

A Local Government Guide to the Chesapeake Bay

Module 8: Preparing Your Community for Water Extremes



Table of Contents

- 1 Purpose
- 2 What You'll Learn
- 3 Changing Conditions
- 4 Drought
- 5 Flooding
- 6 Climate Resilience
- 7 What You Can Do
- 8 To Learn More
- 9 Glossary

*Please refer to individual slide notes for data references and information sources.



A Guide For Local Governments

As a local leader, your decisions set the course for your community. Your actions determine the health and vitality of your jurisdiction, as well as that of your local waterways and the Chesapeake Bay. You can achieve win-win outcomes by prioritizing local economic development, infrastructure resiliency, public health, and education while also protecting your environment.

This module is one in a series created by the Chesapeake Bay Program to support and inform decision making by local officials. We encourage you to examine the full suite of modules listed on the next slide.

To help local government representatives better understand how the information in the modules aligns with their priorities, look for these icons:



Economic
Development



Public Health & Safety



Infrastructure
Maintenance & Finance



Education

A Guide For Local Governments

Available Local Government Modules

1. How Your Watershed Works
2. Foundations of Clean Water
3. Healthy Water for the Economy
4. Capitalizing on the Benefits of Trees
5. Preserving Local Character and Landscapes
6. Protecting Your Infrastructure Through Stormwater Resiliency
7. Building the Workforce of Today *and* Tomorrow
8. **Preparing Your Community for Water Extremes**
9. Understanding and Supporting Your Agricultural Allies
10. Keys to Community Engagement
11. Your Health and the Environment

Laying Foundations

Flooding is not a new problem in the Chesapeake Bay watershed, but it is one that is intensifying. At the same time, drought is increasing across the region.

- As the climate changes, local decision makers need public support and resources to prepare for, manage, and reduce local flooding and drought impacts.
- Although climate change impacts everyone, the burden will not be shared equally. Resilience means addressing regional and societal inequities as well as protecting public safety and economic, natural, and infrastructural assets.
- This problem is accelerating and the cost of not acting will only get higher– now is the time to prepare your community.



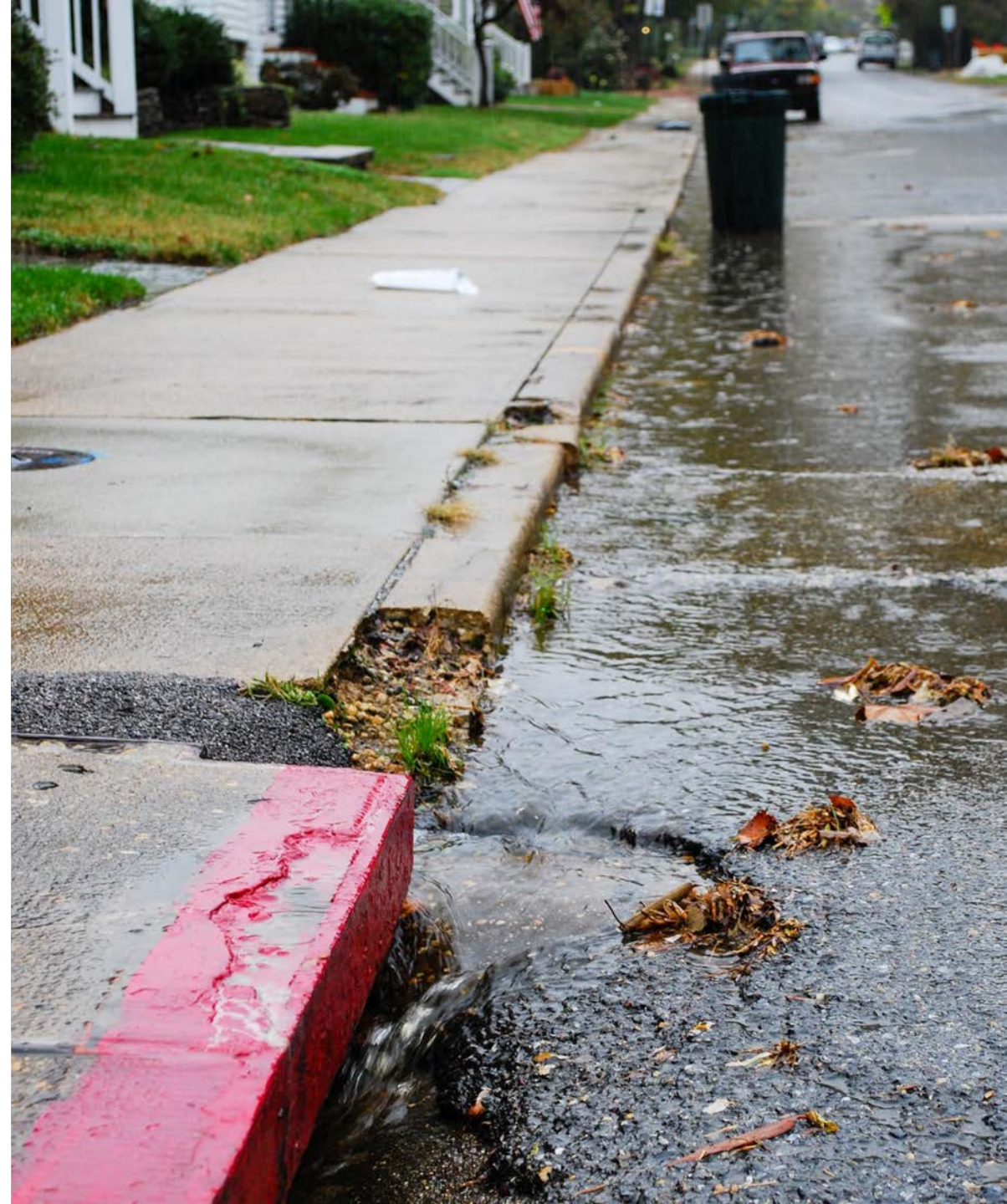
Prettyboy Reservoir During 2002 Drought (LJWorld)

