

PRINTABLE STUDY GUIDE



This study guide includes:

A notetaking sheet



to help you take notes on the main ideas you want to show in your poster

Core concepts



what you need to know to answer the research questions for your poster. No need to cover all of it in your poster – just what you think are the most important things and what’s most interesting to you!

A glossary



to help you understand new terms and definitions about conservation

Notes

Why are healthy soil and water important and how do they affect you?

What are the main problems affecting soil and water health?

How can we protect soil and water for now and our future?

What is Soil?

Soils are complex mixtures of minerals, water, air, organic matter, and countless organisms that are the decaying remains of once-living things. It forms at the surface of land - it is the “skin of the earth.” Soil is capable of supporting plant life and is vital to life on earth. Soil, as formally defined in the Soil Science Society of America Glossary of Soil Science Terms, is:

1. The unconsolidated mineral or organic material on the immediate surface of the earth that serves as a natural medium for the growth of land plants.
2. The unconsolidated mineral or organic matter on the surface of the earth that has been subjected to and shows effects of genetic and environmental factors of: climate (including water and temperature effects), and macro- and microorganisms, conditioned by relief, acting on parent material over a period of time.

So then, what is dirt? Dirt is what gets on our clothes or under our fingernails. It is soil that is out of place in our world - whether tracked inside by shoes or on our clothes. Dirt is also soil that has lost the characteristics that give it the ability to support life - it is “dead.”

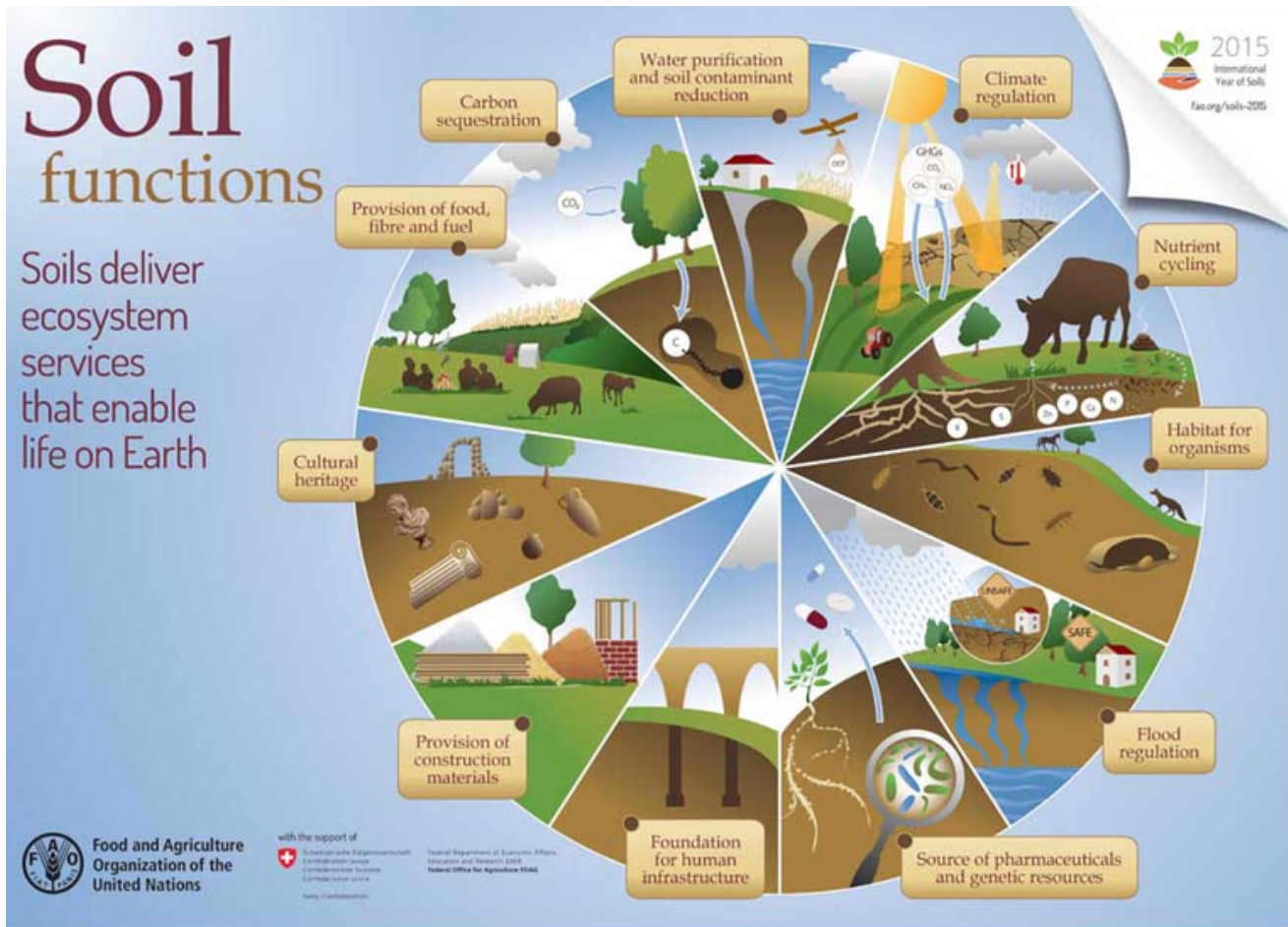
Soil performs many critical functions in almost any ecosystem (whether a farm, forest, prairie, marsh, or suburban watershed). There are seven general roles that soils play:

