A Local Government Guide to the Chesapeake Bay

Module 1: How Your Watershed Works



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***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:

1. **How Your Watershed Works**
2. Foundations of Clean Water
3. Clean 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

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

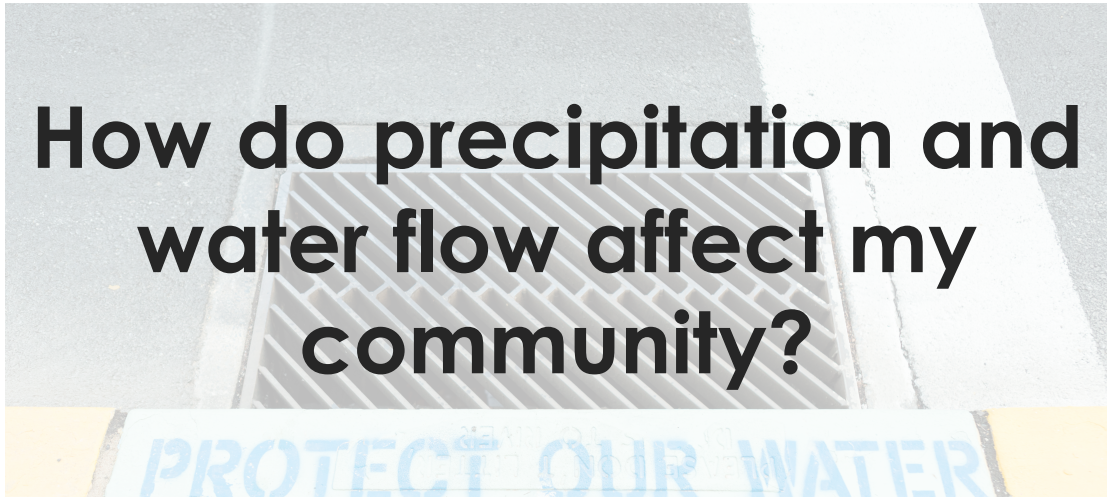


Education

What You'll Learn



How do my community's activities on land impact water quality?



How do precipitation and water flow affect my community?



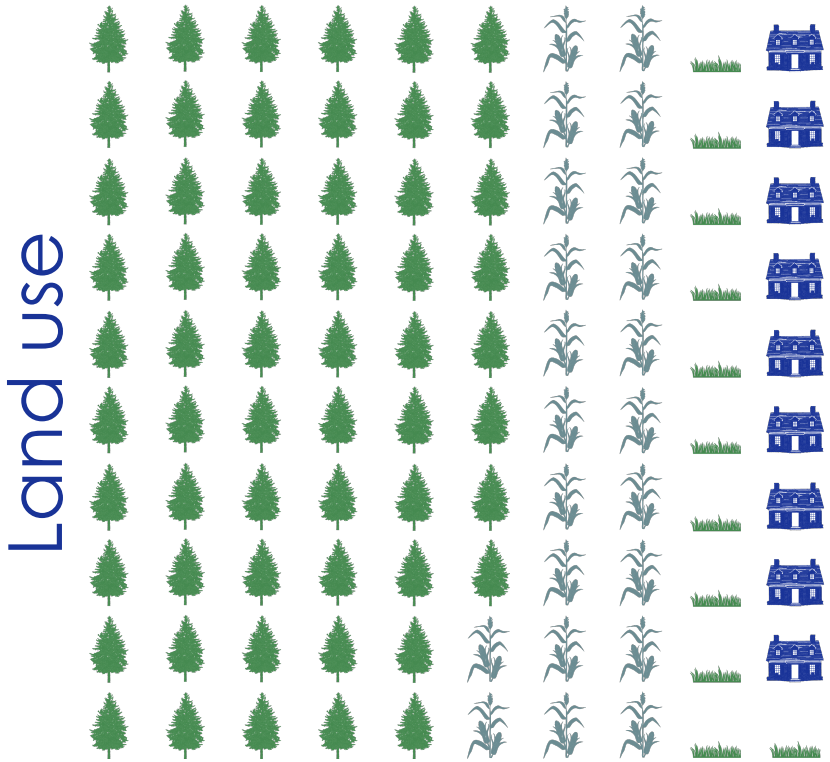
How do healthy local waterways benefit my community?

Chesapeake Bay Overview

This section will introduce you to a few important facts about the Chesapeake Bay and its watershed.



Chesapeake Bay: By the Numbers



= **58%** forests

= **22%** farms

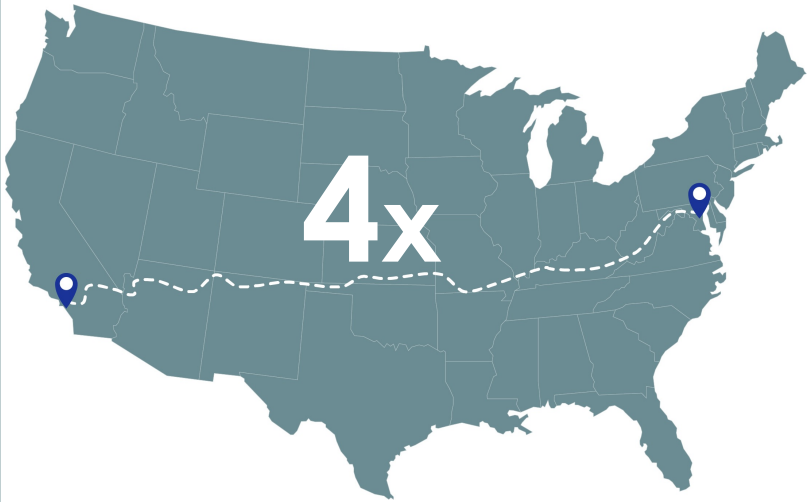
= **11%** other development
(e.g., golf courses, cemeteries, & parks)

= **9%** suburban and urban

11,656 miles of shoreline

in the Chesapeake Bay watershed

That's more than the equivalent of 4 trips between Annapolis, MD & Los Angeles, CA!