What You'll Learn



Changing Conditions

Long-term weather patterns are changing in ways that impact your community.



Weather Versus Climate

As the National Oceanic and Atmospheric Administration (NOAA) puts it: Climate is what you expect, weather is what you get.

Climate comes from long-term averages of conditions in a particular area, such as what the typical temperature is, how windy it usually is, and how much rain or snow you can expect. Weather is the day-to-day conditions of the area, like if it is currently raining or what the temperature is right now. It can change over minutes, hours, days, or weeks.

Weather determines what you wear today:



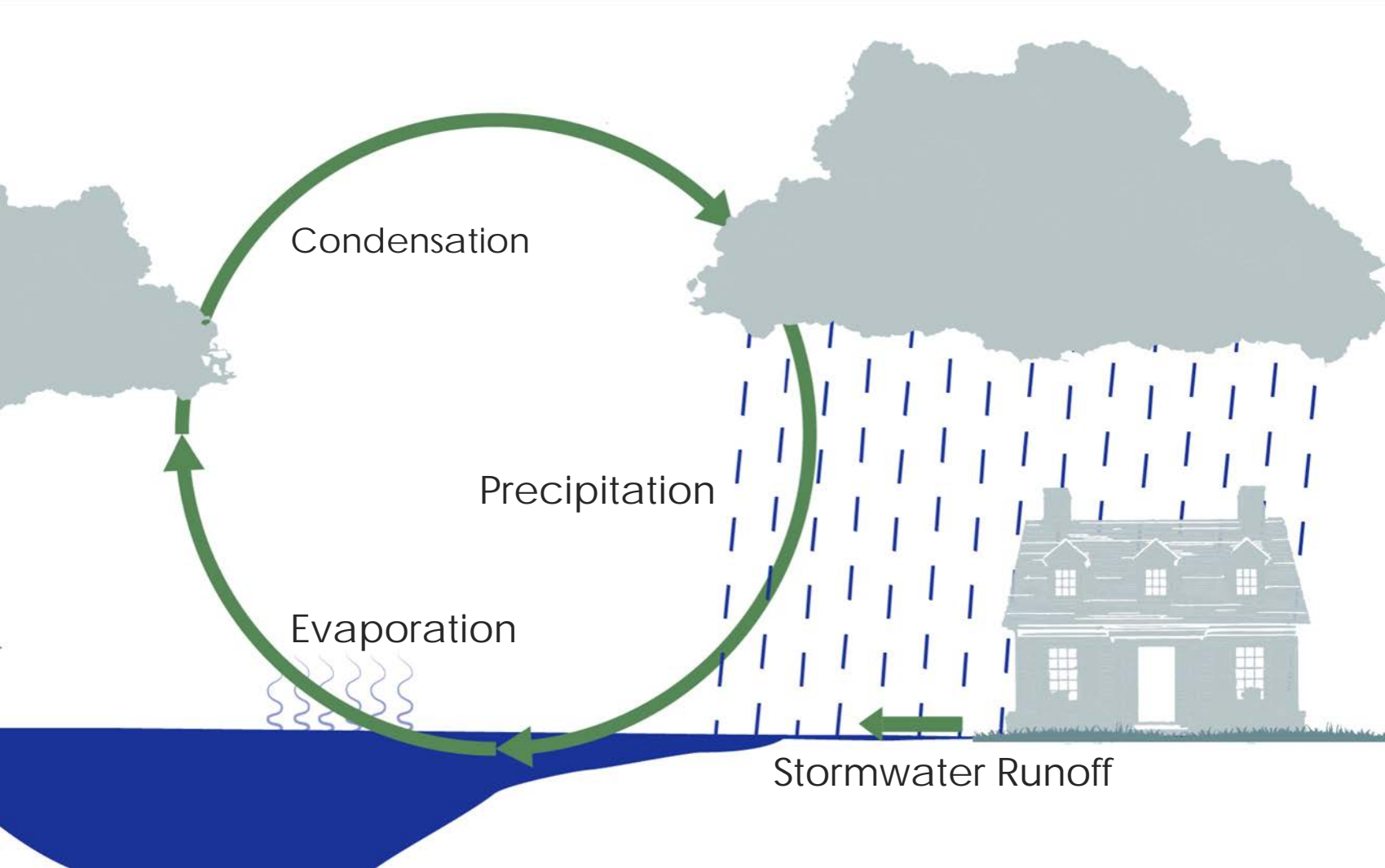
or



Climate tells you what you need in your closet over the course of the year:



The Normal Water Cycle



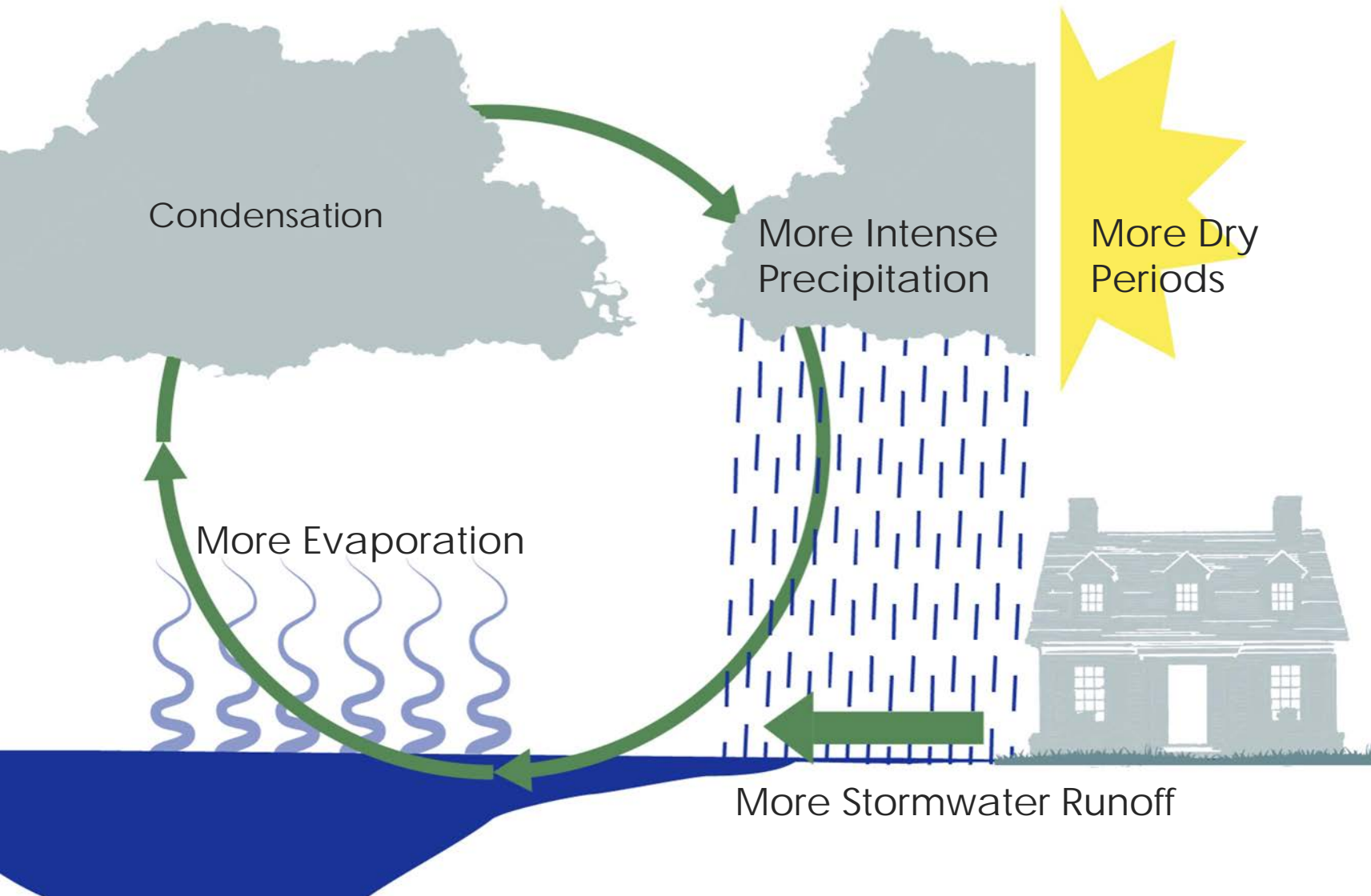
Flooding can occur when more precipitation falls than can absorb into the ground. The excess water, called stormwater runoff, can cause damage and add pollutants to local waters.

