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Lake Champlain Basin Program

AHEAD OF THE STORM
lewiscreek.org
Stormwater Resilience Demonstration Site

Ahead of the Storm
Education and Outreach

Introduction to Watershed Science, Stormwater, and Resiliency

Presented By: Jessica Louisos, MS, PE





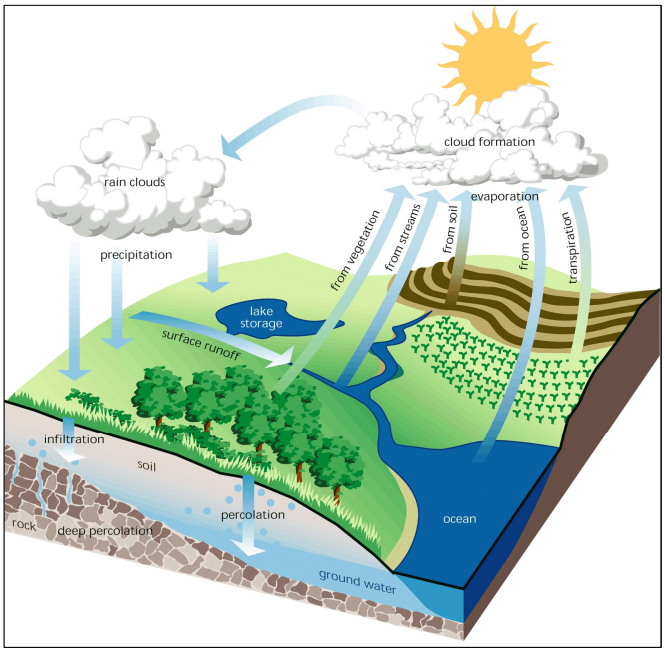
Funded by the Lake Champlain Basin Program - L-2019-032 EO AOTS Project

Overview

- Learn about:
  - Stormwater Runoff
  - Water Quality
  - Preparing for Extreme Storms
  - Weather versus Climate
  - Flood Resiliency
- Complete:
  - Watershed Activity

There will be a second session focused on site assessment and design

The Watershed



(FISRWG, 1998)

A watershed is an area of land that flows to a common body of water like a stream, river, lake, or ocean.

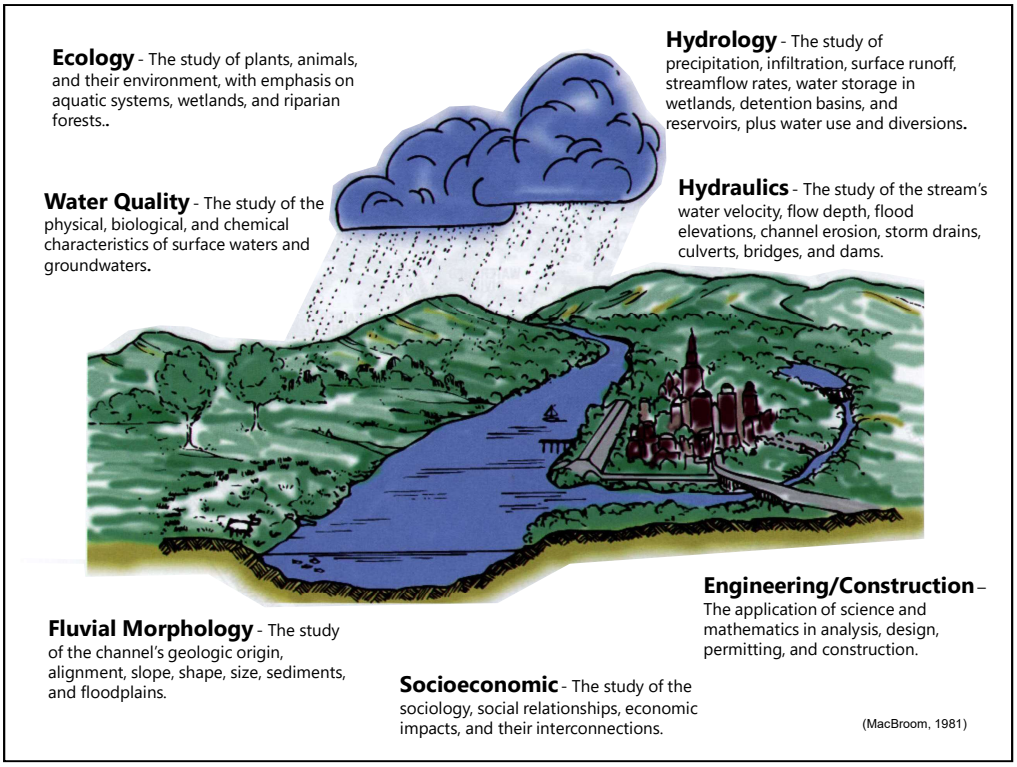
Who lives in a watershed?

The Lake Champlain Watershed

A watershed is an area of land that flows to a common body of water like a stream, river, lake, or ocean.

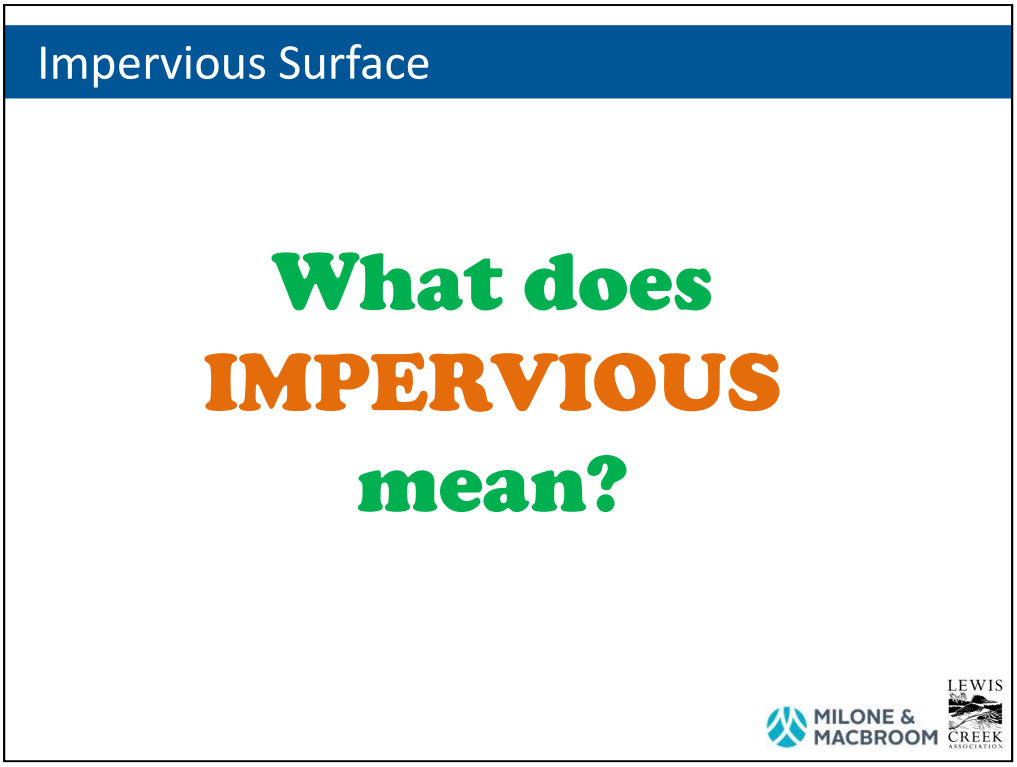
It can be large like the Lake Champlain Watershed- 8,000 square miles or