51 billion



gallons of water flow into the Bay from its rivers daily

18.2 million



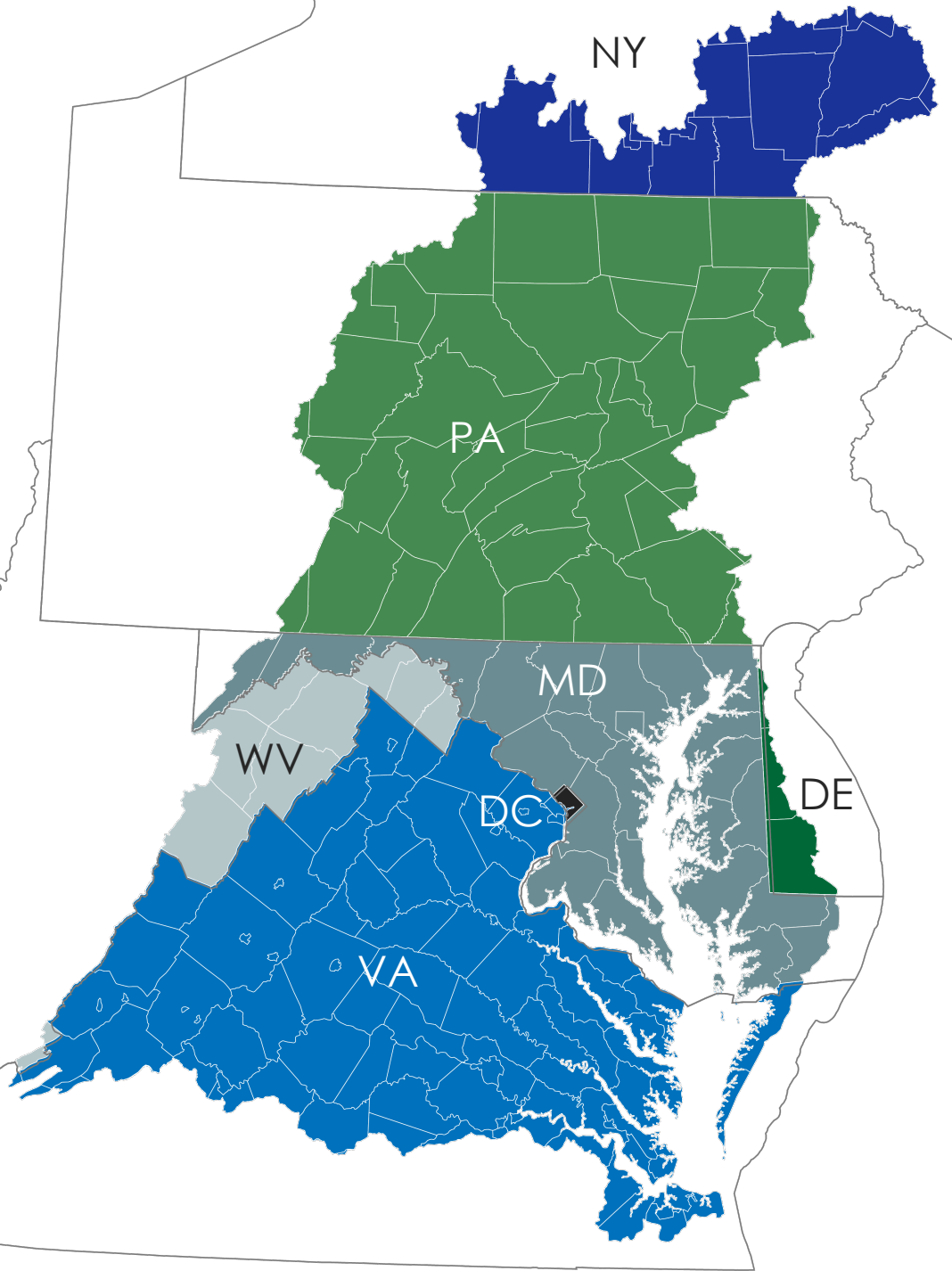
people live in the 64,000-mi^2 watershed

More Than the Bay

The Bay is more than just a body of water: it is a watershed.

The watershed is all the land that drains into the Chesapeake Bay. It begins in Cooperstown, NY with the headwaters of the Susquehanna and stretches down to the mouth of the Bay. A drop of water falling anywhere in the watershed will eventually make its way from land to creek, creek to stream, stream to river, and river to the Chesapeake Bay.

The amount of precipitation that falls in the watershed and how that water is managed has major implications for the health of the whole watershed.