1. Soils serve as media for growth of all kinds of plants.
2. Soils modify the atmosphere by emitting and absorbing gases (carbon dioxide, methane, water vapor, and the like) and dust.
3. Soils provide habitat for animals that live in the soil (such as groundhogs and mice) to organisms (such as bacteria and fungi), that account for most of the living things on Earth.
4. Soils absorb, hold, release, alter, and purify most of the water in terrestrial systems.
5. Soils process recycled nutrients, including carbon, so that living things can use them over and over again.
6. Soils serve as engineering media for construction of foundations, roadbeds, dams and buildings, and preserve or destroy artifacts of human endeavors.
7. Soils act as a living filter to clean water before it moves into an aquifer.



Soil Science Society of America

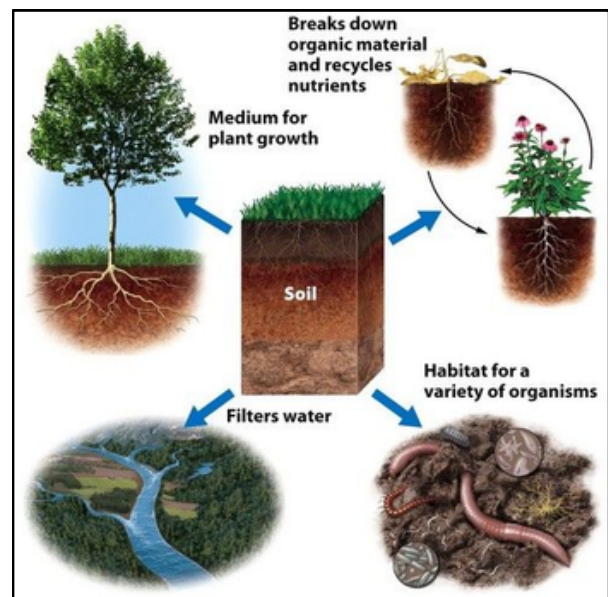
What Soil Does for Us



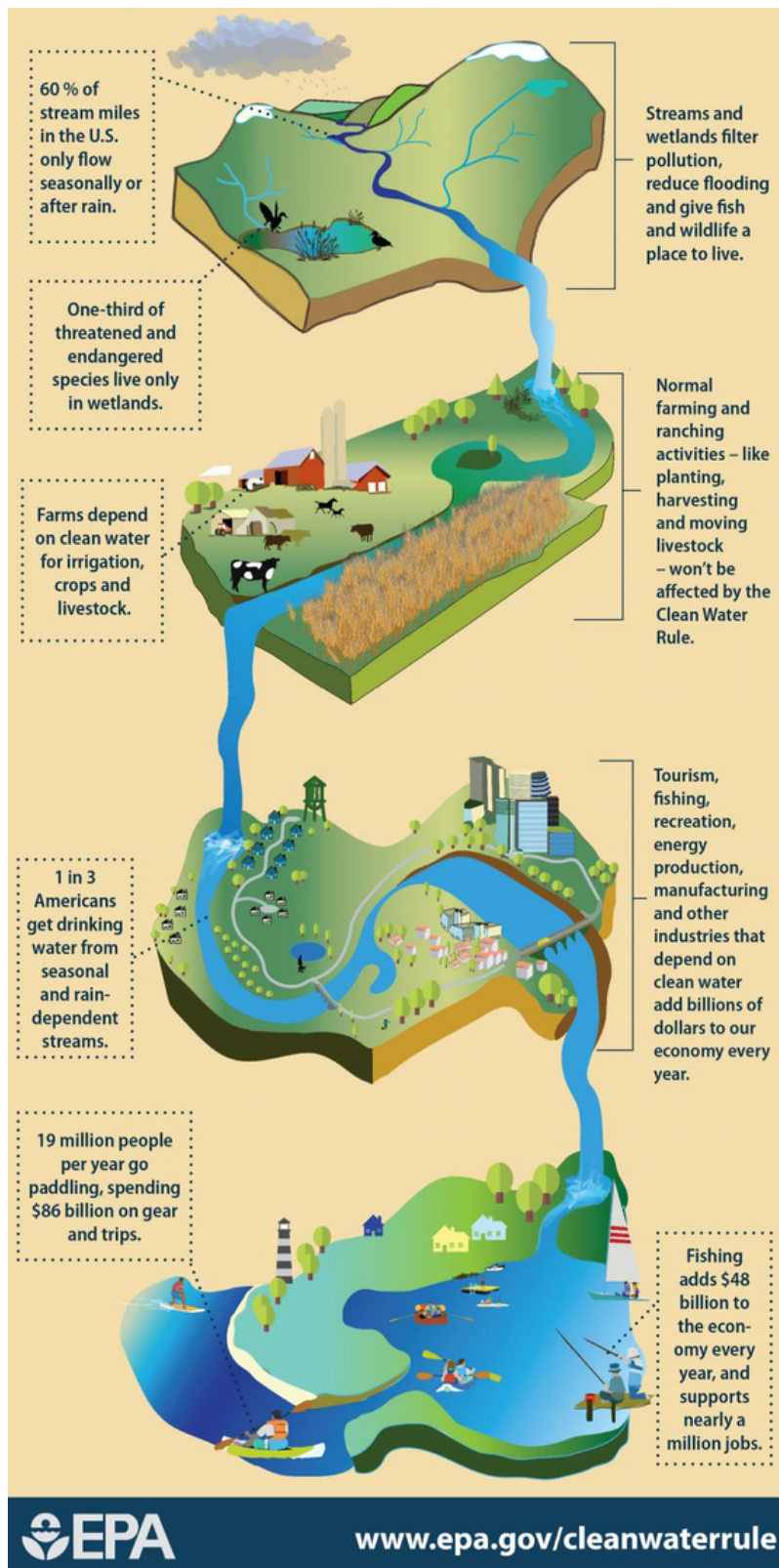
- Soils are critical for the health of our planet
- They are key in the carbon cycle, helping to regulate climate
- They store and filter water, helping to moderate floods and droughts
- They provide nutrients and water to grow food
- Soils support a large and diverse biological community