Very small like the watershed draining to a very small pond.



What types of people's jobs might work with watersheds?

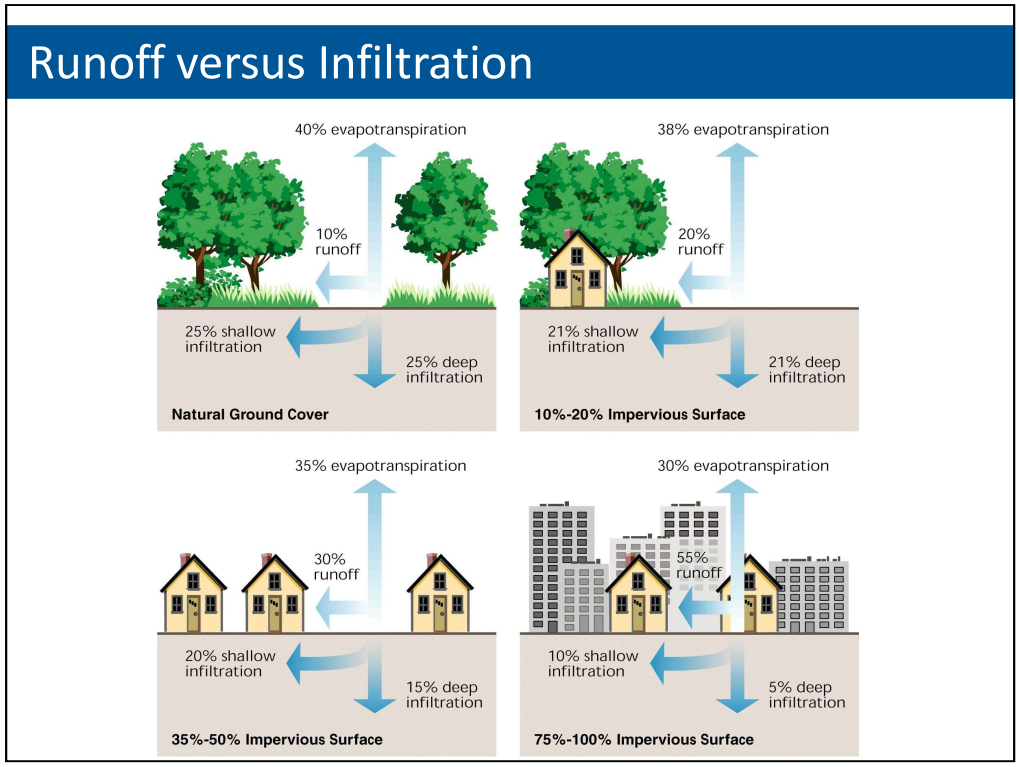
Here are a few- many different types of scientists and engineers.



Does not allow fluids to pass through

In the case of rain – it hits it and can't get through, so it runs off and becomes stormwater runoff

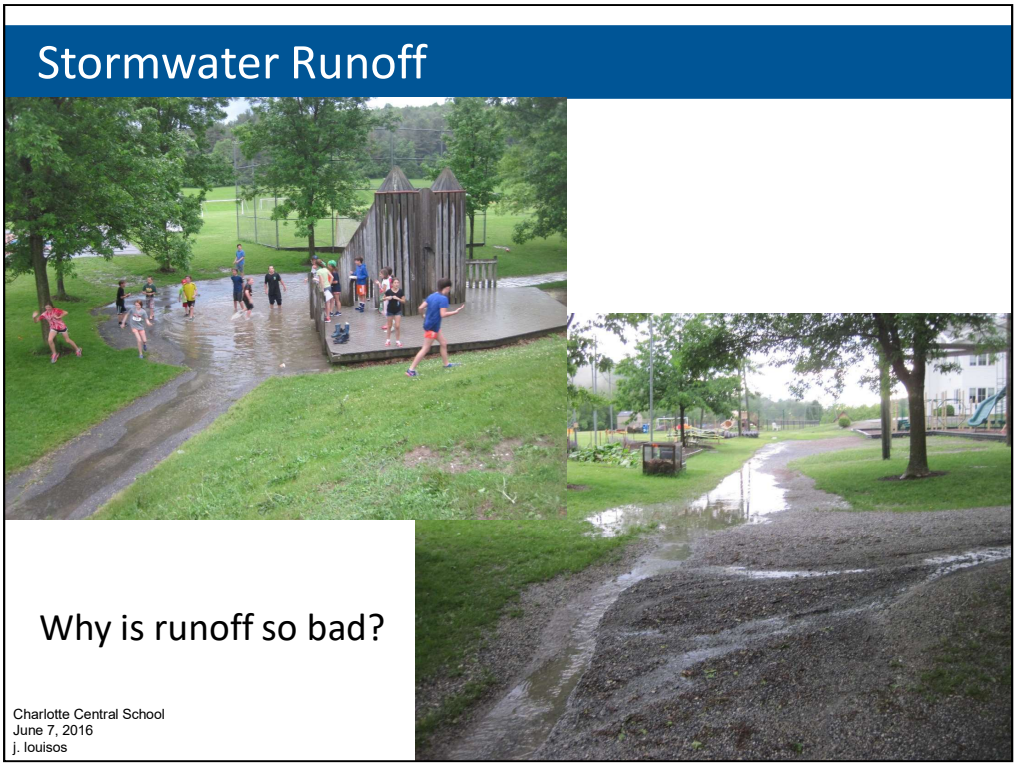
What are examples? – pavement, parking lots, streets, buildings, sidewalks, gravel, other compacted areas



Pervious surfaces like plants and healthy soils help water infiltrate (seep) into the soils and reduce runoff.

