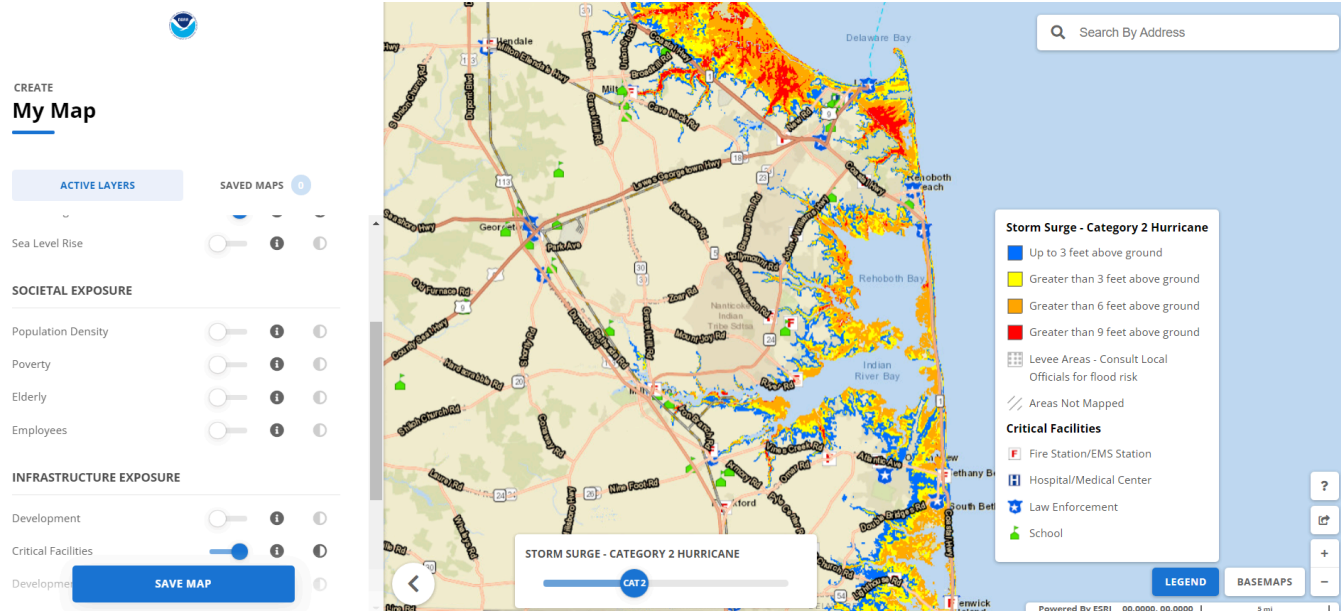
- Coastal Flooding
- Drought
- Earthquake
- Heat Wave
- Hurricane
- Ice Storm
- Landslide
- Lightning
- Tornado
- Tsunami

Using the National Risk Index

Decide between County view and Tract view and select the desired location. The information can be viewed in the interactive map and scrolling sidebar or choose “Create a Report” to view the information in a PDF that can be saved or printed. This report goes into greater detail and provides information through maps, charts, graphs, and tables.

Coastal Flood Exposure Mapper

NOAA's [Coastal Flood Exposure Mapper](#) displays coastal flooding across the nation. In contrast, though, this map includes location data for three additional categories: people, infrastructure, and ecosystem; as well as a larger variety of flood types: high tide flooding, FEMA flood zones, tsunami, storm surge, sea level rise, and a flood composite layer.



Wildfire Risk to Communities

The [USDA USFS Wildfire Risk to Communities](#) tool provides several ways for examining wildfire potential in your community. While this tool can be used to understand risk and probability as defined by USDA, direct and indirect exposure is also considered. In lieu of local data, this may help understand what parts of your community might be within the Wildland Urban Interface (WUI).

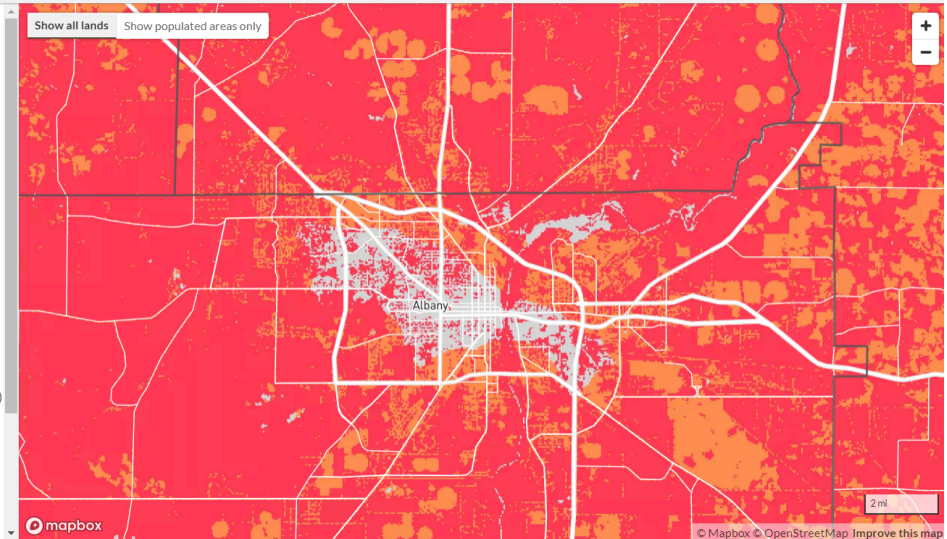
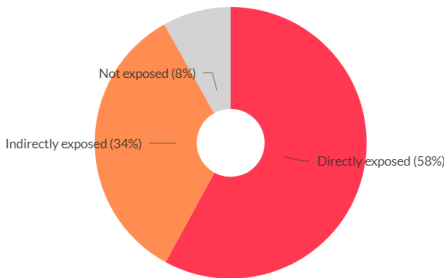
Alabama

Risk to Homes Exposure Type Wildfire Likelihood Vulnerable Populations

Exposure Type

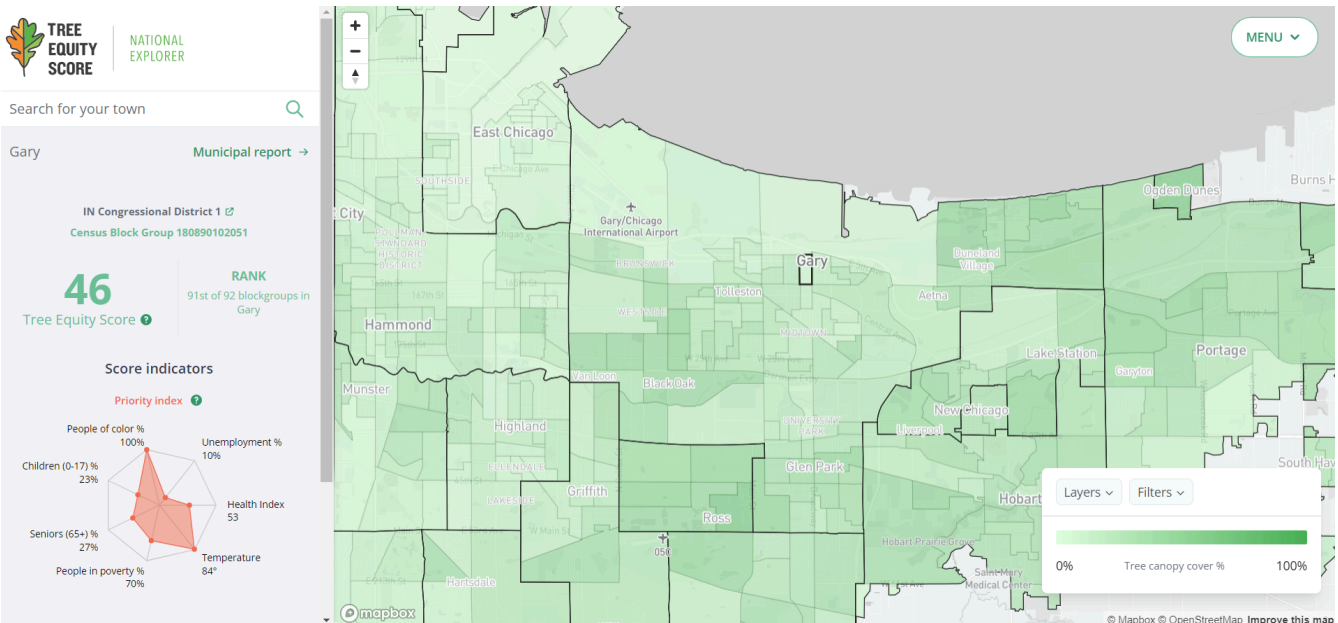
Populated areas in Alabama are predominantly exposed to wildfire from **direct** sources, such as adjacent flammable vegetation.