Drought occurs when there is not enough precipitation to replenish the water consumed by your community and lost to evaporation.

Preparing for Water Extremes

Changing Conditions

How Climate Change Impacts Water



Climate Connection

Higher temperatures cause more water to evaporate from the ground, drying out the soil.

Evaporation also fuels more rainstorms and dry soil cannot quickly absorb rain. This combination can lead to flash flooding.

Preparing for Water Extremes

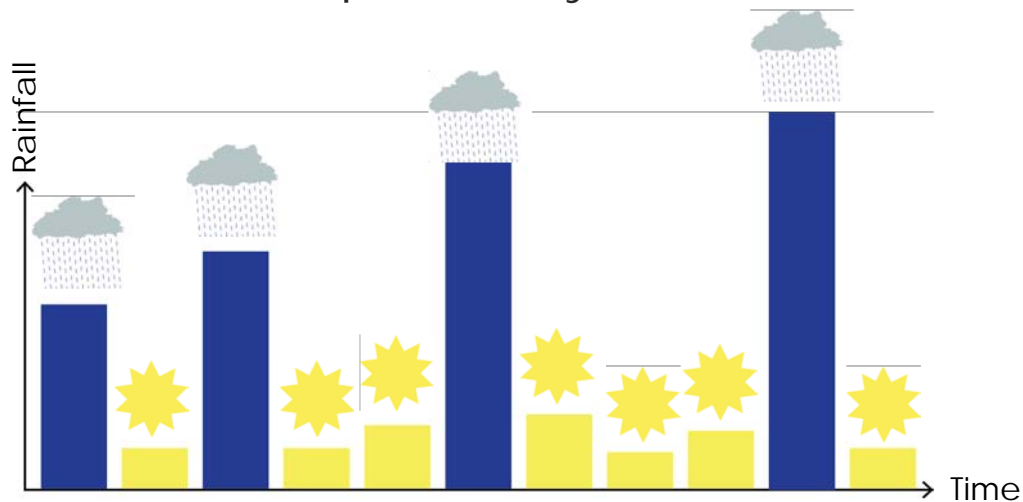
Changing Conditions



Annual rainfall is expected to increase

**6.5% or 2.7 inches
by 2055**

in the Chesapeake Bay watershed.



Storms will get more intense with longer dry periods between rain events.

Failure to account for changing weather patterns may lead to underestimating rainfall by as much as

60%

Being unprepared for increased precipitation heightens risk of flood and infrastructure failure while decreasing the efficacy of established stormwater best management practices.



Drought

Water is critical for a thriving community. What happens when there's not enough?



Periodic or sustained drought affects most U.S. regions, including the Chesapeake Bay watershed.

Drought in the U.S. is projected to become more intense and frequent, resulting in conflicts over water use and increasing vulnerability of infrastructure and communities.

The [National Integrated Drought Information System \(NOAA NIDIS\)](#) is a great tool for forecasting drought in your community.



Agriculture in Somerset County

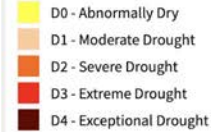
[Soybean](#) [Corn](#) [Wheat](#) [Sheep](#) [Cattle](#)

The USDA's National Agricultural Statistics Service (NASS) conducts hundreds of surveys every year and prepares reports covering virtually every aspect of U.S. agriculture, including agricultural commodities statistics for crops and livestock. This map displays crops and livestock by county alongside the current U.S. Drought Monitor. The size of each dot represents the total acres (crops) or total inventory (livestock) per county. [Learn more.](#)