Runoff from surfaces can pick up pollutants and transport them to downstream waters.

The pollution can impact aquatic ecosystems.



Stormwater Runoff is rain that hits the ground and can't infiltrate so it runs along the ground surface.

Why is that so bad?

As it goes it collects dirt or other pollutants on the ground and carry's them to the next downstream waterbody.

We removed natures resiliency tactics

Brainstorm what Pollutants are in Stormwater

POLLUTANT TYPES:
Litter
Sediment
Bacteria
Nutrients
Pesticides
Heavy Metals
Salt

Area	***Potential Pollutants***
Example: Forest	• *Excessive* ***sediment*** *may be present if the area has a lot of exposed roots and dirt* • ***Nutrients*** *would be bound to sediment and travel in stormwater* • *Potentially:* ***litter*** *if there are hiking trails or a roadway nearby where litter could have been left*
Meadow	
Fertilized Lawn	
Parking Lot	
Dog Park	
Roof	
Road	

Lake Champlain Basin Program Stormwater Curriculum, 2019

Start activity from SeaGrant SW Curriculum Section 1B – "What types of pollutants might be in stormwater?"

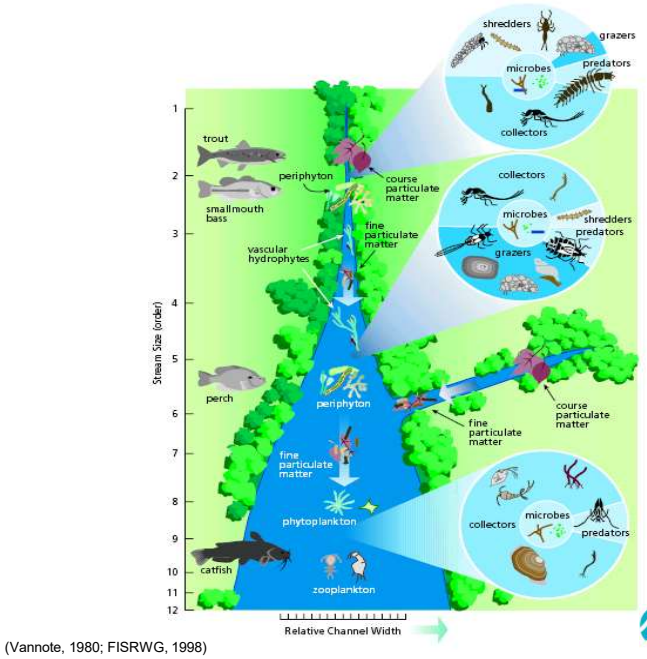
For each area identify the types of pollutants that could potentially be found in stormwater runoff from each of these places

10 minutes alone, then 5 minutes to discuss with a partner

Review as a class

By understanding pollutants we can better prevent them from getting to our waterways

Rivers are Ecosystems



(Vannote, 1980; FISRWG, 1998)

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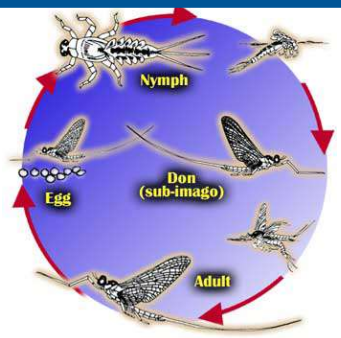
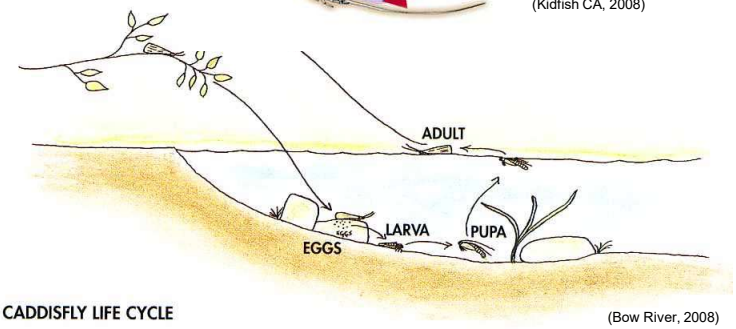
Rivers are ecosystems that support all levels of life.

Need good water quality to live.

Rivers are Homes



(Kidfish CA, 2008)



(Bow River, 2008)

All life stages from eggs to adults need to be able to survive.

We think about fish, but it is the insects and lower food chain that limit these populations.

Need healthy riparian vegetation, proper temps, proper substrate.

Does anyone know what is tested during water quality monitoring?

Volunteers complete it

Why would we want to have this data? – to understand the problems and guide how to fix them

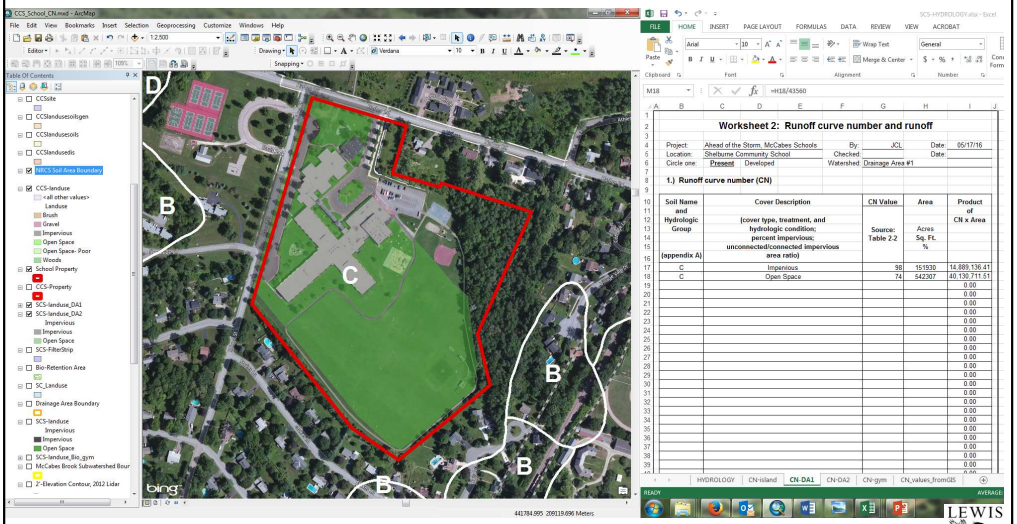
Phosphorus, Chloride, E.Coli, Solids, Nitrogen

Water Quality Measurements are done by volunteers to sample for specific nutrients and pollutants

The state also does bio-monitoring to evaluate fish and macroinvertebrate species present.