CEH Centre for Ecology & Hydrology
 NATURAL ENVIRONMENT RESEARCH COUNCIL

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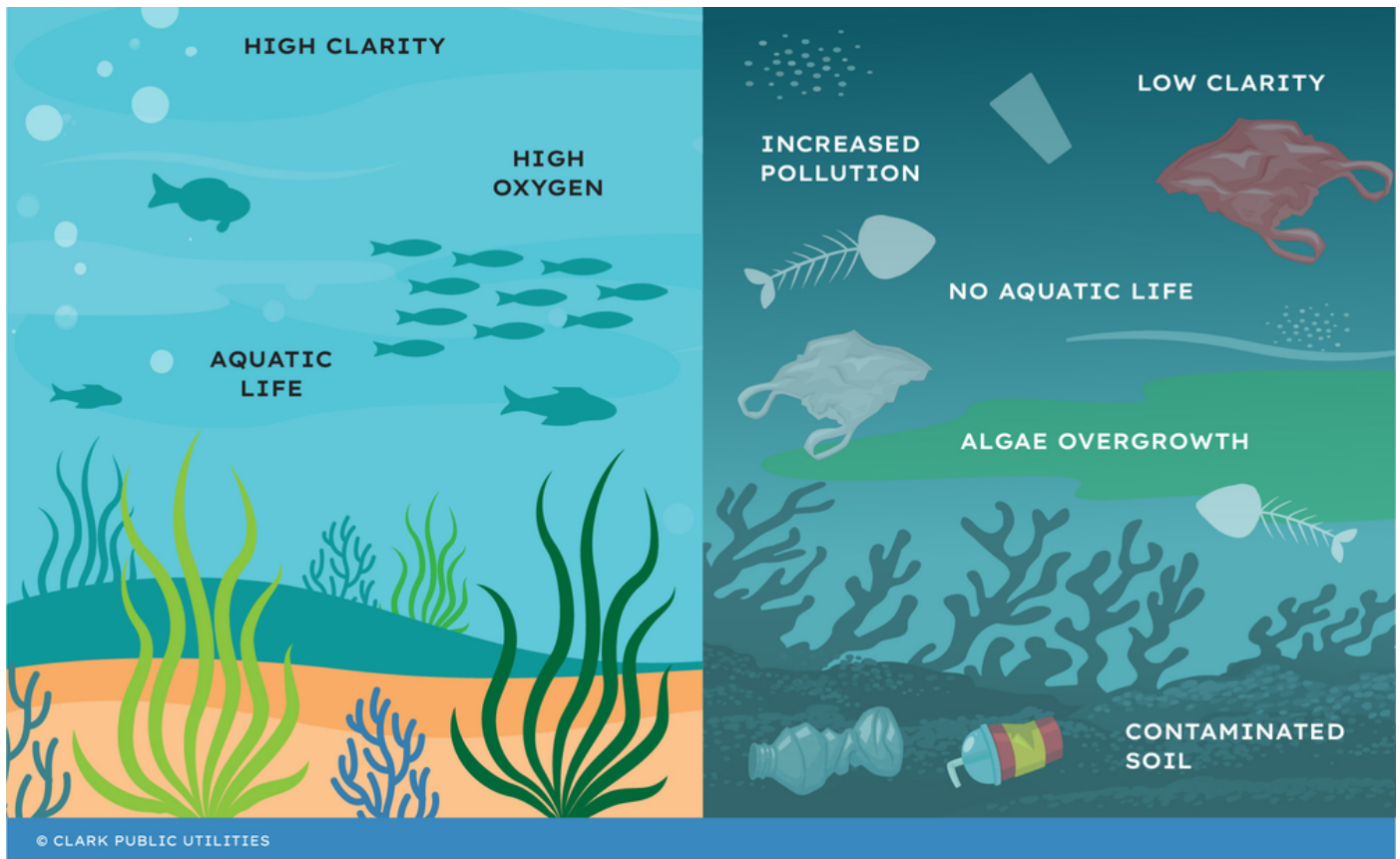


Why Clean Water is Important



Water Quality

Water pollution affects the plants and animals that live in aquatic habitats like streams, ponds, and lakes. When they get sick and die, it's a sign that something is wrong.



Most of our drinking water comes from lakes and rivers, so when the water has chemicals, mud, trash, bad germs, and other types of pollution, we have to remove them in order to drink the water. This takes time, energy, and money to do!

It's much better if we stop the pollution from getting into the water in the first place.

Problems Affecting Soil Health

Erosion

Erosion is the movement of soil due to wind or water. In North Carolina, erosion because of water is the main problem.



Erosion causes soil to move away from farm fields, our gardens, yards, and other areas where we need healthy soil. On farms, when we lose soil plants don't grow as well and we don't get as much food.



Erosion happens naturally when it rains and water flows downhill into creeks, rivers, and the ocean.

But there are some things that people do that make this worse...

Deforestation, Mining, and Construction



Logging has removed all the trees from these slopes. This leaves the soil bare. Runoff can rush downhill and wash away the soil.