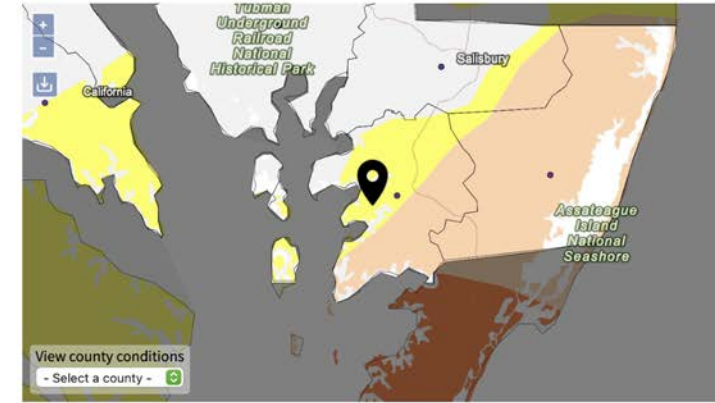
Crop Production (Acres)



U.S. Drought Monitor



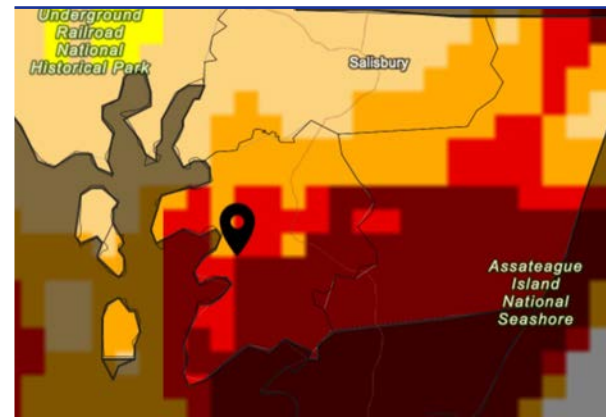
Source(s): [USDA NASS](#)



USDM Updates Weekly - 09/20/22

8,761 acres of soybean in drought (D1-D4) in Somerset County (estimated)	5,869 acres of corn in drought (D1-D4) in Somerset County (estimated)	3,168 acres of wheat in drought (D1-D4) in Somerset County (estimated)	177 number of sheep in drought (D1-D4) in Somerset County (estimated)	137 number of cattle in drought (D1-D4) in Somerset County (estimated)
--	---	--	---	--

Above is the drought map from September 2022 with impacts on agriculture. Below is a map of forecasted drought based on projected evaporation rates.



Drought Impacts



Drought impacts many industries, including energy, manufacturing, transportation, agriculture, and recreation. Learn more in the video below.



The cost of drought events averages over \$9 billion per year in the United States.



Access to drinking water is affected by drought, whether homes are on municipal water or private wells.



In addition to limiting water quantity, drought compounds problems by worsening water quality through increased salinity, algal blooms, and more. This creates human health and environmental concerns.



Case study: Wildfire at Great Dismal Swamp, VA

In 2011, drought dried the plants and soil in Great Dismal Swamp National Wildlife Refuge. When lightning struck, a fire began that burned for 111 days and cost \$12.5 million to fight. It produced copious smoke, endangering the health of those living near the Refuge.

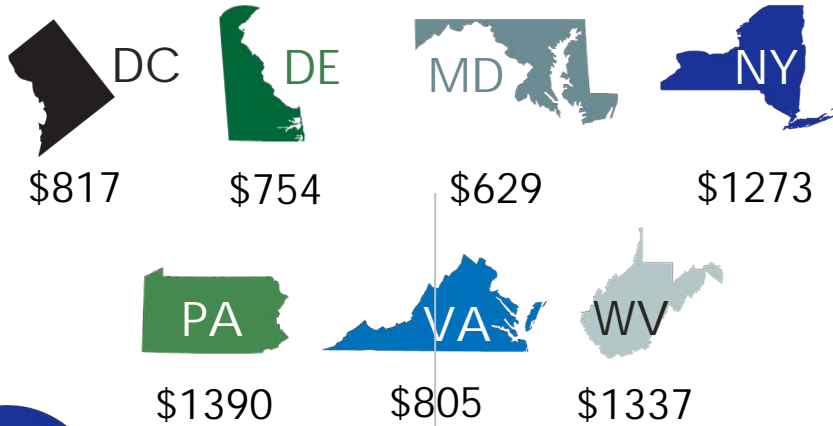
Flooding

Too much water can create just as many problems in your community as not enough.