Hydrology - Calculate Runoff Volume

Landuse, Soil Type, Drainage Area, Flow Path Length, Precipitation

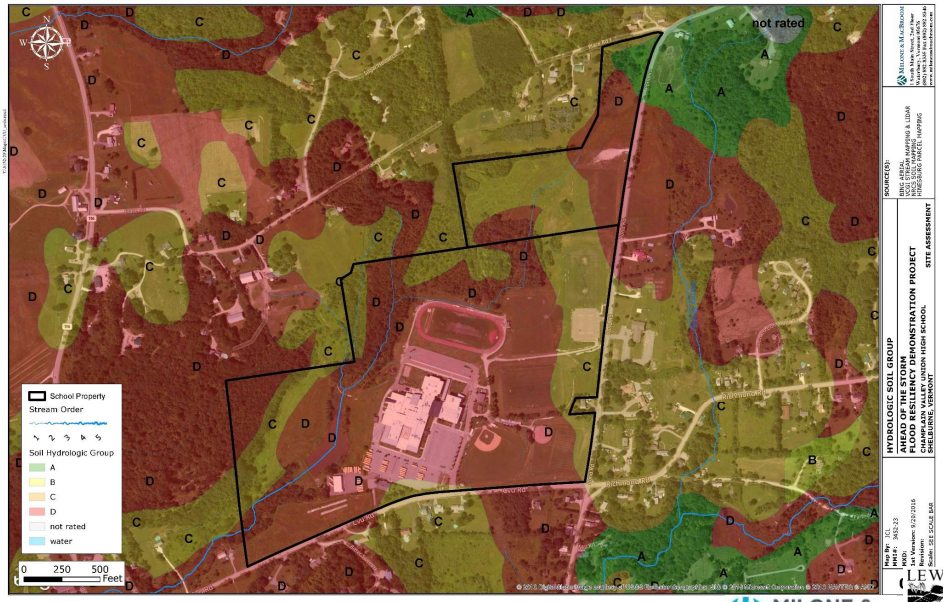


There are a lot of different factors that go into calculating how much stormwater runoff there is

Including how much rain

We will get into this in detail later

Hydrology - Soils

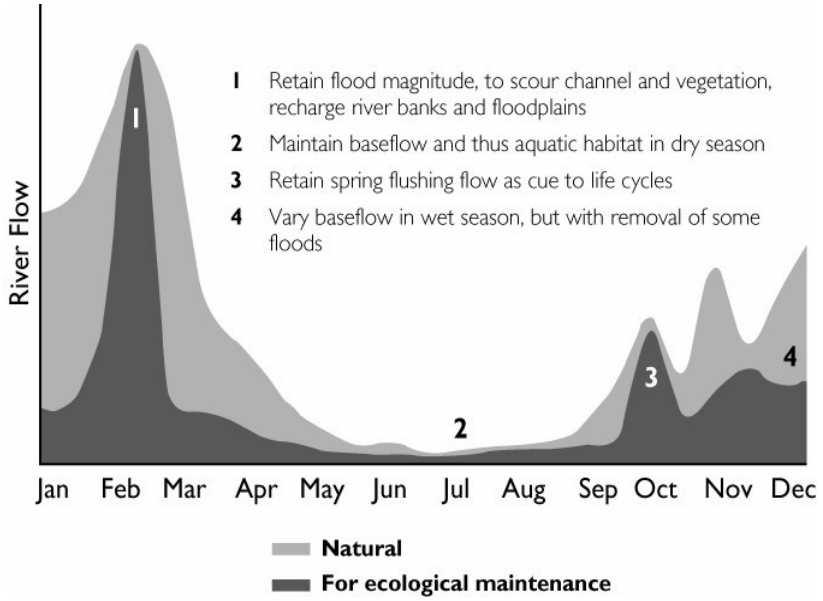


Areas with different soils have naturally different infiltration rates.

Sandy- water sinks in like at the beach

Clay – water sits on the surface or runs off – wetlands are usually clay soils

Hydrology

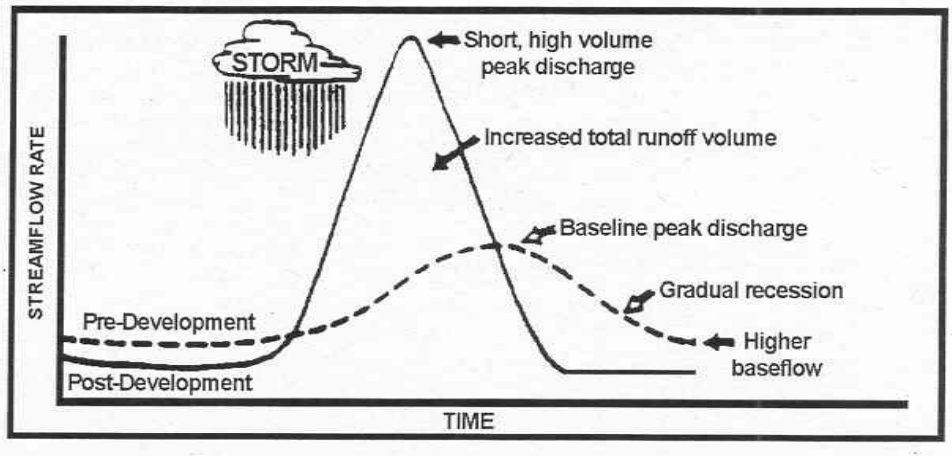


(Richter et al., 1997)

Hydrologic range of variability.

Altered by watershed activities. Clearing, snow-making, urbanization, etc.