Monster trucks are dwarfed by this huge open-pit iron mine. Soil was stripped from the ground, layer by layer, to remove the iron ore.



Earth-moving equipment prepares a site for construction. The soil is pushed aside and the land is left bare. Some of the soil blows away even as the machine moves it.



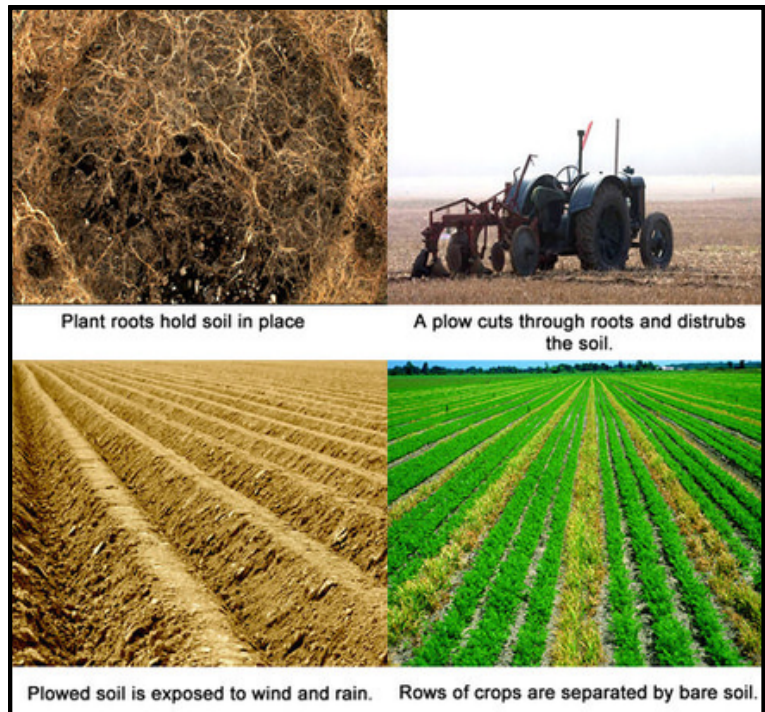
Parking lots and other paved surfaces don't allow rain to soak into the ground. This creates greater runoff and erosion.

Problems Affecting Soil Health

Farming Practices:

Plowing (also called **tilling**) damages plant roots that hold soil in place.

Any soil that is uncovered by plants can erode away when it rains. Leaving fields bare in the winter can cause more erosion.



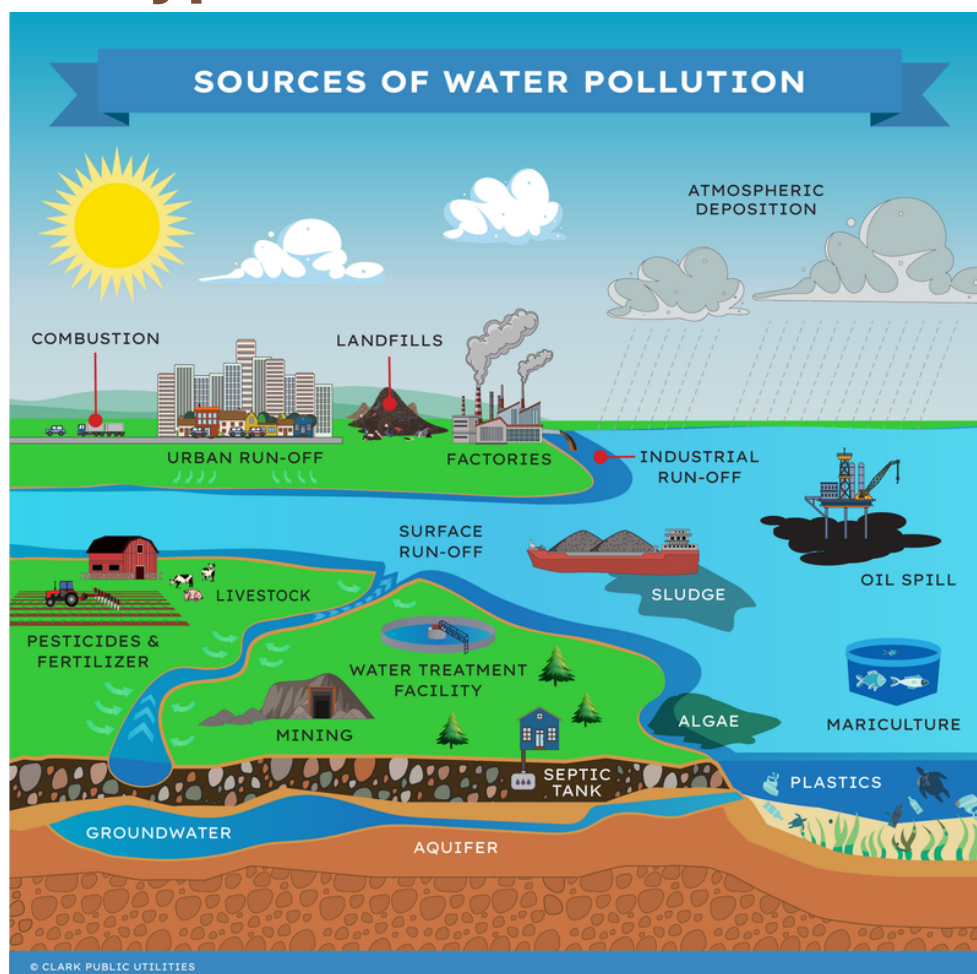
Grazing animals like cows, horses, and goats eat lots of grass and can kill it if they stay in one field for too long. They need lots of space. When they are packed closely together, they also stomp on the ground and make the soil hard (called **compaction**), which makes it harder for plants to grow in it.