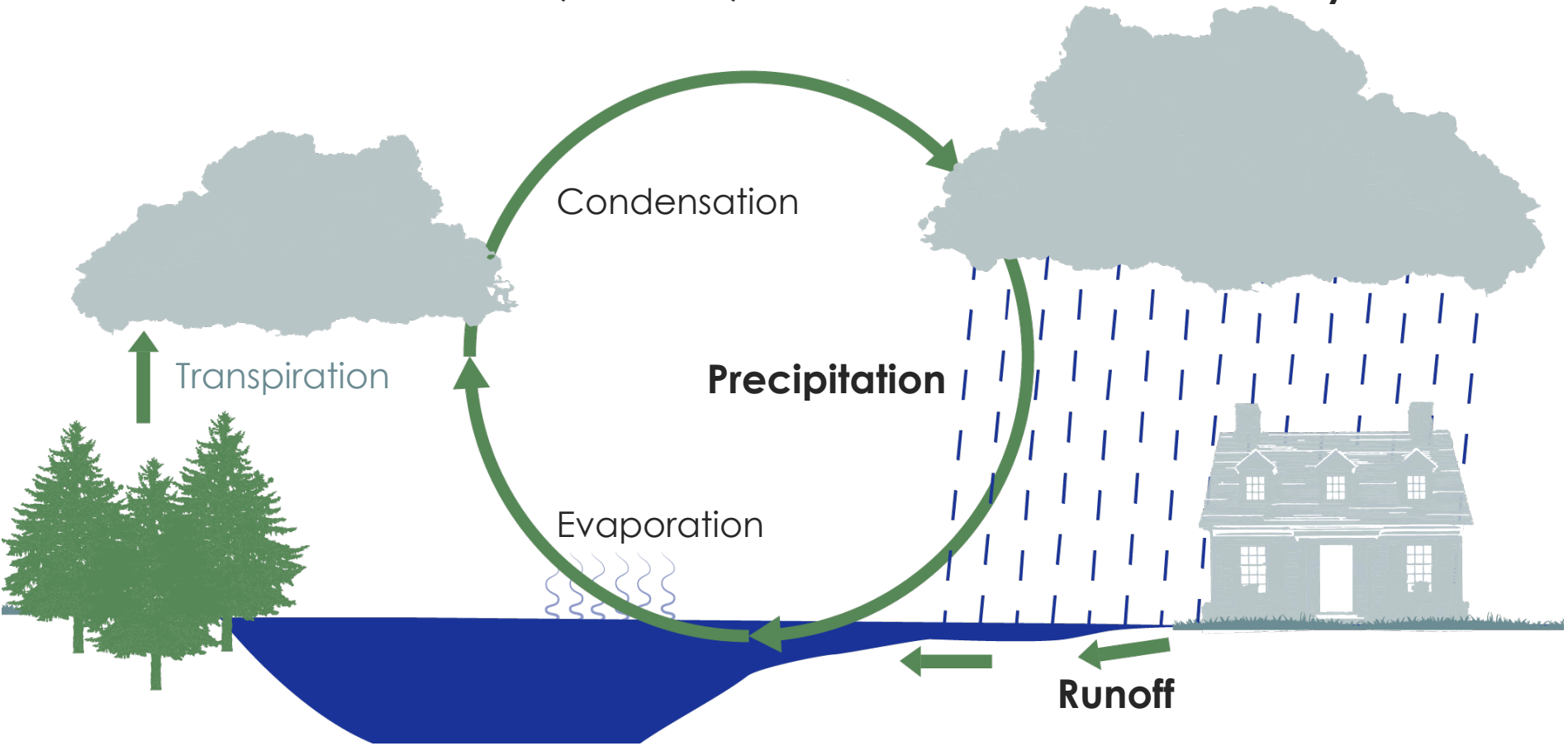
Go With the Flow

You can’t really understand how the watershed works until you understand its water cycle.



The Water Cycle

Clean water is essential for people. How water moves, and what it brings with it, is at the heart of community and watershed health. Let's start the water cycle as water evaporates from land and water. The water vapor cools and forms clouds through condensation. **Precipitation then falls on land and drains into the creeks, streams, and rivers that flow into the Bay.**

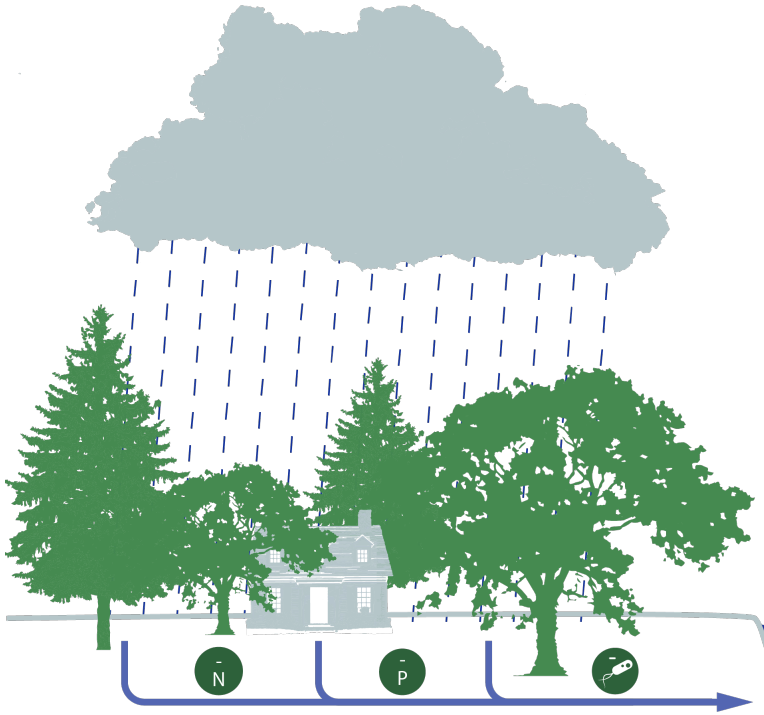


Climate Connection

Warmer air holds more moisture which means more intense and frequent precipitation events as the climate warms. Increased rainfall has the potential to overwhelm waterways and stormwater systems, increasing flood and erosion risks. Rising sea levels and storm surge also increase flood and erosion risks.

Precipitation and Land Use

Natural System



In areas with less development, precipitation is filtered through soil and plant roots before entering streams or local waterways.