■ Directly exposed ■ Indirectly exposed ■ Not exposed



Extreme Heat - Tree Equity Score

The [Tree Equity Score viewer](#) by American Forests provides useful insight into the amount of tree canopy cover in an area, as well as social indicators that may aid in a community's adaptive capacity for extreme heat. The viewer defaults to the Tree Equity Score layer, but can easily be changed to view the percent canopy cover or any other metric provided. Choose a census block group for a summary of the information. The Municipal report option will provide even more insight and download options.



Climate Mapping for Resilience and Adaptation (CMRA)

Knowing what hazards your assets might face is the first step in protecting them. This tool can help you understand some of the climate-related hazards that could occur in your location.

The [Climate Mapping for Resilience and Adaptation \(CMRA\)](#) portal features:

- a real-time dashboard with interactive maps showing where common climate-related hazards are occurring today
- information about five common climate-related hazards: Extreme Heat, Drought, Wildfires, Flooding, and Coastal Inundation
- links to federal funding opportunities related to each hazard
- federal government policy statements relevant for climate adaptation and resilience-building efforts
- curated climate and non-climate data for building equitable resilience plans.

The CMRA Assessment tool provides climate projections relevant to the five hazards for three future periods. Projections are available for counties and Tribal Nations. Flags for census tracts indicate if the selected tract is considered disadvantaged — and therefore eligible for Justice40 efforts — and if buildings within the tract are required to adhere to hazard-resistant building codes.

The screenshot displays the CMRA portal interface. At the top, there are navigation links for 'Data Sources', 'CMRA', and 'User Guide', along with a 'Get Complete Report' button. The main map area shows a map of North Carolina with a search bar set to 'Buncombe County, NC'. Below the search bar, there are options to 'Select a geography: Census Tract, County, Tribal Area'. The map shows various counties and cities, with a tooltip indicating '20.4% of Population in Disadvantaged Communities' and 'Building Code: Lower Resistance'. Below the map, there are three main control panels: 'Hazards' with 'Drought' selected, 'Indicators' with 'Average annual total precipitation' selected showing a value of 46.2 inches, and 'Timeframe' with 'Mid Century (2035-2064)' selected. A 'Prediction Model' section shows 'Lower emissions' selected. The map also displays overlays for '20.4% of Population in Disadvantaged Communities' and 'Building Code: Lower Resistance'.

Climate and Climate Stressor Resources

Fifth National Climate Assessment

[The Fifth National Climate Assessment](#) (NCA5) is the authoritative source for our nation and should be considered the primary “trusted source of information” for background climate information and framing. Content is divided into several chapters that fall into categories, including national topics, regions, and responses.

The screenshot shows the navigation menu for the Fifth National Climate Assessment (NCA5) website. The menu is organized into several categories, each with a list of items. The categories and their items are:

- ABOUT** (dropdown)
- CHAPTERS** (dropdown)
- DOWNLOADS** (dropdown)
- ART x CLIMATE**
- NCA ATLAS**
- SEARCH** (magnifying glass icon)
- About this Report**
- Guide to this Report**
- OVERVIEW**
- PHYSICAL SCIENCE**
 - 2. Climate Trends
 - 3. Earth Systems Processes
- NATIONAL TOPICS**
 - 4. Water
 - 5. Energy
 - 6. Land
 - 7. Forests
 - 8. Ecosystems
 - 9. Coasts
 - 10. Oceans
 - 11. Agriculture
 - 12. Built Environment
 - 13. Transportation
- REGIONS**
 - 21. Northeast
 - 22. Southeast
 - 23. US Caribbean
 - 24. Midwest
 - 25. Northern Great Plains
 - 26. Southern Great Plains
 - 27. Northwest
 - 28. Southwest
 - 29. Alaska
 - 30. Hawai'i and US-Affiliated Pacific Islands
- AIR QUALITY**
 - 14. Air Quality
- HUMAN HEALTH**
 - 15. Human Health
- INDIGENOUS PEOPLES**
 - 16. Indigenous Peoples
- INTERNATIONAL**
 - 17. International
- COMPLEX SYSTEMS**
 - 18. Complex Systems
- ECONOMICS**
 - 19. Economics
- SOCIAL SYSTEMS AND JUSTICE**
 - 20. Social Systems and Justice
- RESPONSES**
 - 31. Adaptation
 - 32. Mitigation
- FOCUS ON**
 - F1. Compound Events
 - F2. Western Wildfires
 - F3. COVID-19 and Climate Change
 - F4. Risks to Supply Chains
 - F5. Blue Carbon
- APPENDICES**
 - A1. Process
 - A2. Information Quality
 - A3. Scenarios and Datasets
 - A4. Indicators
 - A5. Glossary
 - All Figures
 - All Key Messages

Each chapter contains easy-to-follow key messages and various charts, maps, and graphs that can be downloaded and cited for your own report. In addition, there are case studies throughout each chapter, which can help the practitioner better understand the issues facing a particular community. The NCA5 provides regional context for both climate and non-climate stressors.

How to Use the Fifth National Climate Assessment

To use the NCA5 for your project, begin with the regional chapter for the community. The regional chapters assess current and future risks posed by climate change and what can be done to minimize risk. Challenges, opportunities, and success stories for managing risk are illustrated through case studies.

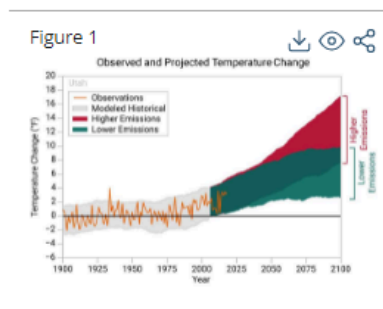
Next, explore the national topics, especially as they are relevant to the community. Exploring these national topics can help provide some context for the impacts climate change may have on the topic and even some mitigation strategies. For example, in [Chapter 11 Agriculture, Food Systems, and Rural Communities](#), topics related to economics, ecology and hydrology, and human health are covered through discussions on crop adaptation and productivity, soil health and water resources, and worker health challenges.

State Climate Summaries

UTAH

Utah is a geographically diverse state with forested, mountainous, and desert regions. It has a varied climate due to its inland continental location and wide range of topography. Elevations across the state range from approximately 2,500 feet in the Virgin River Valley to 13,500 feet in the Uinta Mountains. Based on records from long-term stations, temperatures in the mountains average around 20°F during the winter months, while lower elevations in the southern portion of the state frequently experience days over 100°F in the summer. In the northern part of the state, the Great Salt Lake has a moderating effect on temperatures in its vicinity. The hottest year on record for Utah was 1934 with an average annual temperature of 51.3°F, followed by 2012 with an average annual temperature of 50.9°F.

The early 21st century has been the warmest period on record for Utah (Figure 1). The period from 2000 to 2004 was particularly warm, with the state seeing the largest number of extremely hot days (days with maximum temperature at or above 100°F) in the historical record (Figure 2). In addition to the overall trend of higher temperatures, the state has experienced a dramatic increase in the number of very warm nights (minimum temperature at or above 75°F) and a decrease in the number of very cold nights (minimum temperature at or below 0°F) since 1990 (Figures 3 and 4a).