When we grow only one plant in a field for a long time (called **monoculture** agriculture), certain nutrients in the soil get used up but are not added back. This is why having a variety of plants in soil is important.



Types of Water Pollution



Three types of water pollution

There are many types of water pollution in the world. Here in the Pacific Northwest, the most common types of water pollution we face are:

 Agriculture Agriculture, which includes farming and livestock production, consumes a huge amount of water and is a major contributor to water pollution. This happens because farms use fertilizers and pesticides (and livestock facilities generate animal waste). When it rains, those substances – along with nutrients, bacteria, and viruses – can then flow into our water sources.	 Wastewater Used water from homes, businesses, and industry can contain metals, solvents, sewage, and more. This category of pollution also includes stormwater runoff, which occurs when rain carries oil, chemicals, and salt from roadways into waterways. Globally, much of wastewater returns, untreated, to the environment.	 Stormwater Runoff Stormwater is precipitation that falls on roads, parking lots, roofs and other impervious surfaces and runs off into streams, rivers and lakes. As it drains it picks up pollutants such as oil, pesticides, fertilizer, heavy metals and trash. Untreated stormwater can make our waterways unsafe for humans and other animals.
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Source: PowerZone, Clark Public Utilities

Problems Affecting Water Health

Sediment Pollution:

- When soil gets into rivers and lakes, it is called sediment pollution. This type of pollution is very bad because it clogs fish gills, smothers eggs, kills plants, helps bad bacteria grow, and can kill fish and other animals.



Toxic Pollution:

- The chemicals we put on our crops go with the soil when it rains and harm the plants and animals in the lakes and rivers.
- Chemicals can also come from our lawns, cars, factories, and houses



Livestock Farms:

When we allow our farm animals to go into rivers and lakes, the animals cause the soil to erode at the banks and also use the bathroom in it. This harms the water quality!



Farm fields:

When farm fields have bare soil or areas where rows go downhill, soil gets washed into rivers and lakes.



How to Protect Soil and Water

There are many different strategies that water quality specialists have figured out work best for keeping watersheds healthy. These strategies are called “best management practices” (BMPs), and there are different ones for city areas and farm areas.

Farm BMPs:

Soil and Water Conservation Districts help farmers keep their soil healthy and stop water pollution, and there are many BMPs that help with this!

Four important farmland BMPs that protect watersheds are:

1. Cover crops
2. Grassed waterways
3. Filter strips
4. Livestock exclusion fencing



Cover Crops

A cover crop is a crop that is planted the fall after the summer crop is harvested, and keeps the field covered during the winter. This helps prevent erosion as plants slow down water, absorb it into their roots, and help water seep into the soil rather than eroding the soil. Cover crops are great at returning nutrients to the soil, which keeps the soil healthy!