Developed System

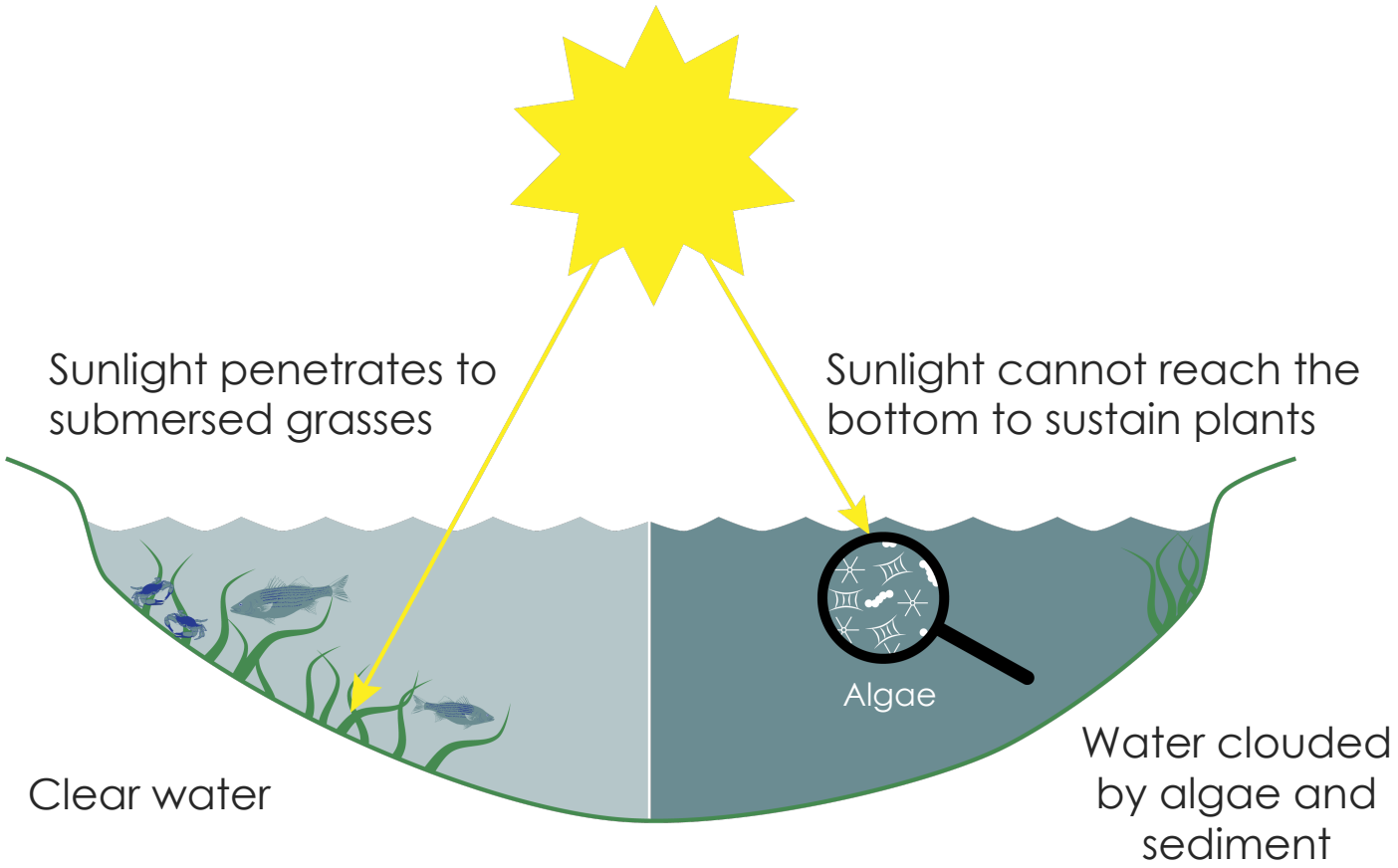


Impervious surfaces, like rooftops and parking lots, create stormwater runoff by preventing water from being absorbed. Farm fields, neighborhood lawns, and city streets add pollutants (including **N**itrogen and **P**hosphorus), sediment, and bacteria to local streams, rivers, and the Bay.

Disturbing the Balance

Natural and developed land need to be balanced. When there is too much development, excess nutrients (nitrogen and phosphorous) and sediment from runoff enter local waterways. The nutrients fuel the growth of algae; some types of algae, but not all, are a threat to public health and safety. When the sun is blocked by algae and sediment covers the grasses, they can't grow.

The Bay's underwater grasses are an important habitat for commercially important species like blue crabs.



Back to the Basics

The Bay is an estuary. Let's find out what that means and how the Bay is unique.