[State Summaries](#) provide a more localized view than the National Climate Assessment, but also include key local case studies. Originally released in 2017, a rolling update is currently underway. The summaries cover historical climate variations and trends, future climate model projections of climate conditions during the 21st century, and past and future conditions of sea level rise and coastal flooding.

How to Use the State Climate Summaries

To begin using the Summaries, choose a state. Within each summary there are three key messages which the content is built around. Similar to the NCA4, various charts, graphs, and maps at the state-level are provided, which can be used and cited for your own report. These summaries provide a one stop shop for understanding temperature and precipitation trends, coastal trends and drought. Exploring these summaries will help the team determine key climate and non-climate stressors that should be further evaluated for the community.

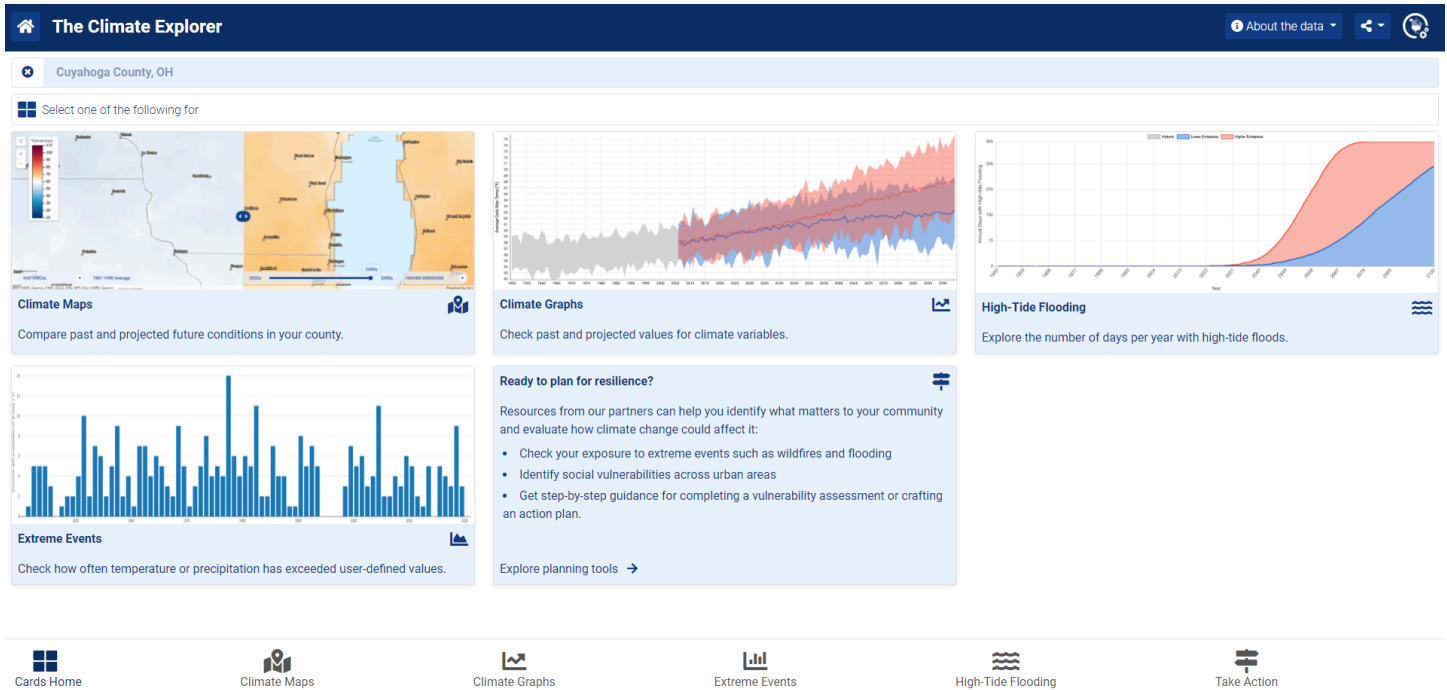
The Climate Explorer

[The Climate Explorer](#) allows the user to explore interactive graphs and compare time-series maps showing climate projections and observations for any location in the contiguous United States, summarized by county. The Climate Explorer provides downscaled projection data at a county level using the same methods employed in the fourth National Climate Assessment. You can also explore historical temperature and precipitation observations at hundreds of climate stations, and view observed and projected days of high-tide flooding at more than 90 coastal tide-gauge stations. It also provides weather station data that you can query to examine thresholds of interest.

The Climate Explorer provides county-level insights for climate hazards and stressors.

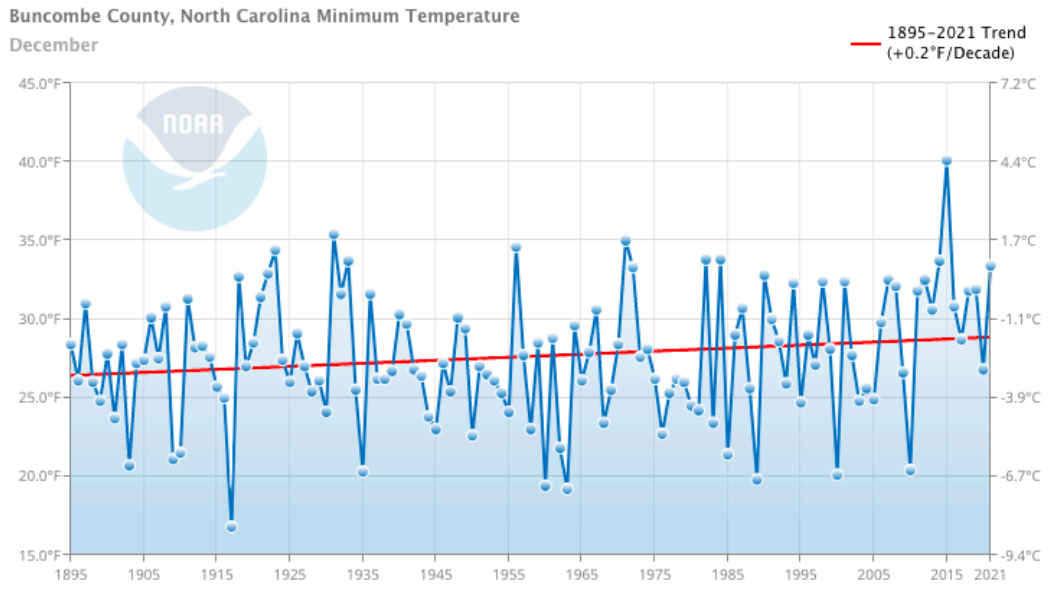
How to Use The Climate Explorer

When you enter The Climate Explorer, you will be asked to enter a location. Once you do, you will be provided with options for viewing climate data.



Climate Maps and Climate Graphs provide a variety of metrics for historical trends and future projections, using two emissions pathway scenarios (RCP 4.5 and RCP 8.5). The maps and charts are also downloadable images, which can be used and cited for your report. Extreme Events allows you to choose a reporting station within (or nearby) your area of interest and explore historical occurrences of extreme temperature and precipitation events. If the area is coastal, the High Tide Flooding option can be used to understand the occurrence of high tide floods in a specific area.

Climate at a Glance (NOAA)



[Climate at a Glance](#) allows near-real-time analysis of monthly temperature and precipitation data across the contiguous United States. Users can request data for select cities, states, regions, and the nation as a whole to compare current conditions with the historical record. Data is available for the period 1895 to the present.

The tool is ideal for studies of climate variability and change. The tool's graphing functions allow users to determine whether, and how much, a given location or area is warming or cooling; or experiencing an overall change in precipitation.

This tool generates time series graphs of Temperature, Precipitation, Heating Degree Days, Cooling Degree Days, and four drought indices from the U.S. Climate Divisional Database. Users select spatial extents as large as the entire contiguous United States and as small as a city within it (data are available for almost 200 selected cities). Time scales range from 1 month to 60 months, and include functions such as Year to date and Previous 12 months. Users can customize the time series graphs by selecting the base period, including a trend line showing change over a decade or a century, or showing a statistically smoothed version of the data. Users can zoom and pan on the interactive graphs.