Bare soil



Covered soil



Grassed Waterways

A grassed waterway is a pathway planted with grass that helps move water off of farm fields in a way that slows the water down and prevents erosion into waterways.



A grassed waterway between fields

Farm BMPs:

Livestock Exclusion Fencing

A fence that keeps cows, horses, goats, and other livestock animals out of waterways. This helps to stop erosion and pollution from the animals' feces, which can cause algae blooms and diseases that can harm wildlife and the livestock animals.



Filter Strips

Filter strips, also called **buffer strips**, are planted areas along the edges of ponds, lakes, and other waterways. They act as barriers to slow down the water coming from farm fields and remove sediment and pollutants from the water. Filter strips protect water quality and also provide habitat for wildlife!

One important type of filter strip is a **riparian buffer**, which is an area planted on the edges of rivers with thick vegetation of trees and shrubs.



Filter strip bordering a field



Riparian buffer near a farm

City BMPs:

Cities and towns (**urban areas**) have a lot of impervious surfaces where water can't reach the soil – it runs off of those surfaces instead, causing flooding, erosion, and the spread of pollution. While paved surfaces are helpful for our cars and for moving around easily, they're not great for water quality! But there are many things we can do in cities to help water slow down and get into the ground.



A few important BMPs that work well around cities are:

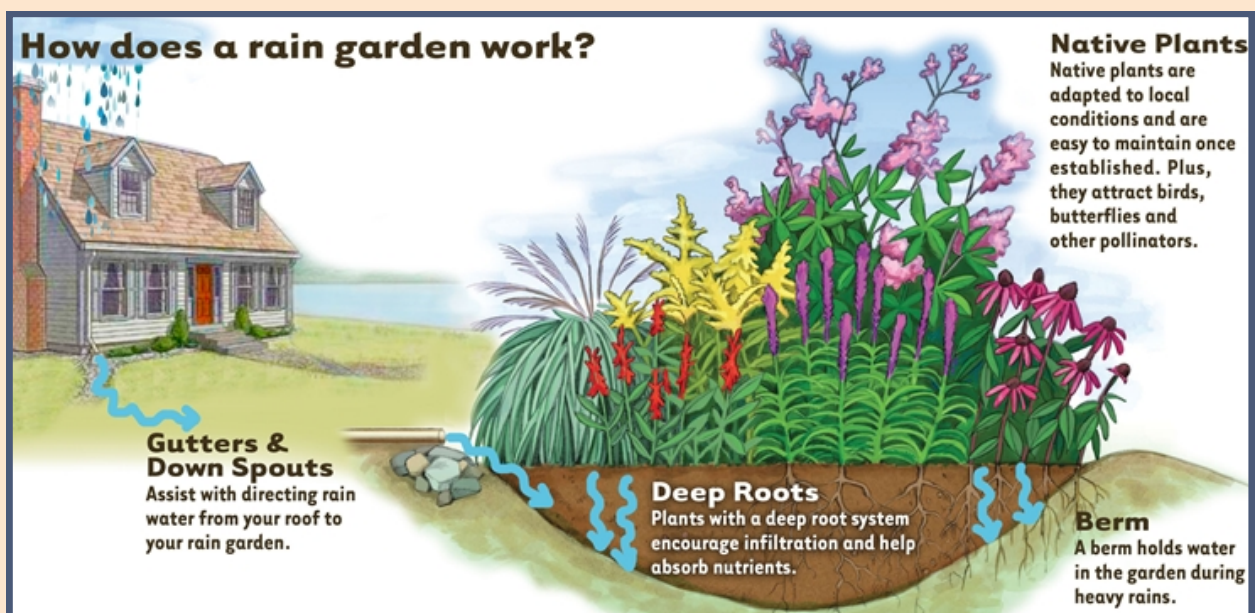
1. Rain gardens
2. Permeable pavement
3. Cisterns
4. Stormwater wetlands



Flooding in Raleigh after a large rain event

Rain Gardens

A rain garden is an area filled with native plants that is designed to slow water down and help absorb and clean the water, helping it to soak into the ground rather than running off the surface onto roads. Native plants work best, and they also provide important habitat to wildlife and pollinators! Rain gardens work well in cities as well as around our homes!