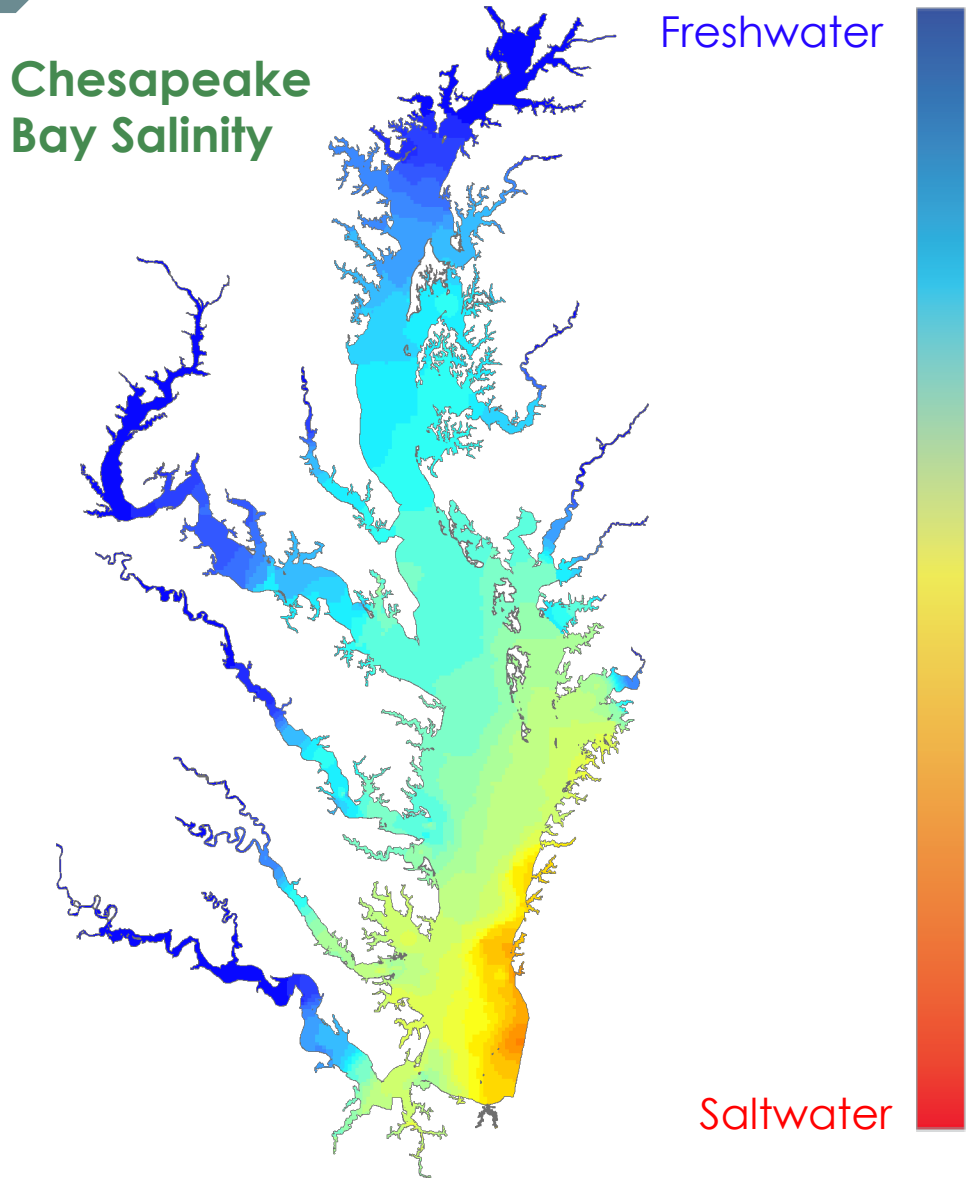
Back to the Basics

The Bay is an estuary.

An estuary is where freshwater from the rivers and saltwater from the ocean mix.

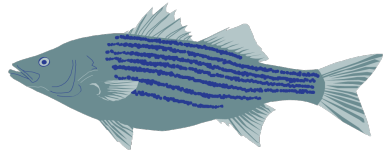
The saltiness of the water, or salinity, depends on your location; generally, salinity decreases as you move up the Bay and away from the ocean.

The salinity of an area determines which plants and animals can live there.