Flooding Impacts

Average annual flood insurance cost:



Flooding cost the agriculture industry

\$752.6 million

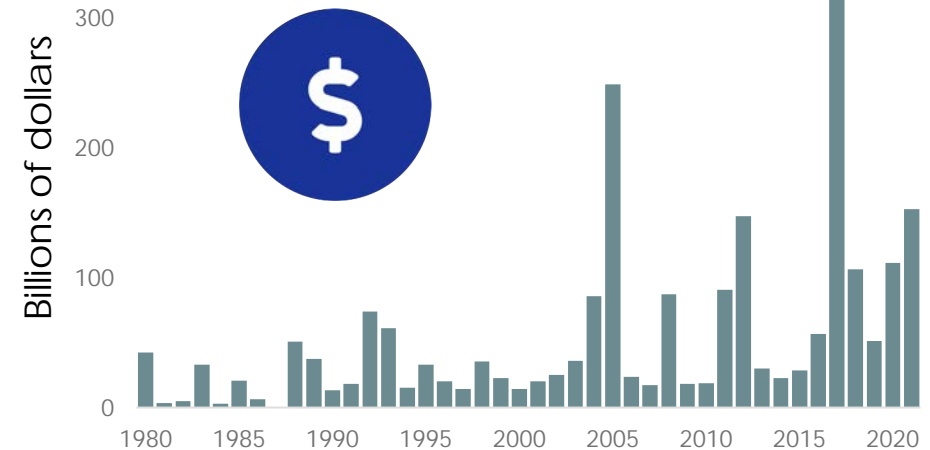
in the watershed states from 1995-2020



Low-income families are more likely to live in flood zones and less likely to have flood insurance - only 26% of insured houses within the 100-year floodplain are low-income households.



Weather and climate disasters are getting more costly. The cost of billion-dollar disasters over time in the US is shown below.





Coastal

Both rising waters and sinking land are leading to more flooding along coasts. Storm surge, the additional sea water pushed on shore from a storm, is a significant issue for coastal communities. Nuisance flooding (driven by tidal activity) also presents a chronic risk to coastal communities, with cumulative damage potentially exceeding that from storms.



Urban

Because of a higher proportion of impervious surfaces, heavily developed areas experience more stormwater runoff. This can lead to localized flooding and infrastructure damage during storms. As your community grows, it's important to keep in mind how water will move through growth areas.

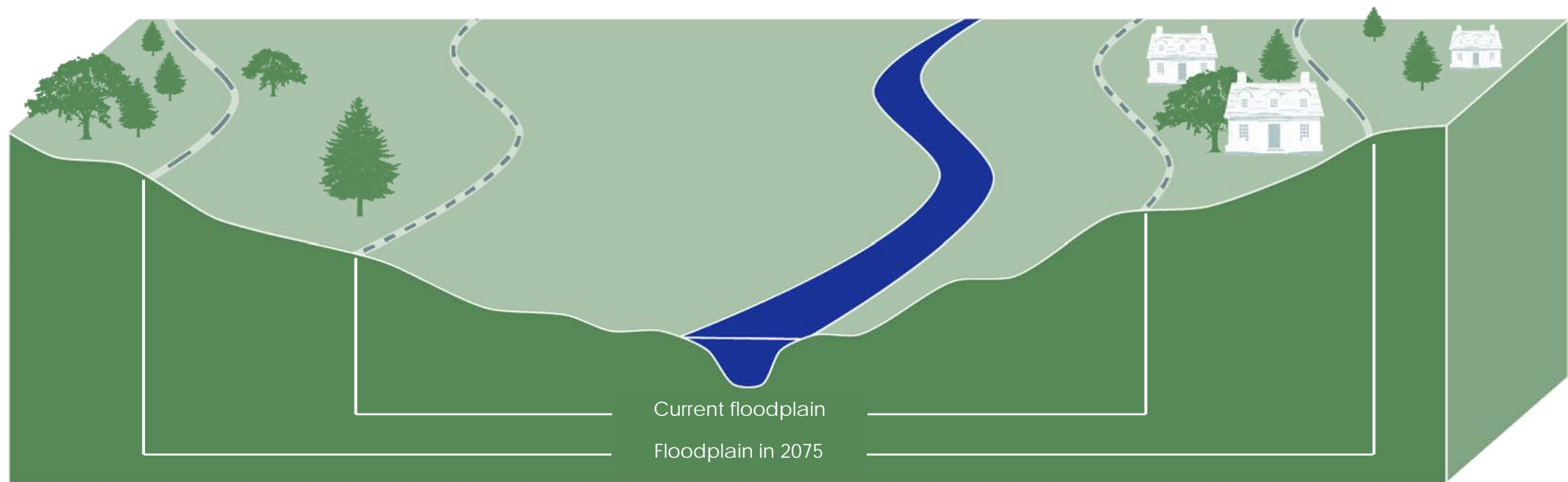


Inland

Storm events are worsening with changes in the water cycle. We can expect more powerful storms with the potential for more flash flooding. Mudslides are an additional hazard associated with high-elevation storms. Rural communities are especially vulnerable due to capacity limitations and geographic isolation.