Unnatural Hydrology



Source: EPA, 1997

Vertical – Stream Flow

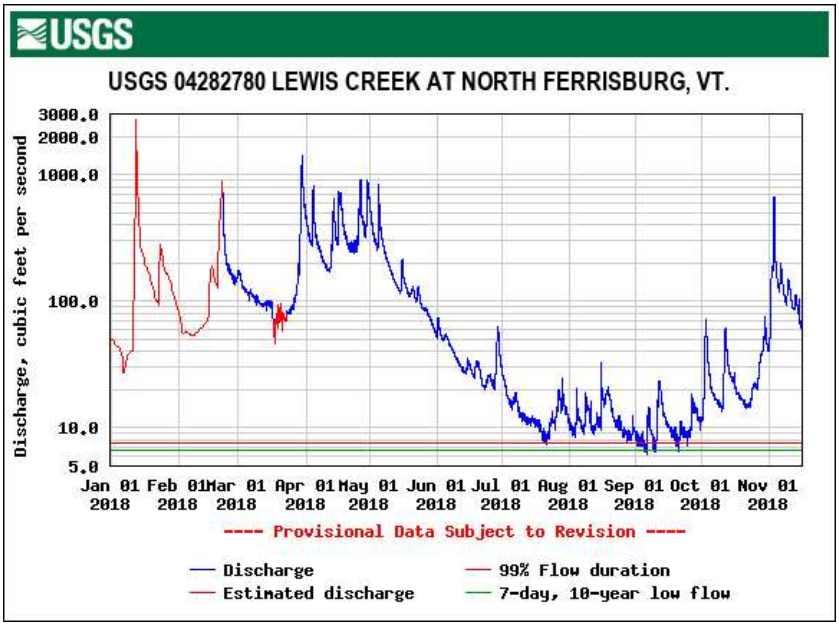
Horizonatal – time

One storm

Peak is higher and earlier

More water getting to streams faster

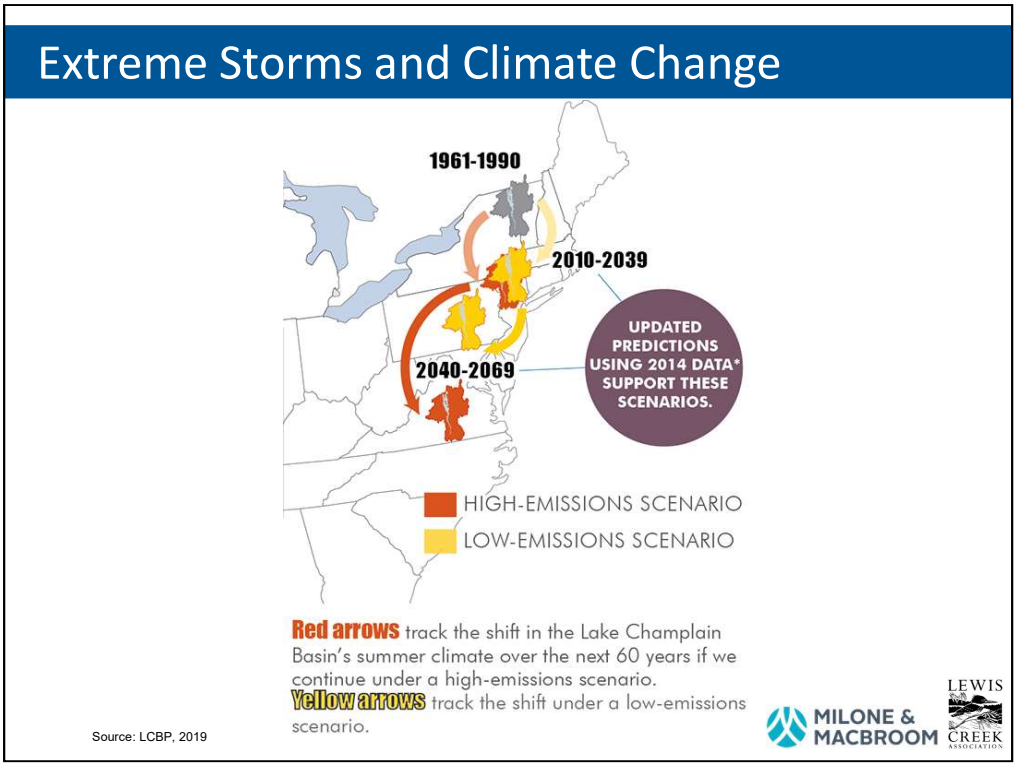
Measured Stream Flows



USGS 04282780 LEWIS CREEK AT NORTH FERRISBURG, VT

Station operated in cooperation with the Lake Champlain Basin Program.
77 SM, 28 years,

Key data, Need more gauges

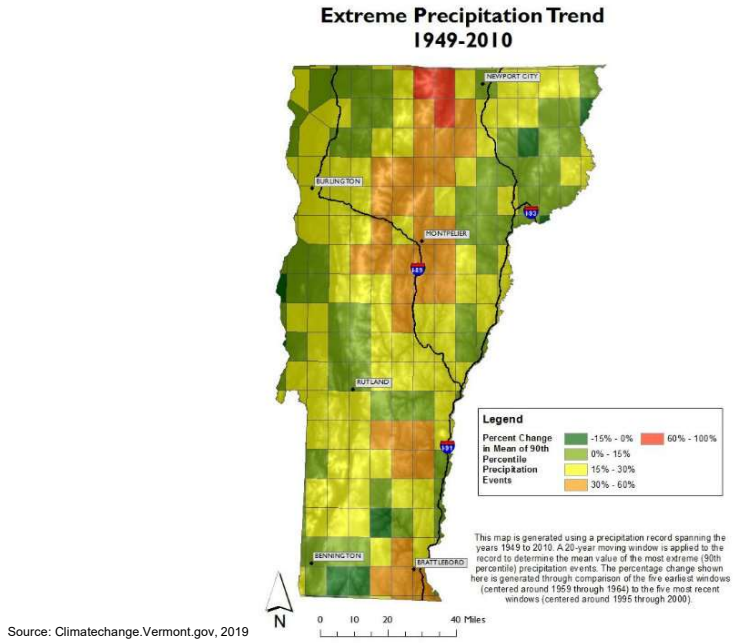


HOTTER- National Academy of Sciences determined earths surface has risen 1 degree F in last century with acceleration in last two decades

Lake Champlain freezes over less frequently

Attributable to human activities

Extreme Storms and Climate Change



Source: Climatechange.Vermont.gov, 2019

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WETTER-

Larger storms

Extreme storms are more frequent storms – flooding happens more often

More extremes – including more drought

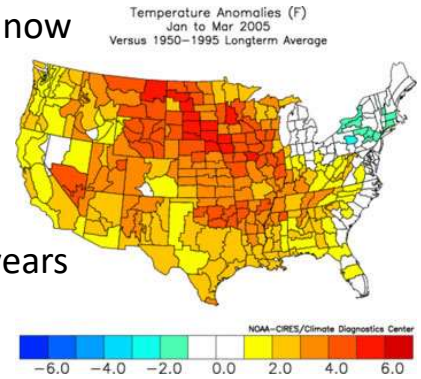
Weather versus Climate

Weather

- Day-to-Day
- Short term state of conditions
- Snapshot of what is going on now
- Temperature, Humidity, Precipitation, Cloud Cover, Visibility, Wind, Pressure