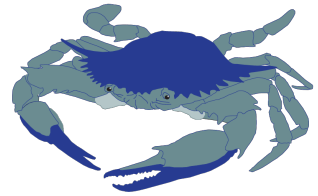
Fresh only



Fresh to somewhat salty



Salty to somewhat fresh



All salinities

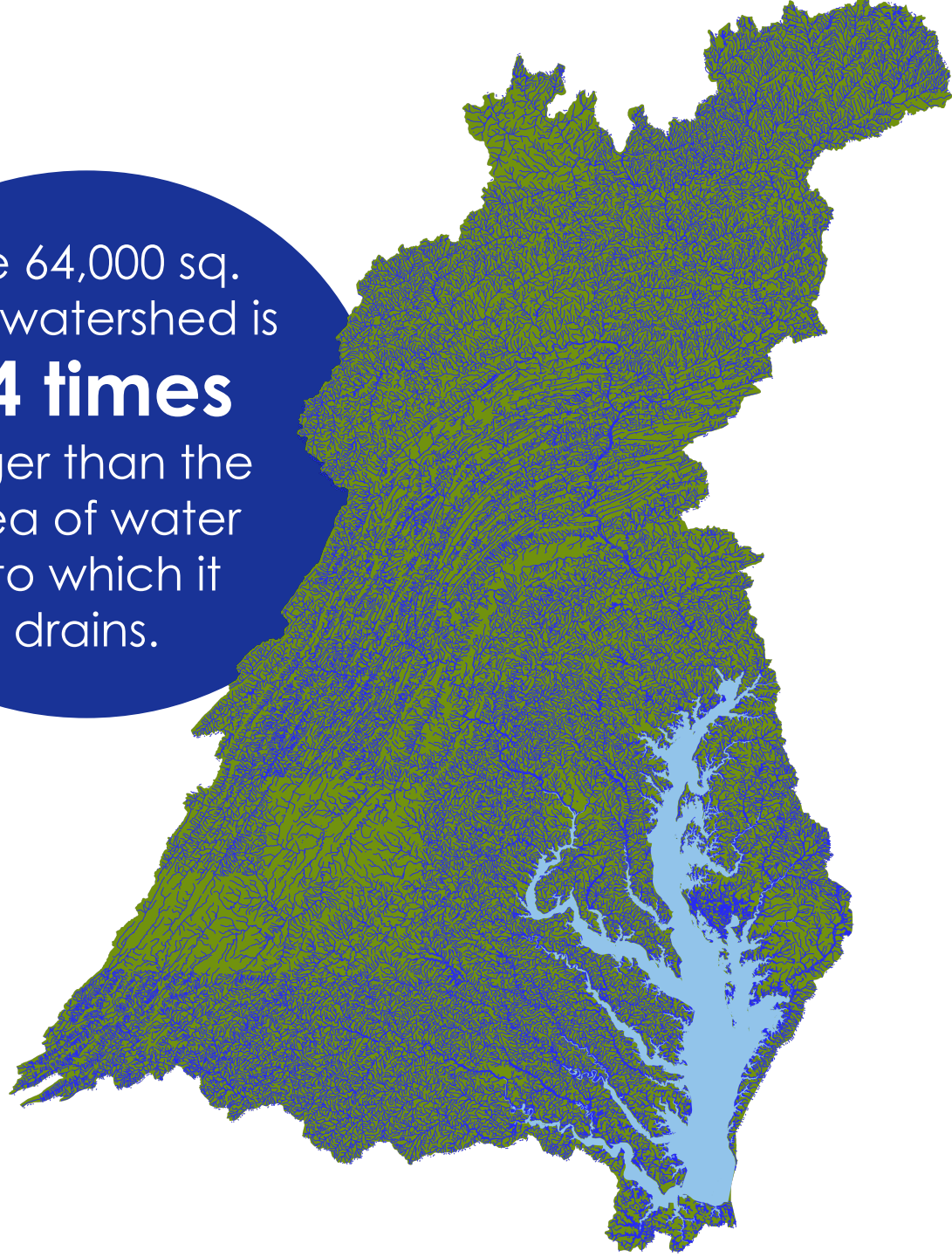
Back to the Basics

The Bay is unique.

What makes it special? The Bay is very shallow – **the average depth is only 21 feet.** This makes it important habitat for blue crabs, oysters, juvenile fish, underwater grasses, and waterfowl.

This also makes it very susceptible to pollution. Compared to other estuaries in the US, **it is very shallow** relative to the land area that drains into it. This means there is less water to handle the pollution that washes in from the land.

The 64,000 sq. mile watershed is **14 times** larger than the area of water into which it drains.



Bay 101

Local communities thrive when the watershed is healthy.



Protect Your Watershed

Clean water and a healthy watershed are critical to:



Economic Development



Public Health & Safety



Infrastructure Maintenance & Finance



Education

A healthy watershed attracts businesses, creates jobs, and provides safe drinking water and food for our families, which creates and supports thriving communities.

Economic Development: Benefits of Clean Water

The fisheries in the watershed are worth millions of dollars each year.

BLUE CRABS

$79.1 million

OYSTERS

$45.2 million

FISHING LICENSES

$80.1 million

Recreational fishing by state:

	$ spent while fishing	# jobs supported
NY	$1.9 billion	20,030
PA	$417 million	6,359
MD	$491 million	5,085
DE	$90 million	987
WV	$344 million	4,840
VA	$998 million	9,786



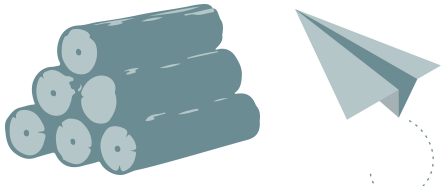
Clean water can raise the value of a nearby home by up to **25%**.

Access to clean water promotes:

- purchase of fishing licenses
- increased tourism
- visits to local businesses
- hunting revenue
- local breweries
- robust agriculture

Economic Development: Benefits of Trees

The trees of the Chesapeake Bay watershed provide



$22 billion
in forestry products



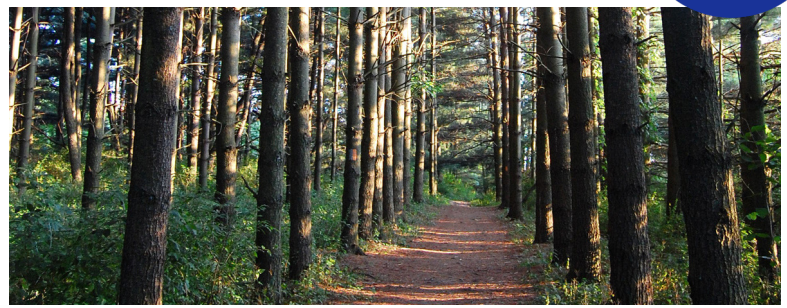
$24 billion
in ecological services (carbon removal, flood control, wildlife habitat, and recreation)

Case study: Pembroke Woods

Developers in Frederick County, MD saved over **$360k** by leaving trees and wetlands undisturbed in a residential subdivision. The savings primarily came from storm water management benefits and reduced clearing/grubbing costs.



Customers spend **more time** & **11% more money** in well-treed areas.



Homes near natural forests earn **$10k** in property premiums (more than homes near golf courses or specialty parks).