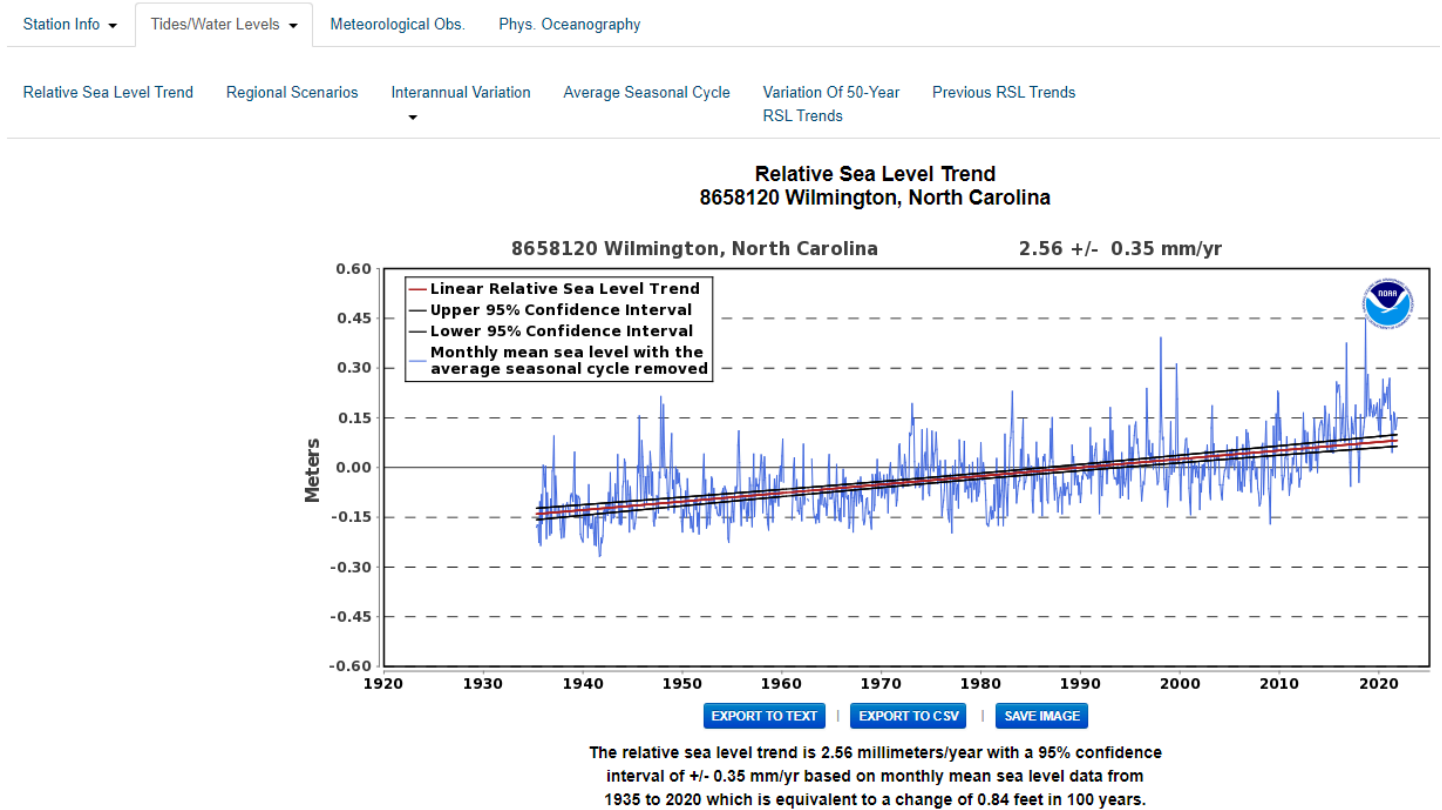
How to Use Climate at a Glance

This tool can be used to collect a variety of data and charts at a very local level by selecting "City" and "Time Series." Once you enter each drop down menu with the desired information, click the "Plot" button to update the graph. The chart is interactive, but can be downloaded as a simple image by right clicking anywhere within it and choosing View as PNG and then right clicking and choosing Save image as...

The same information can be plotted at the county, divisional, statewide, regional, and national levels.

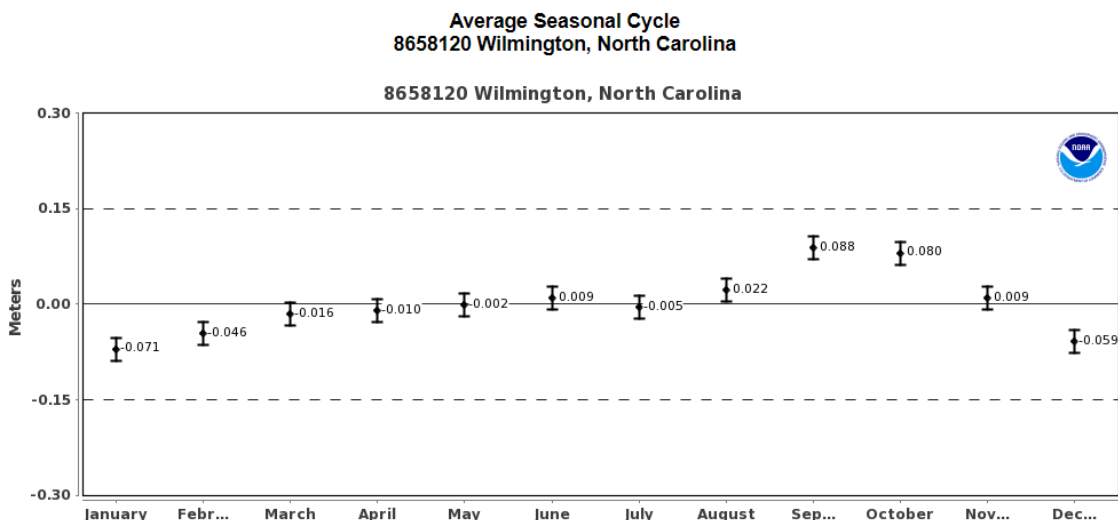
NOAA National Ocean Service Tides and Currents

NOAA's [Tides and Currents site](#) provides interactive charts and maps showing sea level trends measured by gauges across the country.



How to Use Tides and Currents

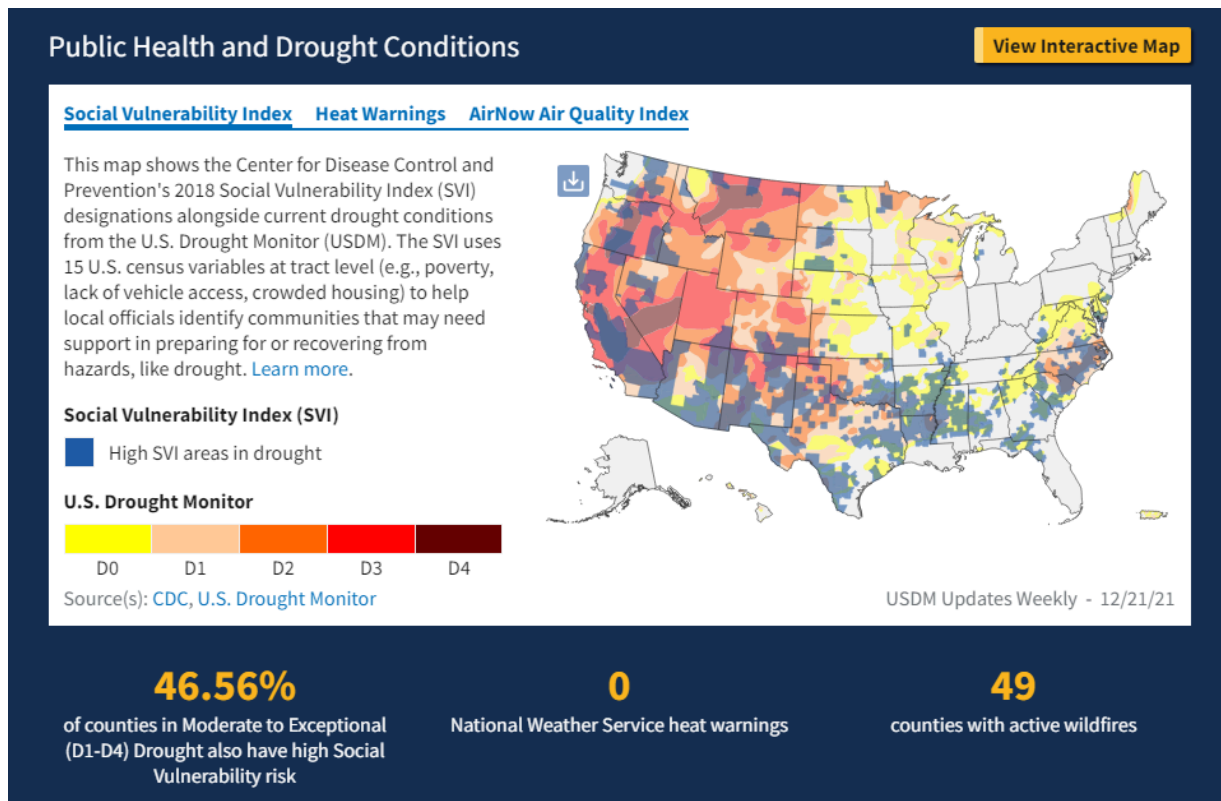
Local relative sea level trends can be viewed by station by clicking on a location in the interactive map and choosing Linear Trend. The next page allows you to toggle between Relative Sea Level Trend (shown), Regional Scenarios, Interannual Variation, Average Seasonal Cycle, Variation of 50-year Trends, and Previous Trends. These graphs can be downloaded as images to be used and cited directly in your report.