Floodplains are areas susceptible to being inundated by floodwaters from any source. They are being altered by the changing water cycle – floodplains in the future will be larger than they are today. This endangers more houses and infrastructure as time goes on.



Do You Know Your Flooding Terms?

You may have also heard floods referred to as #-year floods, such as a 100-year flood.

It's not what it sounds like - it means that the likelihood of a flood of that magnitude happening is 1 in 100, or a 1% chance in any year, not that a flood of that intensity occurs once every 100 years. That is why it is possible, and getting more likely with climate change, to see a 100-year flood two years in a row.

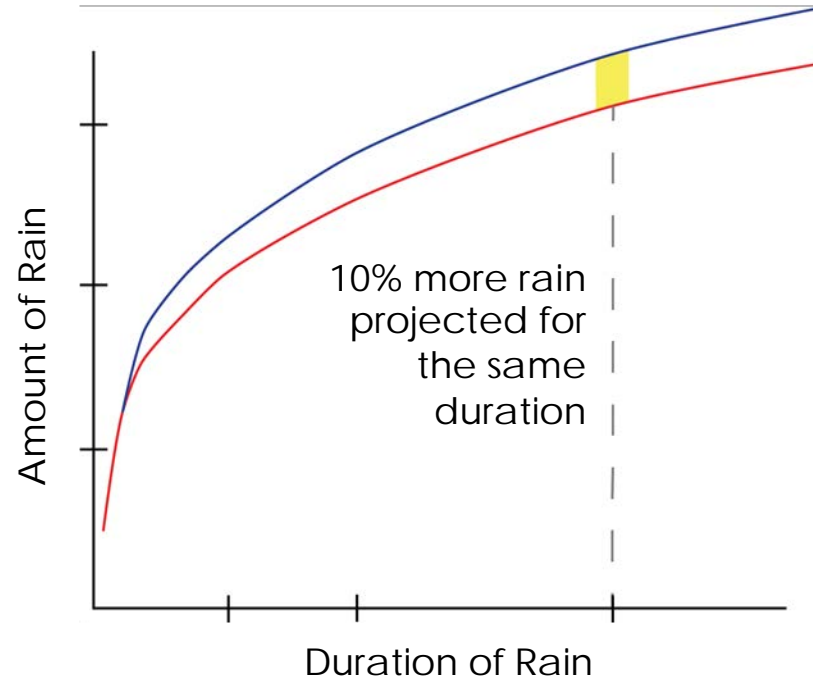


Measuring Rainfall Intensity

Climate Connection



Intensity-Duration-Frequency (IDF) curves represent how much rain falls, for how long, and how often it happens. They are used for forecasting flooding and informing water engineering and design. Because the water cycle is changing, we must adjust IDF curves and design specifications to be prepared for more intense and frequent rainfall.



The plot to the left for Luzerne County, PA shows the standard IDF curve in red and one that accounts for climate change in blue. Look up your county: <https://midatlantic-idf.rcc-acis.org>.

Case study: Virginia Beach



The City of Virginia Beach updated its Public Works Design Standards Manual to adjust for increases in precipitation. The City already sees rainfall 10% above the standard projections and anticipates increases over the next 30 years. The Manual has been updated to increase IDF curve values by 20%, meaning that infrastructure design will now have to accommodate a larger amount of rainfall. This may increase costs initially, but the investment is in protecting the community.

Climate Resilience

The climate is changing; is your community ready for the impacts?



Climate Resilience

Climate resilience is the ability to anticipate, prepare for, and respond to hazardous events, trends, or disturbances related to climate. Being resilient to changes in climate can include:



Understanding your community's exposure.



Assessing your vulnerability and risk.



Investigating your options.



Prioritizing and planning.



Taking action.





Water conditions in your community are changing. Business as usual in your community will leave you vulnerable to increasing drought and flooding; we can't keep building for historical conditions and not expect to see increasing damage.

Avoiding future flood damage to new structures requires a two-part strategy:



1



New building standards, including keeping development out of the high-risk areas

2



Rebuilding stronger after damage

1. Incorporate effects of climate change into water, wastewater, and energy infrastructure planning using updated IDF curves
 - Watch the webinar for additional information
2. Register with the Chesapeake Stormwater Network to view climate and stormwater reports and other resources
3. Review the US Climate Resilience Toolkit to learn the five steps to resilience and how to achieve them, as well as case studies like the one below

Case study: Walton, NY



The Walton Flood Commission brought together 25 people from Walton and various state government offices to discuss flooding mitigation.

The flood commission suggested hiring a consultant to model a variety of flood scenarios and past storm events. There were also public meetings to educate and hear feedback. In the end, the village reclaimed the floodplain, reducing flooding and its impacts on the community.