City BMPs:

Permeable Pavement

Most pavement does not allow any water to soak into it. The water then runs off, picks up pollution and speed, and then can cause flooding and water pollution problems. But, we can use pavement that DOES allow water to pass into the ground! It works by creating spaces between the pavement stones where water can flow. Sometimes grass is planted in these spaces as well, which also helps to slow down the water and soak it up!

Permeable means that water can pass through it. Permeable pavement does a great job slowing water down, letting it sink into the ground, and reducing runoff. This helps the water quality of our rivers, lakes, and drinking supplies a lot!



Stormwater Wetlands

Wetlands are areas that have water in them for most of the year, and are filled with plants that are incredibly good at slowing down, absorbing, and cleaning water. They also provide great habitat for wildlife! In city areas, it's helpful to build wetlands in certain spots where water tends to collect.

Stormwater wetlands are also called constructed wetlands, because they are built by people and aren't natural to the landscape. They're built specifically to catch runoff, slow it down, and filter it.



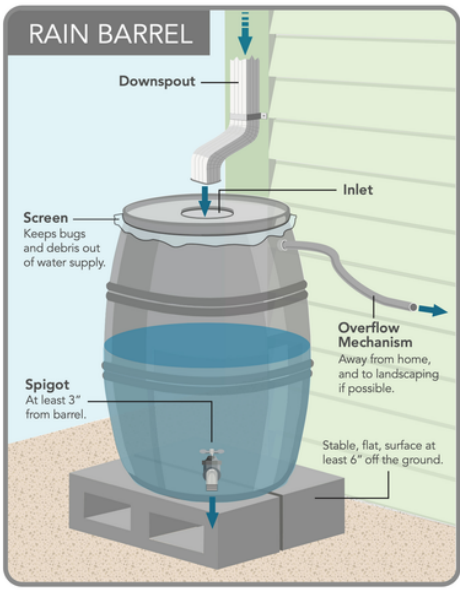
City BMPs:

Rain Barrels & Cisterns

A lot of rain falls on the roofs of buildings. As it does, it runs off the roof fast or flows through a gutter which drains the water onto the ground. But what if we could slow down this water, capture it, and then use it?

Rain barrels and cisterns are both containers that a gutter empties water from a roof into. Cisterns are larger and hold more water.

The water stored in rain barrels and cisterns can be used to water plants, flushing toilets, washing cars, and as a drinking source for livestock animals.



Important idea!

If we can find ways to SLOW water down, SPREAD it out, or help it SOAK into the ground, we can improve soil and water health!

Do Your Part to Protect Water Quality

Simple actions at home can reduce water pollution



Keep leaves and grass clippings out of streets and storm drains. Use them as mulch or compost in your garden.

Install a rain barrel to collect rain water. The rain water can later be used to water your plants and lawn.

Keep trash out of streets and storm drains. Make sure trash cans have tight-fitting lids.

Make sure sprinklers are watering your lawn – not the street or sidewalk.

Never dump household waste outside or in a storm drain. If you no longer need a product, take it to a local household hazardous waste collection program.

Always pick up after your pet.

Use fertilizer and pesticide sparingly. Read the label and wait for dry weather to apply.

Plant native trees and shrubs. Their roots help absorb and filter pollutants from rain water.

Find out more: NEEFusa.org

Glossary

Impress the judges with your new vocabulary!

Conservation:

The wise use and management of natural resources (soil, water, air, plants, and animals) to fulfill human needs now and in the future.

Soil Conservation:

To protect soil from erosion; to keep it productive and out of waterways, to use and manage soil wisely now to ensure a rich soil resource for future generations.

Water Conservation:

To protect water quality by keeping water clean from sediment, chemicals, oil and animal wastes; to protect water quantity by using smaller amounts; to use and manage water wisely now to ensure good water quality for future generations.

Best Management Practices (BMPs):

Agricultural practices that are suitable for reducing or minimizing the amount of water pollution generated by non-point sources; an engineered structure or management activity, or combination of these, that eliminates or reduces adverse environmental effects of pollutants. Often called BMPs.