Climate

- Average of weather over 30 years or more
- Big trends



NOAA

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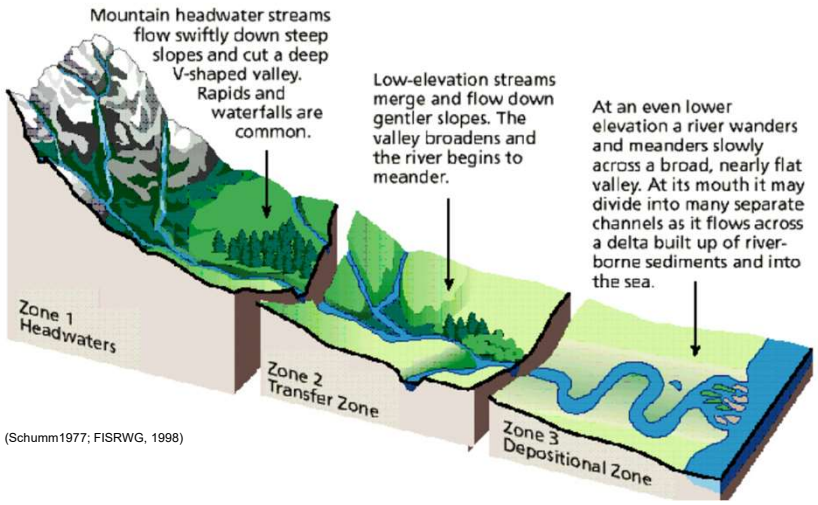
Climate is like the entire football season – preseason through superbowl

Weather is like one or two plays within a game

The planet is warming over a long time, but that doesn't mean we will not have a cold day in winter.

The Valley and River Process



(Schumm1977; FISRWG, 1998)

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What is a river?

Potential to kinetic energy to move water, sediment and woody debris from upland to lowland.

Form and process.

Studies have shown that headwater conditions often dictate water quality, physical features, and biology downstream. Wood and sediment inputs are essential.

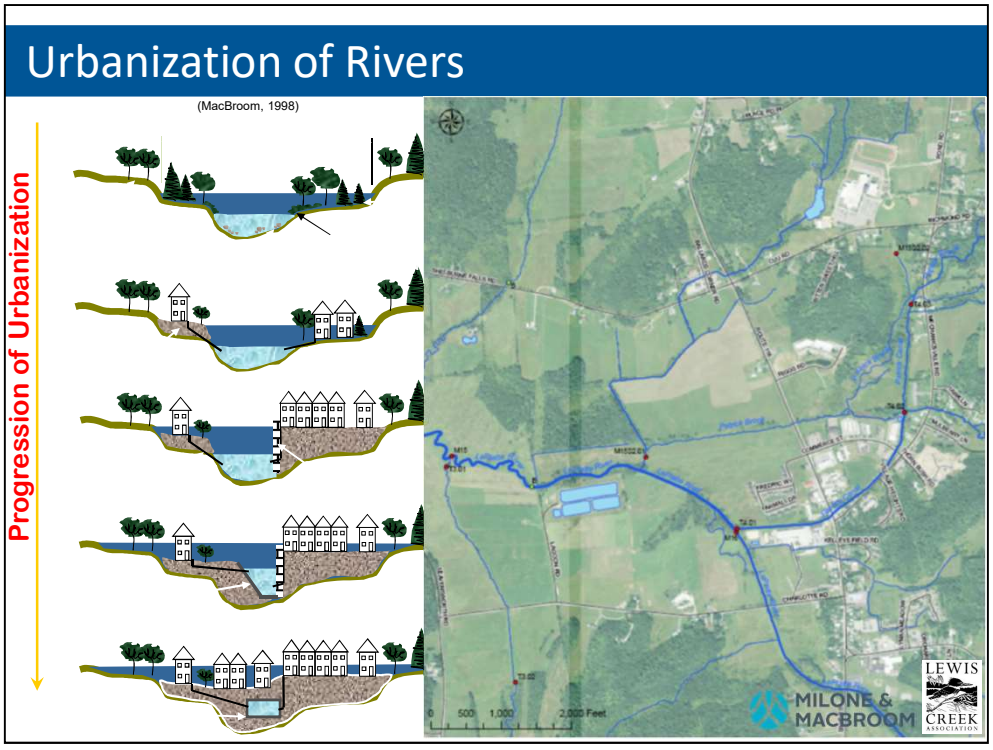
Urban rivers reduce the potential to have natural form and process and thus rivers are often managed.

You can see how this has happened over time in Hinesburg

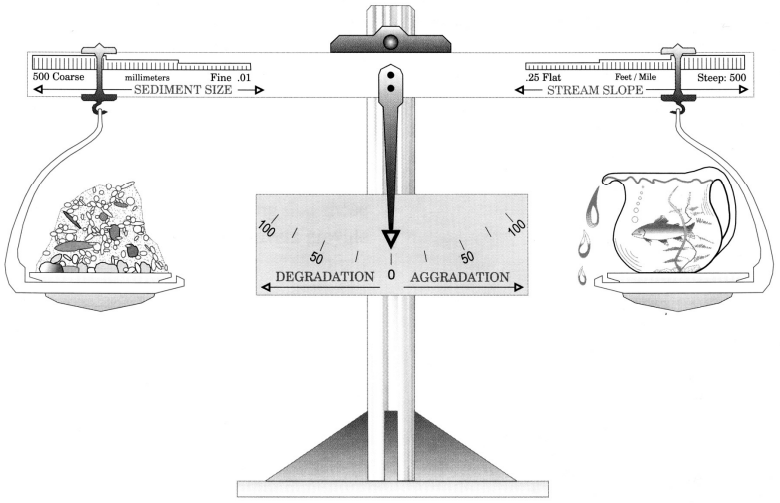
Rivers are not typically straight, do not usually make right angle turns around field edges

The canal rerouted a channel

Development pushed streams aside



Unbalanced Rivers



(Sediment LOAD) x (Sediment SIZE) ≍ (Stream SLOPE) x (Stream DISCHARGE)