Partnerships

Increase your capacity by partnering with existing collaboratives.

Potential partners:

- Soil and Water Conservation Districts
- Nonprofits (local, regional, national)
- Technical experts (foresters, engineers, natural resource consultants)
- Schools (see case study)

Learn more about connecting with your community in Module 10: Keys to Community Engagement.



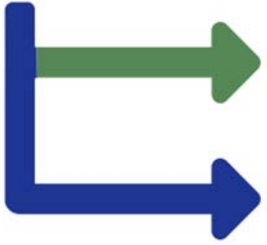
Case study: Richmond, VA



“Taking a School by Storm” is a runoff reduction effort at Binford Middle School that includes a garden with a rain-harvesting sculpture.

The project was funded with \$200,000 awarded by the by National Fish and Wildlife Foundation through an EPA Small Watershed Grant.

What You Can Do



Adopt a resilience plan in your community.

- View a [list of resources](#) compiled by the Chesapeake Bay Program Climate Resiliency Workgroup and read [this one-pager](#) on resilience strategies.



Consider resilience in all future planning. Make sure that comprehensive plan updates include resilience as a cornerstone.



Start safety and preparedness campaigns to encourage property owners to get flood insurance and explain the risks of flash flooding.

To Learn More

- [US Climate Resilience Toolkit](#)
 - Find and use tools, information, and subject matter expertise to build climate resilience in your community.
- [EJ Screen Chesapeake](#)
 - Discover which portions of your community are most vulnerable to climate impacts.
- [NOAA Data Snapshots](#)
 - View and use an up-to-date archive of freely available climate maps – great for websites or presentations.
- [FEMA](#)
 - Review the FEMA website for information on flooding and insurance, including the updated Risk Rating 2.0 system used to calculate flood insurance premiums.
- [Wetlands Watch Sea Level Rise Adaptation Guide](#)
 - View a Virginia-specific guide of existing programs and authorities that you can use to take action on flooding and sea level rise.
- [American Flood Coalition's Resources](#)
 - Find and use resources like an adaptation guide, disaster handbook, and flood funding finder.

Glossary

- Climate

The average weather conditions for a particular location and over a long period of time

- Weather

The state of the atmosphere, including temperature, atmospheric pressure, wind, humidity, precipitation, and cloud cover

- Best Management Practices

Actions that people can take to prevent pollution from entering their local waterways

- Floodplains

Areas susceptible to being inundated by floodwaters from any source

- Intensity-Duration-Frequency (IDF) curves

Graphical tools that describe the likelihood of a range of extreme rainfall events. They relate rainfall intensity with its duration and frequency of occurrence for the purposes of flood forecasting and civil engineering.

- Climate Resilience

The ability of living resources, habitats, public infrastructure and communities to withstand adverse impacts from changing environmental and climate conditions, like flooding and increased temperatures

Images and Graphics

- Title Page
Photo by W. Parson/Chesapeake Bay Program
- Table of Contents
Photo by W. Parson/Chesapeake Bay Program
- Laying Foundations
Photo from Lawrence Journal-World/LJWorld.com
- What You'll Learn
Photos by W. Parson/Chesapeake Bay Program
- Changing Conditions
Photo by W. Parson/Chesapeake Bay Program
- Weather Versus Climate
Graphics by Green Fin Studio
- The Normal Water Cycle
Graphics by Green Fin Studio
- How Climate Change Impacts Water
Graphics by Green Fin Studio
- Water Projections
Photo by S. Droter/Chesapeake Bay Program
- Drought
Photo by S. Droter/Chesapeake Bay Program
- Drought Impacts
Photos by W. Parson/Chesapeake Bay Program and NASA
- Flooding
Photo by W. Parson/Chesapeake Bay Program
- Flooding Impacts
Photo by M. Land/Chesapeake Bay Program
- Do You Know Your Flooding Terms? 1
Graphics by Green Fin Studio
- Do You Know Your Flooding Terms? 2
Photo by R. Magnien/NOAA
- Measuring Rainfall Intensity
Photo by W. Parson/Chesapeake Bay Program
- Climate Resilience 1
Photo by W. Parson/Chesapeake Bay Program
- Climate Resilience 2
Photo by W. Parson/Chesapeake Bay Program
- Rebuilding Stronger
Graphics by Green Fin Studio
- Funding
Photo by S. Ballard/Chesapeake Bay Program
- Tools for Resilience
Photo by G. Dutcher/Delaware County Soil and Water Conservation District
- Partnerships
Photos by W. Parson/Chesapeake Bay Program