Each chart provides an additional layer of understanding. For example, the relative trend in sea level rise in Wilmington (above) is increasing. Seasonally, the fall months are seeing higher sea levels (right), which coincide with the Atlantic hurricane season. Sea level rise is a climate-related stressor that exacerbates storm surge.

The National Integrated Drought Information System (NIDIS) Drought Portal

NIDIS is a multi-agency partnership that coordinates drought monitoring, forecasting, planning, and information at federal, tribal, state, and local levels across the country. Drought is a climate-related stressor and can be highly unpredictable. The [Drought Portal](#) provides data by state or city for current conditions, various drought indicators (measures), short-term and long-term predictions, and future outlooks. Additional information is provided by sector. These pages discuss current conditions, key issues, and drought impacts, as well as provide resources for planning and preparedness, communication and outreach, and other topics.



Also through NIDIS, you can link out to the [U.S. Drought Monitor Maps](#). These maps are released weekly and use the same five-class scale. Chances are, if you have seen a drought map of your state, it's in this format. There are current and past maps available at several scales: national, regional, state, watershed, tribal areas, and others. These maps are available for download.

How to Use the NIDIS Drought Portal

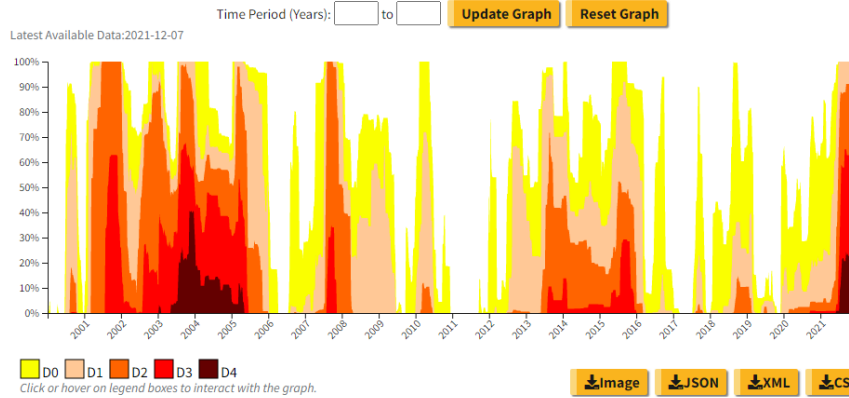
Drought in Idaho from 2000–Present

The U.S. Drought Monitor started in 2000. Since 2000, the longest duration of drought (D1–D4) in Idaho lasted 258 weeks beginning on January 30, 2001, and ending on January 3, 2006. The most intense period of drought occurred the week of December 23, 2003, where D4 affected 40.78% of Idaho land.

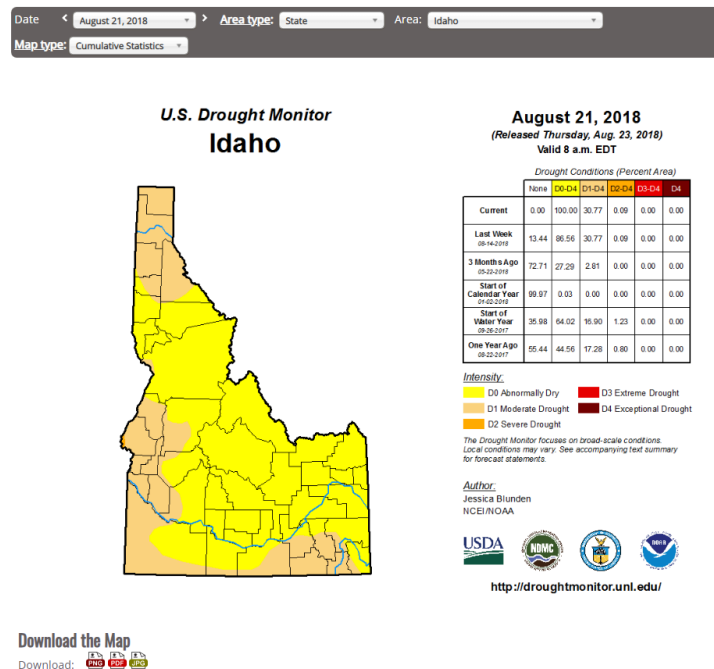
2000 - Present (Weekly) 1895 - Present (Monthly) 0 - 2017 (Yearly)

Explore Historical Maps

The U.S. Drought Monitor (USDM) is a national map released every Thursday, showing parts of the U.S. that are in drought. The USDM relies on drought experts to synthesize the best available data and work with local observers to interpret the information. The USDM also incorporates ground truthing and information about how drought is affecting people, via a network of more than 450 observers across the country, including state climatologists, National Weather Service staff, Extension agents, and hydrologists. [Learn more.](#)



Enter your community's name into the search bar and explore current and past drought conditions. There are optional links to a county and state page as well. Some of the images here are available for download to cite and use for your report. The spatial data typically available for drought is not suitable for a detailed vulnerability and risk analysis. However, information related to past drought conditions and future precipitation projections and drought predictions can help a community understand if there may be drought-related impacts to the economy, public health, wildfire, or something else. In this way, communities can still plan to prepare, even if the impacts can't be quantified.



The U.S. Drought Monitor maps (above) can be viewed at a variety of scales and for past or current conditions. These maps can be downloaded directly from the website for use in your report.

Social Vulnerability and Non-Climate Stressors Resources

Climate and Economic Justice Screening Tool (CEJST)

[About - Climate & Economic Justice Screening Tool](#) is an interactive online mapping tool that uses datasets that are indicators of burdens in eight categories: climate change, energy, health, housing, legacy pollution, transportation, water and wastewater, and workforce development. The tool uses this information to identify communities that are experiencing these burdens. These are the communities that are disadvantaged because they are overburdened and underserved.

