Soils Clean and Capture Water

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Soils Capture Water

Capturing water is one of the most important roles that soils play in our ecosystem. This happens through the pores in the soil. The pores of a soil are important in determining if water will move into the soil and through to groundwater. Pores can be any size from small, microscopic holes in the soil to large worm-like holes and prairie dog tunnels. Soil with lots of small pores will slow down how quickly rain enters, resulting in the potential for runoff and flooding. However, soil with lots of large pores will allow water to move through quickly. An ideal soil has both large and small pores so that some water moves through but some is stored for plants.

The size of soil pores is dictated by both soil texture and soil structure (see the January overview https://www.soils.org/files/sssa/iys/edu-materials-kit/soils-overview-for-teachers.pdf). Structure can be affected by human activity, which then affects the size of the pores. Coarse textures, like sand, generally have larger pores while fine textures, like clay, generally have smaller pores. A soil with good structure will have lots of big and small pores, even if it is clayey. A soil with poor structure, whether natural or because of erosion or compaction, will only have small pores.

Land surface cover is also important. Soil covered by plants is one of the most efficient at capturing water, (like grass and trees). Soil covered in concrete, like parking lots and buildings, will capture the least amount of water. Open lands that have been compacted also make it difficult for water to move into the soil.

Soils are Nature's Filters

Not only does soil capture water, but soil also filters water. Water that moves into and through soil is cleaned by physical, chemical, and biological processes. For example, when pollutants carried by water get caught in the small pores of the soil, they get physically cleaned. Most soils have a slight chemical charge which attracts and captures chemicals with the opposite charge. For instance, many soils (especially clayey soils) are negatively charged. Positively charged substances, such as Ammonium (a form of Nitrogen), are attracted to the soil. So, the soil holds the pollutants rather than releasing it into the groundwater. Negatively charged chemicals, such as Nitrate (another

Soil covered in concrete will capture the least amount of water. NRCS

Making a rain garden in Chicago to reduce runoff. Dan Wendt

form of Nitrogen), are not attracted to the soil and may move through to groundwater. Many pollutants are used or altered by the microorganisms living in soil. Bacteria, fungi, and more may use the pollutants and transform it to something different. Recently, scientists have found bacteria that will transform spilled oil, into less dangerous substances like Carbon Dioxide and Water.

Water that has been used for cleaning and cooling in places like homes and businesses is known as **gray water**. This water can be filtered through soil to clean it and return the water to the environment. Sometimes, in a city, there is too much of this type of wastewater compared to available soil. So, water treatment facilities clean it before it is returned to the environment. These treatment facilities use some of the same physical, chemical, and biological processes that soil does.

Soils are Nature's Reservoir

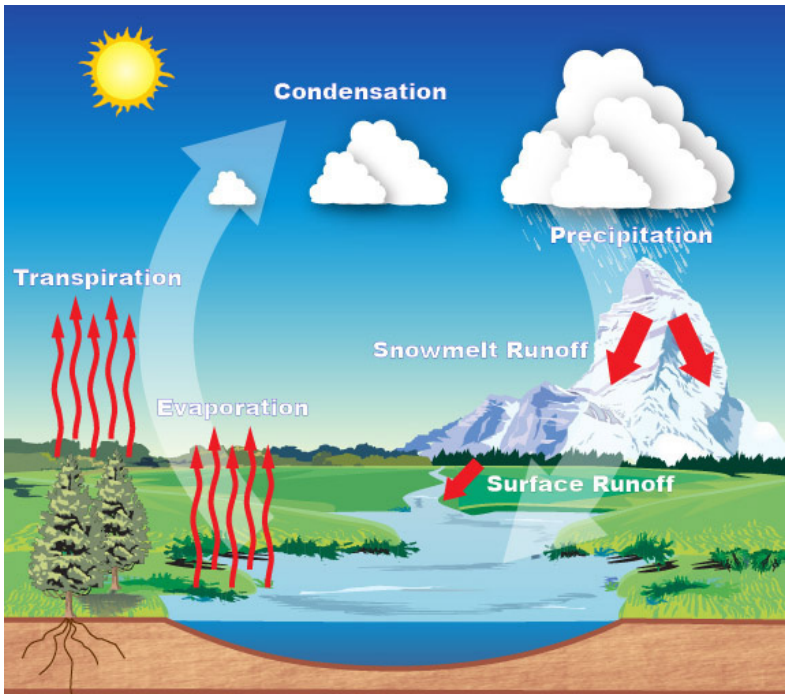
The water cycle is a great way to understand how water flows. Some runs off the land surface and enters streams, lakes, and rivers (called a surface water body). Other times, water moves down through the soil and recharges groundwater. Finally, some water is held in the soil for use by plants. Soil characteristics dictate where the water ends up. Water that moves over or through soil and enters a surface or ground water body (aquifer) is known as **blue water**. In contrast, water stored in the soil and plants is known as green water. Lawns and crops grown on soils with ample **green water** supplies may not need irrigation or rainfall as often.

There are many practices which can help move more water into the ground and reduce the amount that becomes runoff or floodwater. In cities, building rain gardens or using specially designed porous concrete for places like parking lots helps reduce runoff. On farms, using no-till and precision agriculture practices helps reduce compaction, which helps capture water.

Water that doesn't enter the soil can cause floods, and it can also pick up chemicals from the land surface (such as oil in parking lots or pesticides in fields) and then enter the water supply. By increasing the amount of rain moving into the ground and by adding wetlands as buffers between land and water, we can help reduce the impact of flooding and chemicals to water bodies.

Recap

Soil plays an important role in capturing and cleaning water. Soil texture, structure, and land coverings all have roles in determining how easily water will move through the soil to filter, store, and distribute water to reduce runoff and flooding. The work of cleaning water is done by physical, chemical, and biological processes. Healthy soils are critical to ensure clean water for recreation, consumption, crop production, and more.



Water Cycle. NOAA weather.gov

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