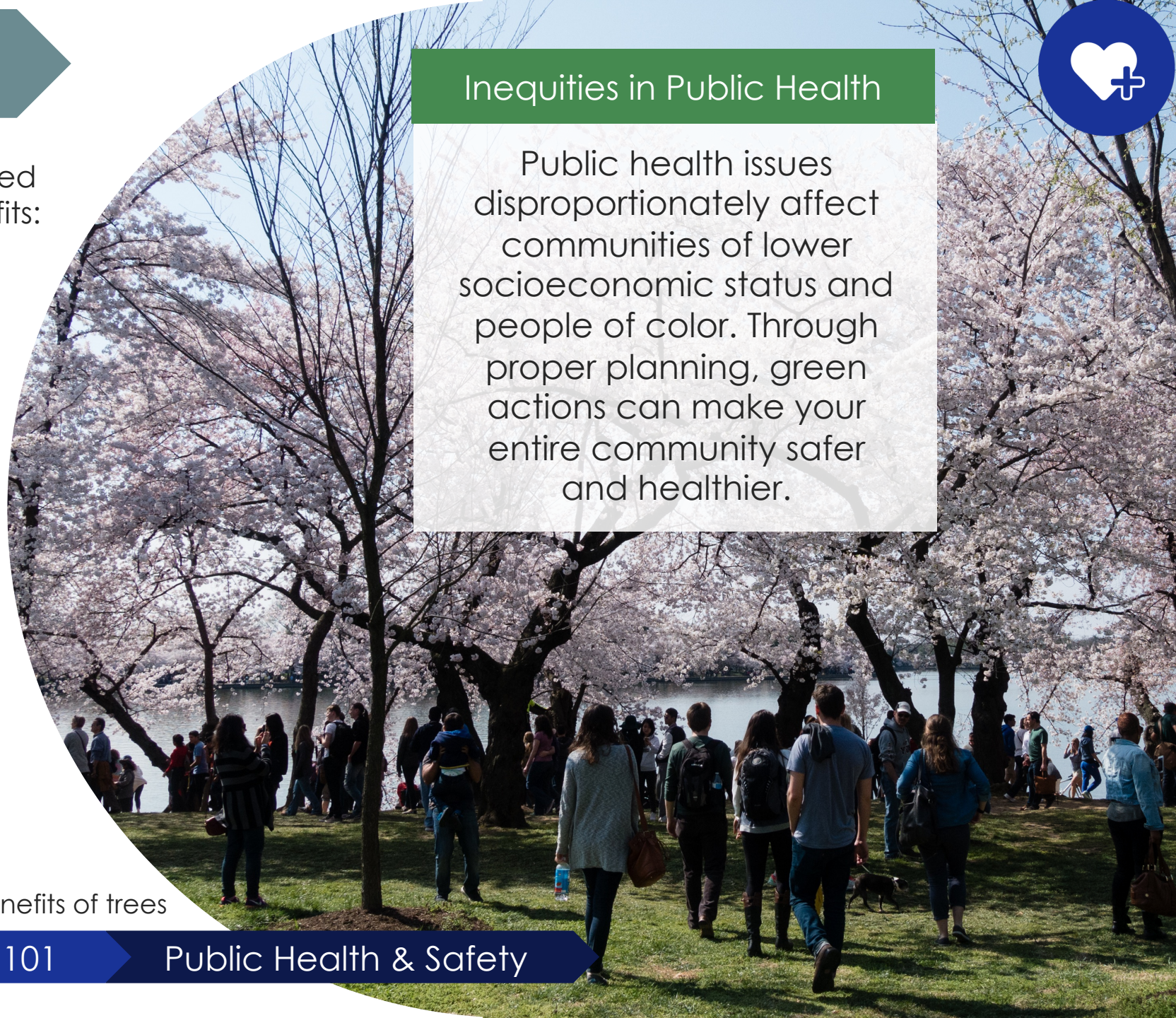


Well-placed trees can save
- **21-24%** in cooling costs
- up to **25%** in heating costs

Public Health & Safety: Benefits of Trees

Trees reduce stress and are associated with multiple other community benefits:

- reduced urban heat island effects: less heat-related illness and death
- clean air and water: lower rates of asthma and cardiovascular disease
- reduced crime: higher quality of life
- more exercise: better cardiovascular health



Inequities in Public Health

Public health issues disproportionately affect communities of lower socioeconomic status and people of color. Through proper planning, green actions can make your entire community safer and healthier.

See Module 4 for more information about the benefits of trees

Infrastructure Maintenance & Finance

What is grey versus green infrastructure?

Grey stormwater infrastructure uses man-made technologies to capture, filter, and convey stormwater. Green infrastructure uses systems that incorporate natural processes and technology inspired by nature. Because green infrastructure works with nature, it is often less costly, less disruptive to the environment, and better for your community's wellbeing. See Module 6 for more information about stormwater infrastructure.

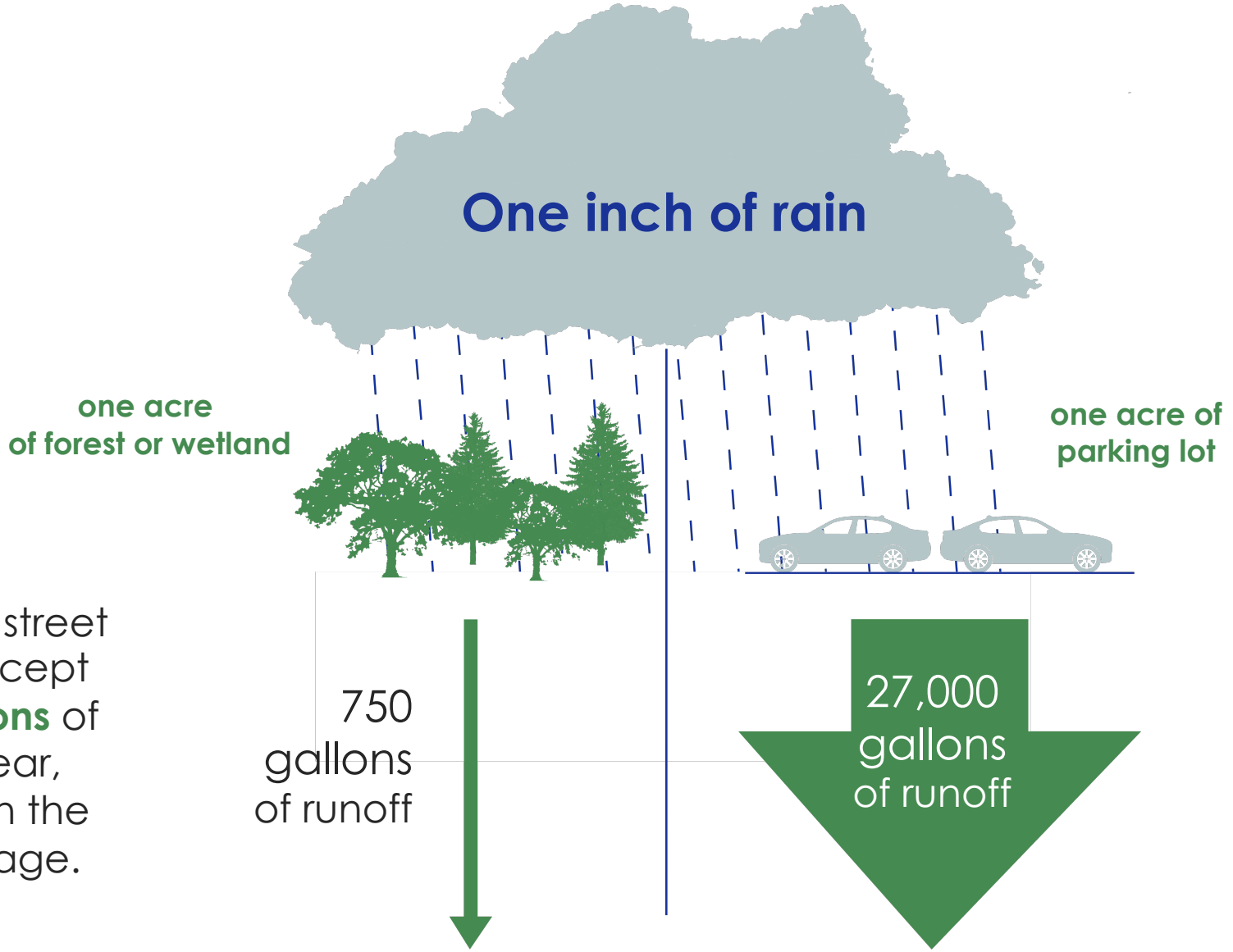
Case study: Lancaster Green Infrastructure