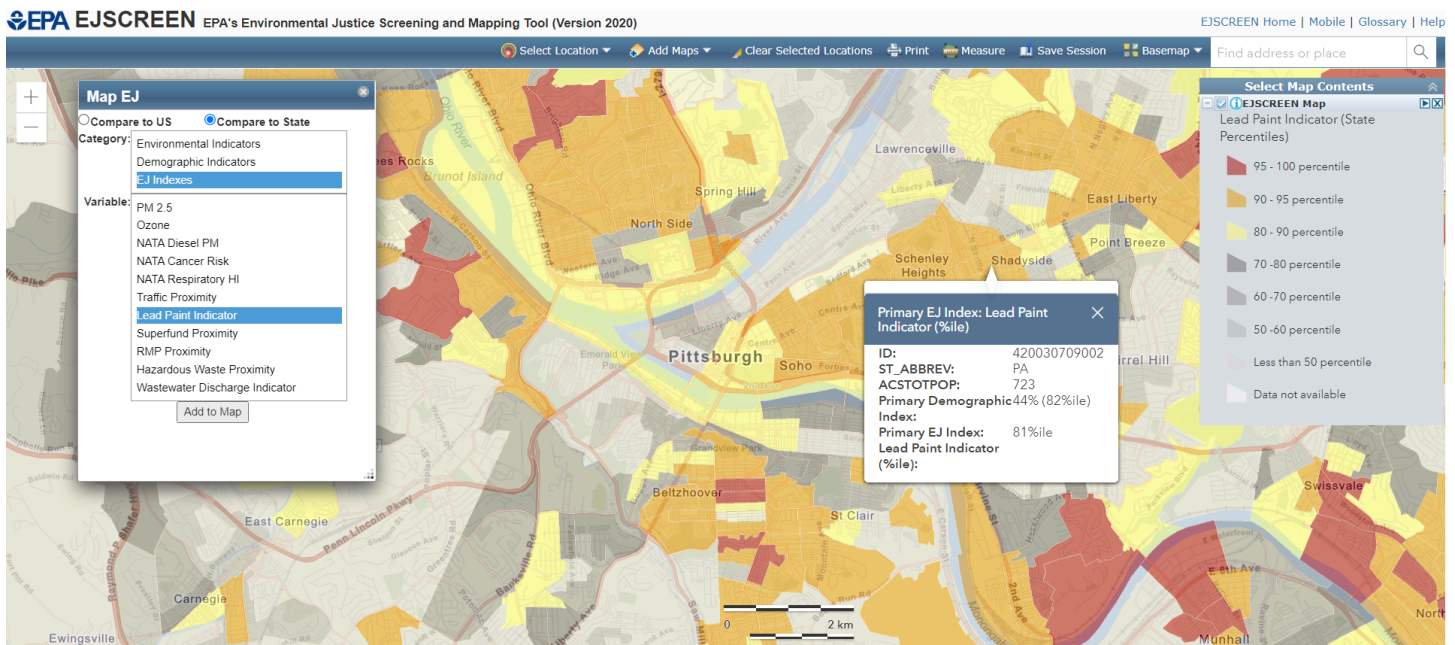
This tool, in combination with the [National Risk Index](#) is used to define Community Disaster Resilience Zone (CDRZ). A census tract is designated as a CDRZ if its National Risk Index (NRI) score ranks in the top 50 nationally or in the top 1% in its state and it is identified as a disadvantaged community by the federal Climate and Economic Justice Screening Tool (CEJST).

How to Use CEJST

(From the website) - The tool shows information about the burdens that communities experience. It uses datasets to identify indicators of burdens. The tool shows these burdens in census tracts. The tool utilizes the census tract boundaries from 2010. This was chosen because many of the data sources in the tool currently use the 2010 census boundaries. The tool also shows land within the boundaries of Federally Recognized Tribes and point locations for Alaska Native Villages.

The tool ranks most of the burdens using percentiles. Percentiles show how much burden each tract experiences compared to other tracts. Certain burdens use percentages or a simple yes/no.

A community is considered to be disadvantaged if they are located within a census tract that meets the tool's methodology or are on land within the boundaries of Federally Recognized Tribes.



To return to the chart or report pop-up, click on the cross hairs that were placed when you selected a location. In this example, the location selected was Pittsburgh, PA. Although the rest of the information summarized remains the same, the map within the option Get Printable Standard Reports... will update based on the map displayed. This and the other available reports can be downloaded as a PDF for a handy reference throughout the project.

Community Resilience Estimates Dashboard (U.S. Census Bureau)

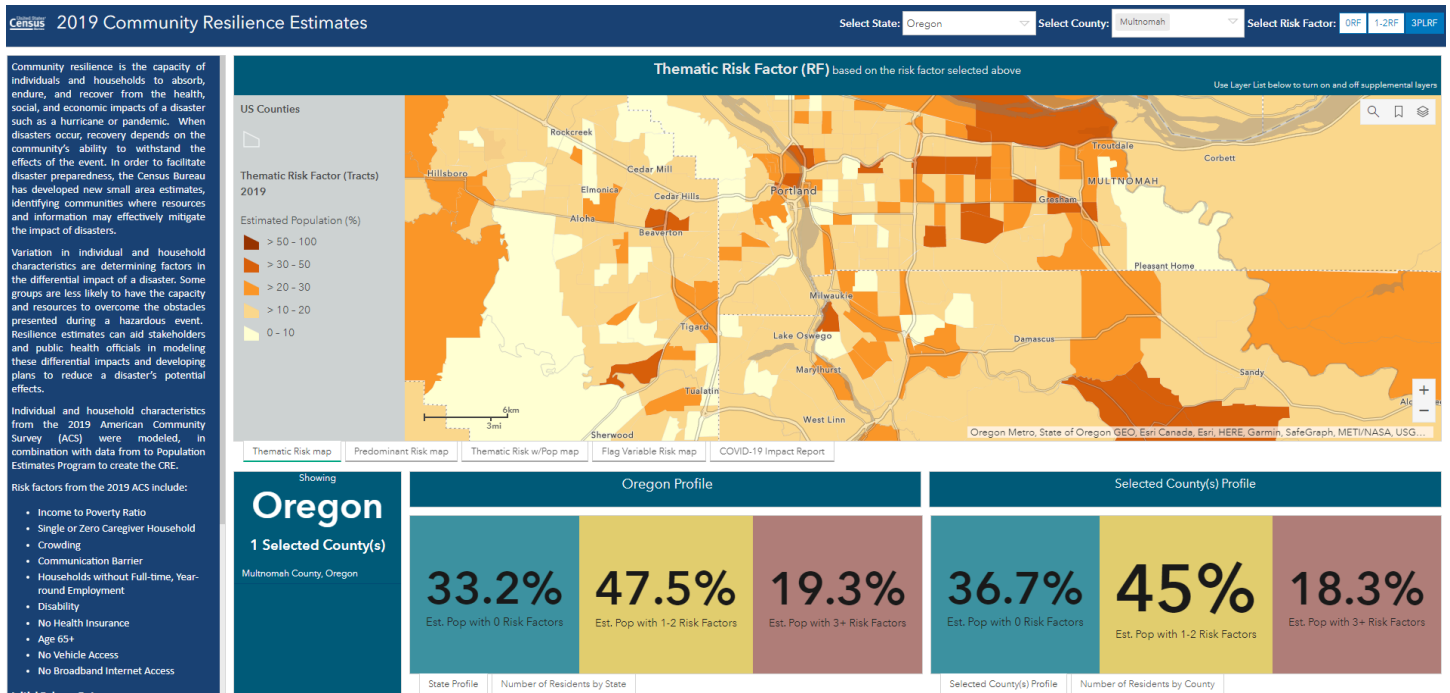
The [U.S. Census Bureau Community Resilience Estimates Dashboard](#) compiles small area estimates to identify communities where resources and information may effectively mitigate the impact of disasters. Individual and household characteristics from the 2019 American Community Survey were modeled, in combination with data from the Population Estimates Program. Risk factors include:

- Income to poverty ratio
- Single or zero caregiver household
- Crowding
- Communication barrier
- Households without full-time, year-round employment
- Disability
- No health insurance
- Age 65+
- No vehicle access
- No broadband internet access

How to Use the Community Resilience Estimates Dashboard

Select state and county from the menu at the top. Additionally, select how you would like the risks grouped: zero risks, 1-2 risks, or three plus risks (remember that the risks are listed above). The interactive dashboard will update as you make these selections.

Although the dashboard only displays summarized information, the basic premise is that areas with more risk factors will be less resilient to disasters.