Source: Lane, 1955; Rosgen and Silvey, 1996

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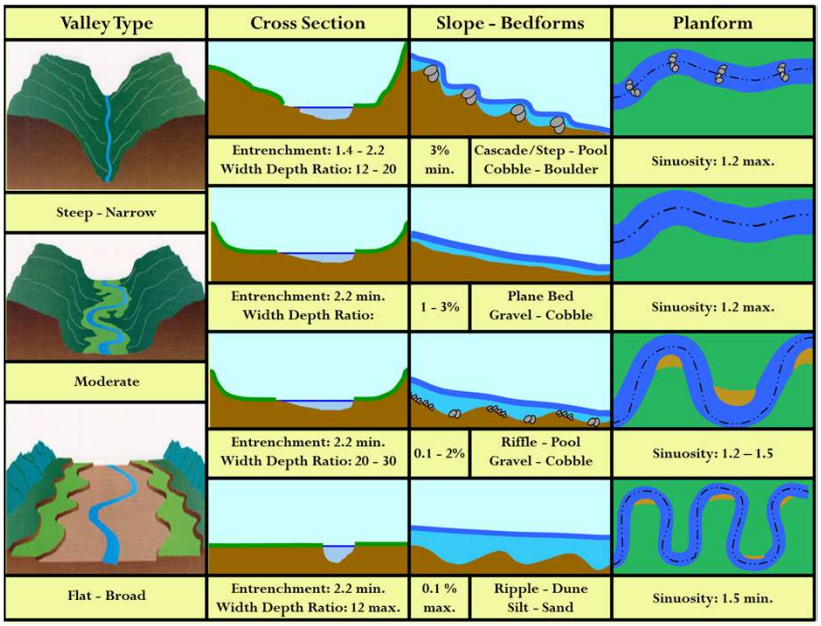
When we add more water the balance is off

It increases the water power and leads to erosion

Fluvial Geomorphology



(ANR, 2017)

A river's form and process – what it looks like and how it acts

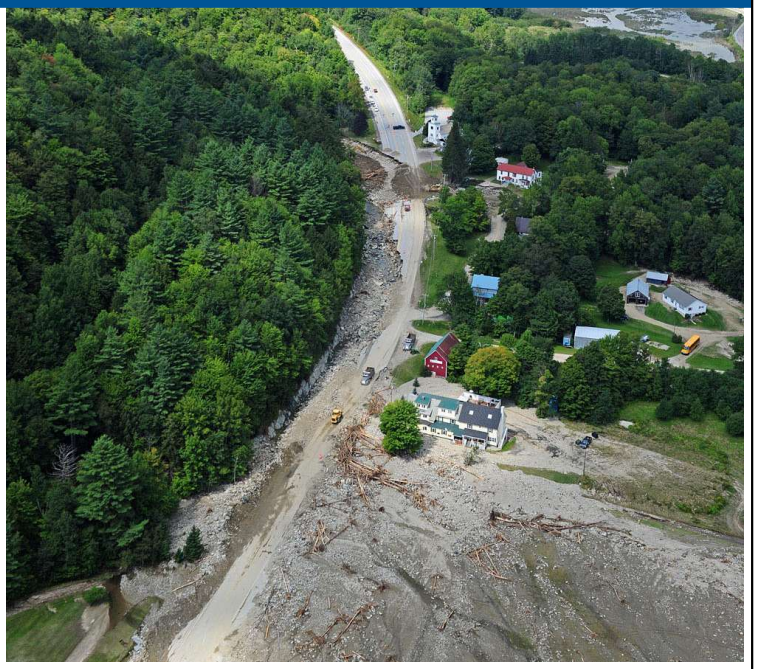
Morphology is determined by valley setting.

When we add extra water from runoff or climate change, it changes how rivers act and move

This can cause erosion or flooding

It can damage property as it trys to regain its balance again

Flood Resiliency

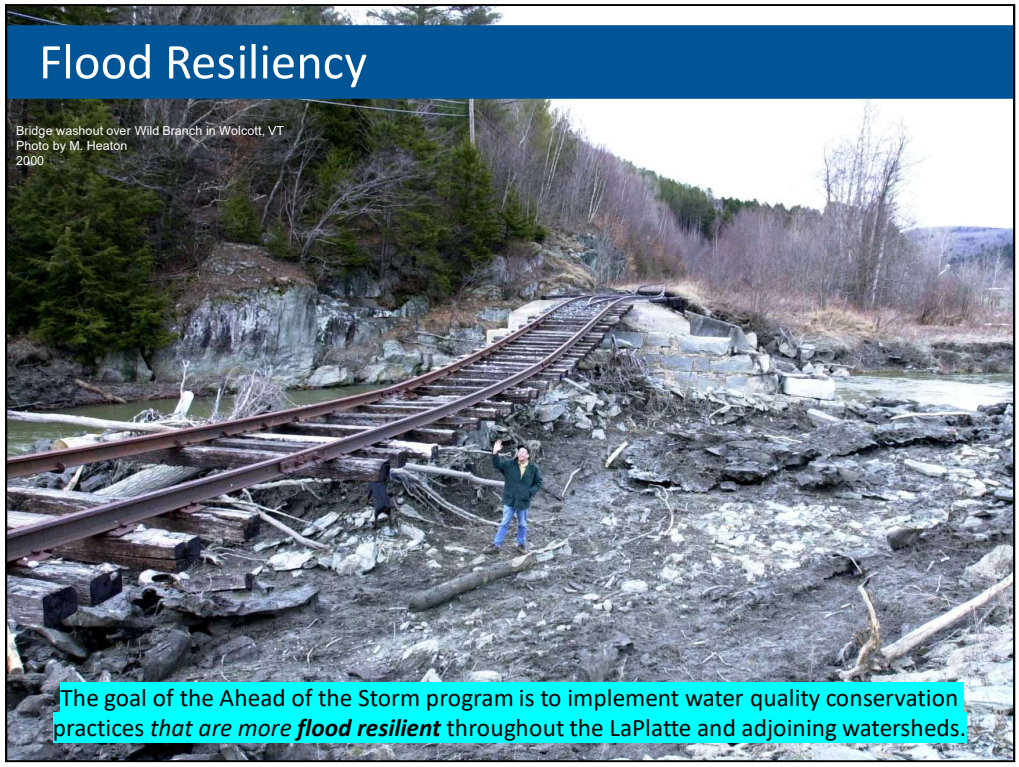


Roaring Brook
US Route 4 in Killington, VT
Photo by Lars Gange &
Mansfield Heliflight, August
31, 2011)

You can imagine the water from a river flooding a home or downtown, but what people don't always think about is the rocks, trees, and other debris that the water carries with it.