The City of Lancaster in Pennsylvania saved over **$160 million** by pivoting from a grey stormwater control plan to a green plan.

The entire plan was less than half the cost of installing an underground storage tank for the stormwater, which would require an additional $750k in treatment annually.

Infrastructure Maintenance & Finance



Even a typical street tree can intercept **760-3000 gallons** of water per year, depending on the species and age.

Runoff can flood neighborhoods, stress storm drainage systems and increase runoff into and the erosion of community creeks.

Education

96% of parents support environmental education



85% want government agencies to support environmental education

40% $ $ $ $ $ $ $ $ $ $

of total direct general expenditures at the local level are invested in elementary and secondary education. That's more than any other single functional category.

To get the most out of this investment, consider schoolyard projects that teach future generations environmental stewardship and improve community health, including water quality, ecosystem health, and public health & safety.

Education is an indicator of current and future workforce condition and quality of life for employees, making good public education attractive for businesses *and* workers.

Education

Case study: Camp Hill, PA



A new aquaponics lab in Cedar Cliff High School provides hands-on learning for students across the school district to develop skills in science, business and leadership as part of a workforce development strategy.

The lab was funded through a grant from the Pennsylvania Department of Labor & Industry for approximately $250,000 which the District received in collaboration with the South Central Workforce Investment Board.

Case study: Richmond, VA



"Taking a School by Storm" is a schoolyard retrofit project at Binford Middle School. It reduces stormwater runoff using several methods, including a rain garden with a collaboratively-designed rain harvesting sculpture.

The project was funded with $200,000 awarded by the by National Fish and Wildlife Foundation through the EPA's Small Watershed Grants Program.

What You Can Do

Reduce impervious surfaces in your jurisdiction to reduce pollutants entering your local waterways. Use these EPA resources to get started:

- The Green Infrastructure Municipal Handbook
- Enhancing Sustainable Communities With Green Infrastructure
- Local Water Policy Innovation: A Road Map for Community Based Stormwater Solutions

Plant trees and preserve forested areas. Trees provide many community and ecosystem benefits.

Invest in environmental education and projects within your school systems to provide dividends in citizen stewardship, community health, and clean water protections.

- EPA provides $2 to $3.5 million in environmental education grant funding each year. Learn more here.

Lead your community to achieve environmental and local government goals by exploring technical and funding resources like grants from the National Fish and Wildlife Foundation, EPA, and your state.

Share this information with others to create an even stronger, more resilient community.

To Learn More

- US EPA's How's My Waterway
  - Look up the condition of your local waterways and what challenges they face
- Video Series: Chesapeake Bay Program's Bay 101
  - Learn more about topics ranging from invasive insects to wastewater treatment in bite-sized video clips
- NOAA's Chesapeake Bay Ecosystem Atlas
  - Learn about the history and current dynamics of the system with this free, interactive iBook that includes in-depth classroom curricula for middle and high school teachers
- Alliance for the Chesapeake Bay's RiverWise Communities Manual
  - Motivate people to adopt and maintain environmentally friendly practices on their own properties and in their communities
- Stroud Water Research Center's Model My Watershed
  - Learn about how different conservation or development scenarios could modify your local runoff and water quality with an interactive modeling tool

Glossary

- Watershed

  An area of land that drains into a particular river, lake or other body of water

- Transpiration

  The release of water vapor from plant leaves

- Runoff

  Precipitation that does not evaporate or soak into the ground but instead runs across the land and into the nearest waterway

- Impervious Surfaces

  Paved or hardened surfaces that do not allow water to pass through (e.g., roads, rooftops, sidewalks, pools, patios, and parking lots)

- Algae

  Simple aquatic plants that can be single-celled or grow in clumps or slimy mats

- Estuary

  A partially enclosed body of water where fresh water from rivers and streams mixes with salt water from the ocean (also called bays, harbors, inlets, or sounds)

- Salinity

  Amount of dissolved salt in water; the ocean has more salt, and therefore a higher salinity, than a river.

- Grey Infrastructure

  The traditional, manmade structures that collect water before releasing it into rivers and streams, including pipes, reservoirs, and treatment plants

- Green Infrastructure

  Nature-based solutions that use soil and vegetation to help slow the flow of runoff and manage rainwater where it falls

- Aquaponics

  A combination of growing fish and plants in recirculating water