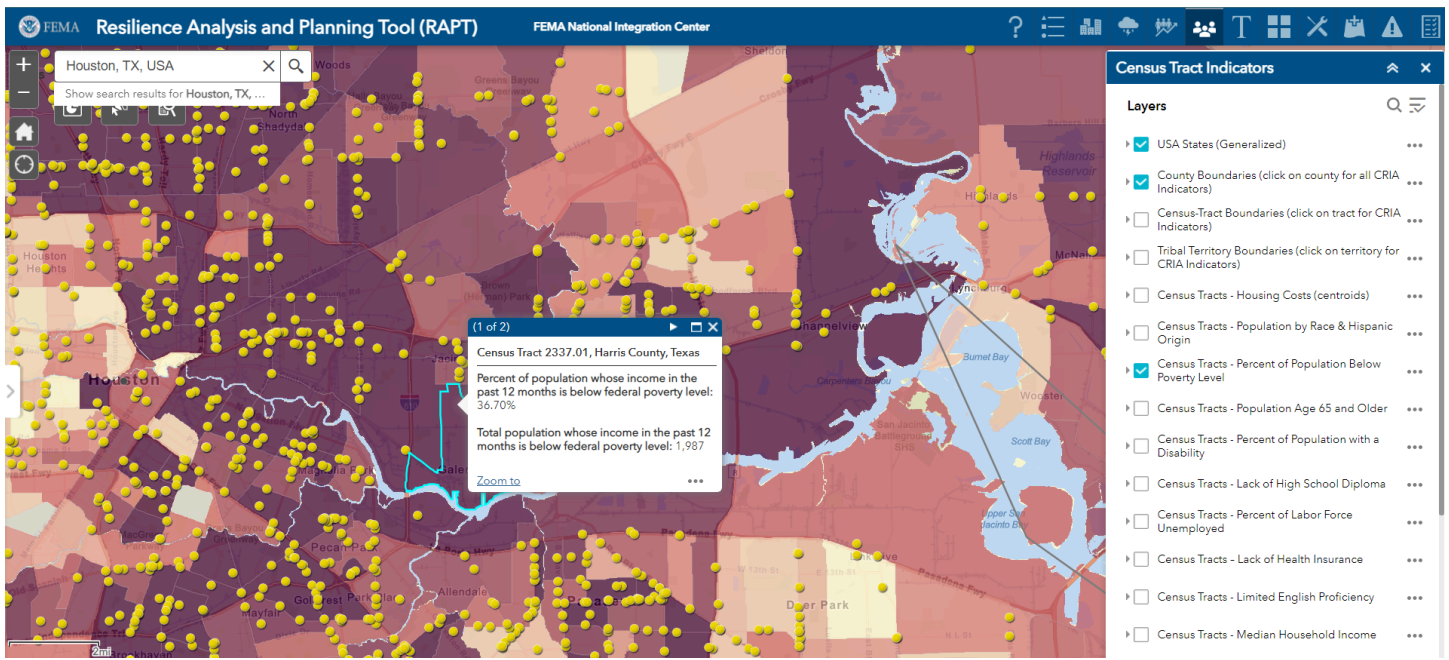
Integrating Hazards, Stressors, and Social Vulnerability

Resilience Analysis and Planning Tool (FEMA)

The [Resilience Analysis and Planning Tool \(RAPT\)](#) allows federal, state, local, tribal and territorial emergency managers and other community leaders to examine the interplay of census data, infrastructure locations, and hazards, including real-time weather forecasts, historic disasters, and estimated annualized frequency of hazard risk. This tool can be used to understand asset locations (using the infrastructure menu), non-climate stressors (such as developed areas), and a variety of demographic indicators at both the county and census tract levels.

Using the Resilience Analysis and Planning Tool

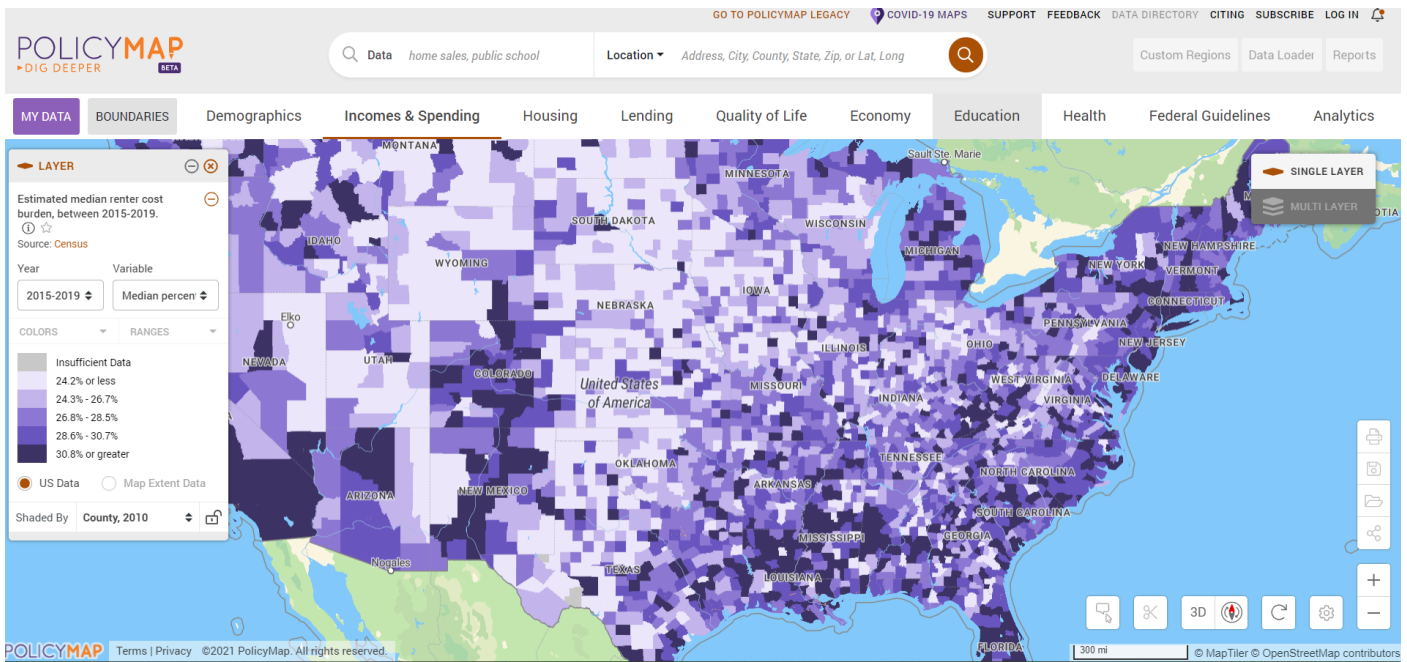
Begin by selecting a location. From there, add different types of data to the map from the menu at the top. There is no right or wrong way to add data, as it depends on what you would like to visualize for the project. Select an area on the map to further interrogate the data you have added.



Use the Toolbox menu at the top to save the map as an image for your report.