Rivers can be so powerful that they wash out roads

And carry tons and tons of sediment that can clog bridges and culverts and bury homes.

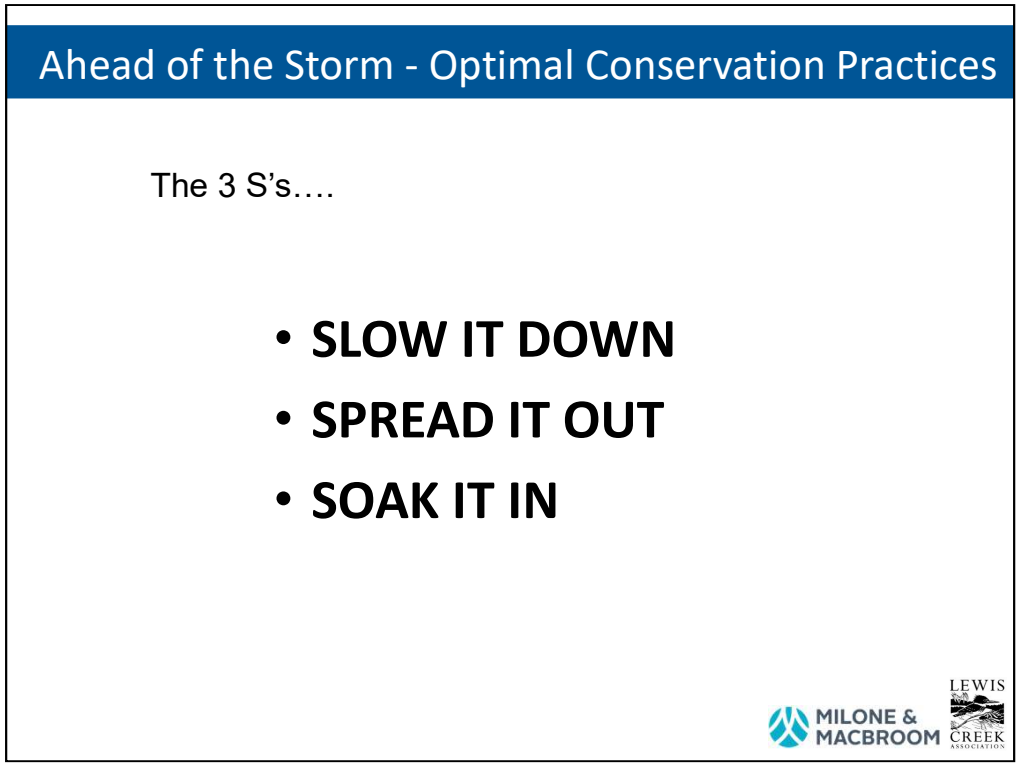


River erosion and flooding are hazards.

Does anyone know anyone who's home flooded? Road flooded? A spot with erosion?

We need to prepare for extreme weather and climate change.

Resilient designs will help.

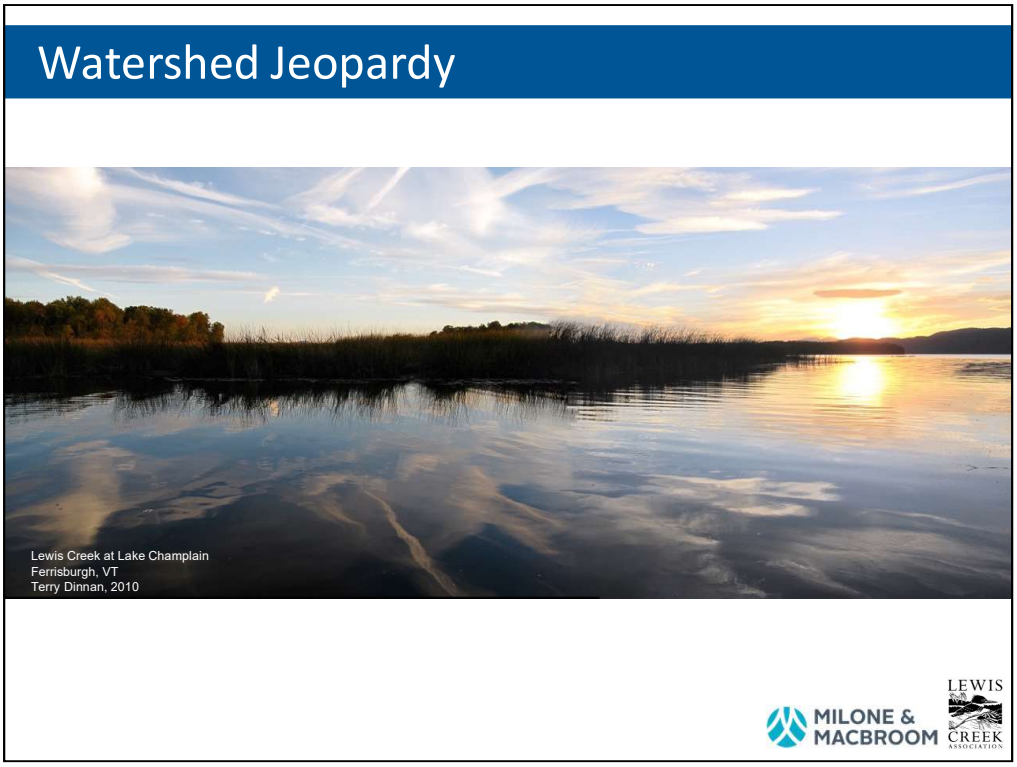


To be more flood resilient we can take steps to reduce the amount of runoff and therefore the amount of water in our rivers.

Our goal is to identify locations where water is collected and concentrated or where dirty water is running off impervious surface.

Once identified we will want to consider ways to Slow, Spread, and Soak.

Next time we get together we will learn more about how that can be done.



Describe Watershed Jeopardy

Describe “rain” activity - straws, aluminium foil, moss, cardboard, etc and had the students build a replica of their school, then I came around with a squirt bottle and "made it rain" and we watched and discussed where the water went. We ended with a discussion on what could be done on the school campus to slow, soak, spread water.

or a discussion with teachers about how they think some of this material could be taught at their age groups.