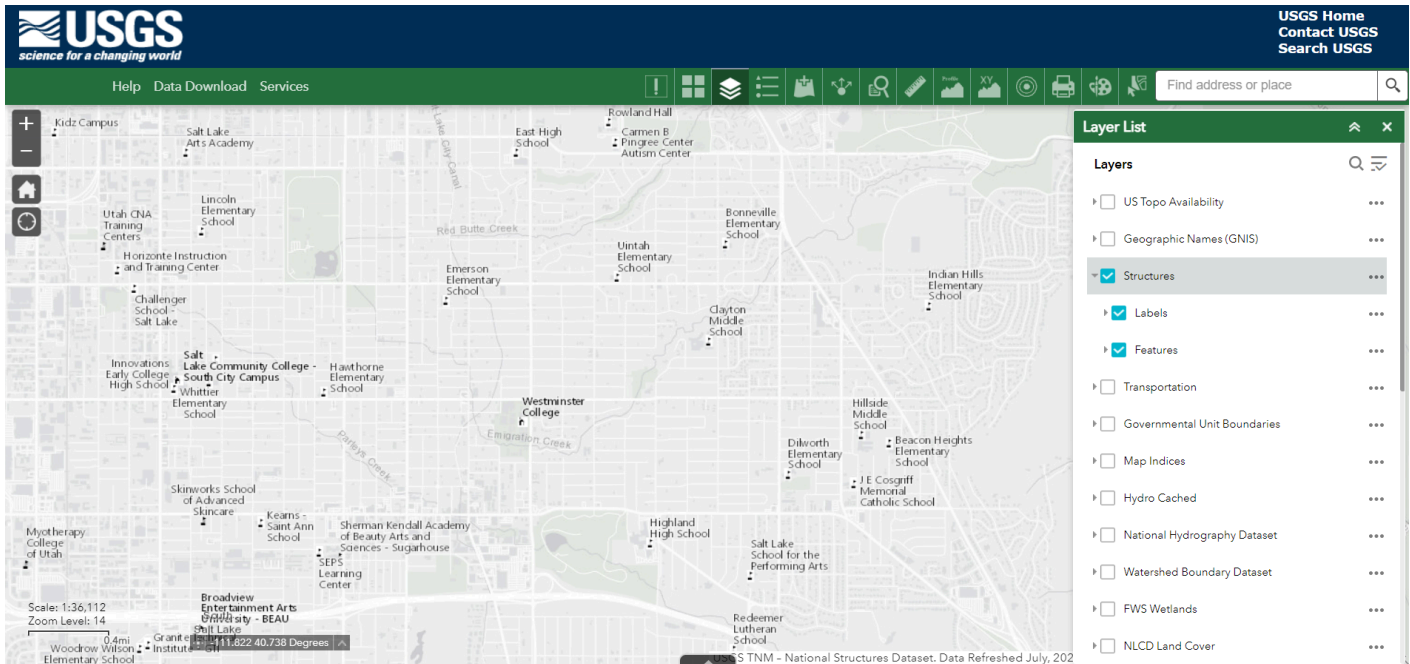
PolicyMap

Many companies and groups are now providing some really good GIS links for datasets. One of the primary ones to check out for the Human and Economic themes is [PolicyMap](#). There is both a free part of this database and an expanded subscription service. The data is provided under several themes: Demographics, Incomes and Spending, Housing, Lending Activity, Quality of Life, Economy, Education, Health, Federal Guidelines, and Analytics.



The National Map

The [USGS National Map](#) provides a go-to source for viewing and downloading many datasets such as NLCD land cover types (forested, wetlands, impervious surfaces), transportation, and watersheds. One important dataset for Step 1 is the National Structures Dataset (shown below), which provides point locations for federal and state landmarks, medical facilities, education, public safety, and more. Datasets shown on The National Map are available for download.



Neighborhoods at Risk

The [Neighborhoods at Risk](#) tool by Headwaters Economics has several functionalities at the census tract level. This tool helps provide context through an interactive map with filters for areas that may have a greater social vulnerability to hazards. Choose a place and set the criteria for people by moving the sliders on the pre-selected criteria or clicking “See More” to add or remove criteria. Set the criteria for the percent area lacking tree canopy, percent area that is impervious surface, and percent area within the 500-year floodplain. As you set the criteria, the map automatically updates. This information can be downloaded in a summarized PDF format from this interface.

Asheville intersects **17 census tracts** where vulnerabilities to climate change exceed the selected criteria.

Find at-risk neighborhoods

People

Set criteria: None Community Median U.S. Average

People over 65 years > 15%

Families in poverty > 0%

Children under 5 years > 0%

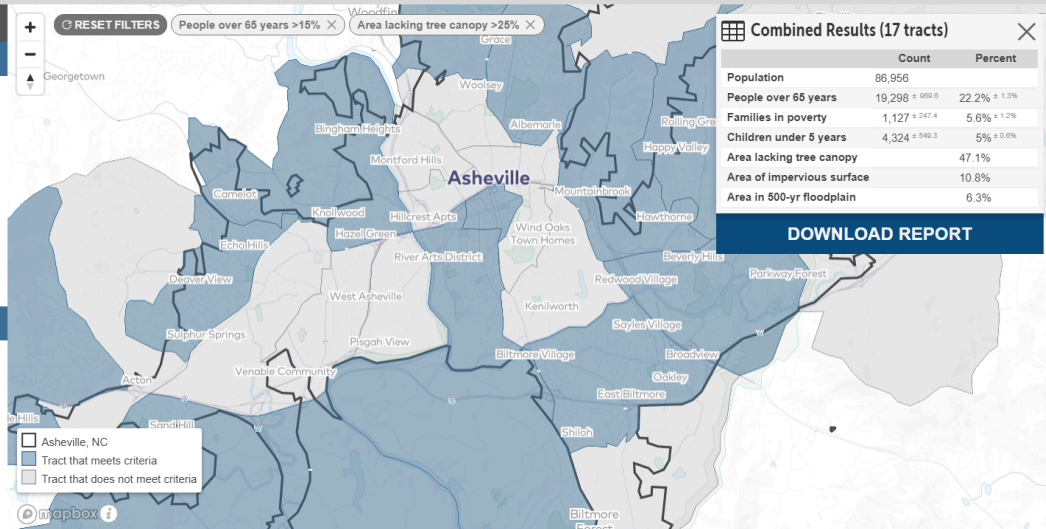
SEE MORE

Climate Exposure

Area lacking tree canopy > 25%

Area of impervious surface > 0%

Area in 500-yr floodplain > 0%



Combined Results (17 tracts)

	Count	Percent
Population	86,956	
People over 65 years	19,288 ± 909.0	22.2% ± 1.3%
Families in poverty	1,127 ± 247.4	5.6% ± 1.2%
Children under 5 years	4,324 ± 549.3	5% ± 0.6%
Area lacking tree canopy		47.1%
Area of impervious surface		10.8%
Area in 500-yr floodplain		6.3%

DOWNLOAD REPORT

This free tool is nationally available thanks to generous contributions from the Tableau Foundation, Mapbox, Urban Sustainability Directors Network, M. J. Murdock Charitable Trust, Climate Resilience Fund, National Oceanic and Atmospheric Administration, and National Academy of Sciences, Engineering, and Medicine. **HEADWATERS ECONOMICS**

By choosing Climate Projections in the top right corner, graphs show future heat and precipitation projections.

Asheville is expected to experience a **270% increase in extremely hot days** and a **9% increase in days with heavy precipitation** within 25 years.

Explore climate projections

Select time range: 25 Years

Select an emissions scenario: Higher Emissions (RCP8.5) Lower Emissions (RCP4.5)

HEAT

Days per year above: 90°F 95°F 100°F

By 2046, Asheville is expected to experience **5 more days** that reach above 95°F (from 2 days to 7 days per year).

Average annual temperature

By 2046, Asheville is expected to have a **2°F increase** (from 56°F to 58°F) in average annual temperatures.



Extremely hot days are the leading cause of weather-related fatalities in the U.S. and contribute to economic stress as the need for (and cost of) air conditioning rises.

Increasing annual temperatures contribute to droughts, longer and more catastrophic wildfire seasons, and warmer oceans that fuel hurricanes and offshore storms.

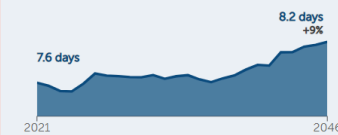
PRECIPITATION

Days per year with precip. above: 1" 2" 4"

By 2046, Asheville is expected to experience **0.7 more days** of heavy precipitation per year (from 7.6 days to 8.2 days per year).

Average annual precipitation

By 2046, Asheville is expected to have a **1.1" increase** (from 48.4" to 49.5") in average annual precipitation.



Heavy precipitation leads to both riverine flooding and flash floods as the ground fails to absorb the high volume of precipitation that falls in a short period.

Increasing annual precipitation contributes to sustained flooding. For example, in 2019 areas along the Mississippi remained above flood stage for at least three months.

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