

An aerial photograph of a landscape in Hill Country, Texas. The foreground shows a mix of green trees and dry, brownish vegetation. A paved road with yellow double lines curves through the middle ground. In the background, there are scattered houses and buildings under a clear blue sky with some light clouds.

Hill Country Master Gardeners

**Building Healthy Landscapes:
*The Why and the How***

**Debbie Reid, Technical Director
Greater Edwards Aquifer Alliance**

April 1, 2026

The basis of a healthy landscape is really healthy soil...

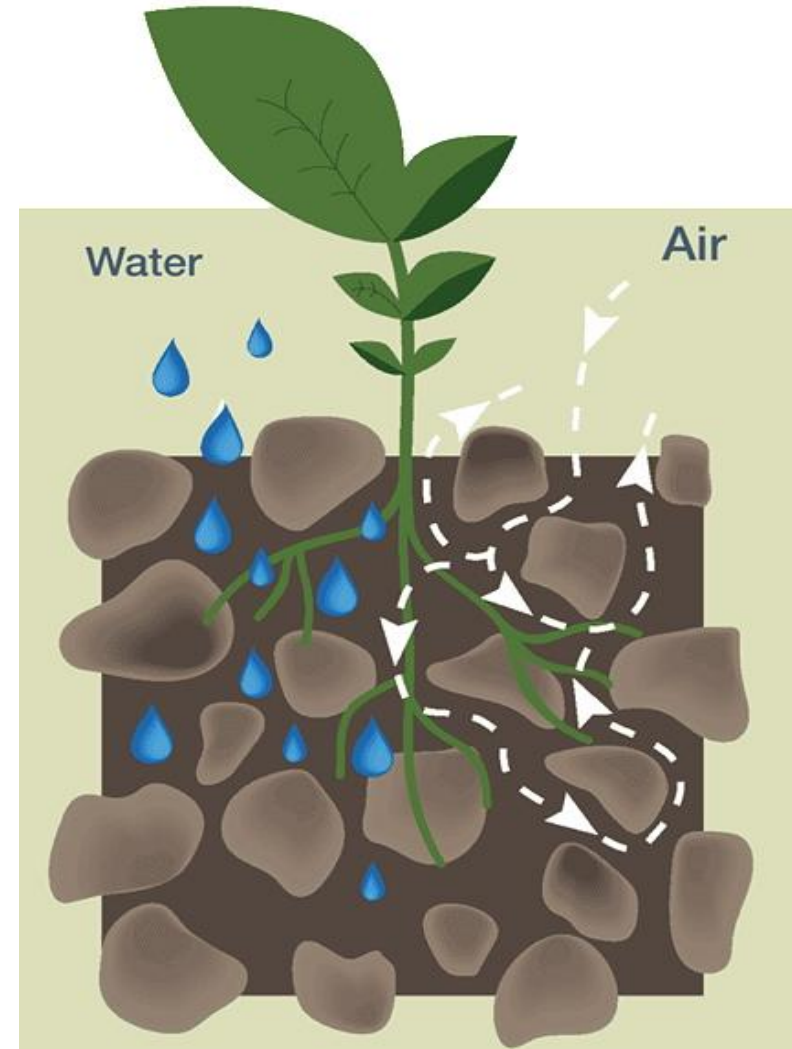


Figure 1. Good soil structure has adequate space (pores) between aggregates to alleviate compaction so that air, water and nutrients can reach plant roots.

Why build a healthy soil?

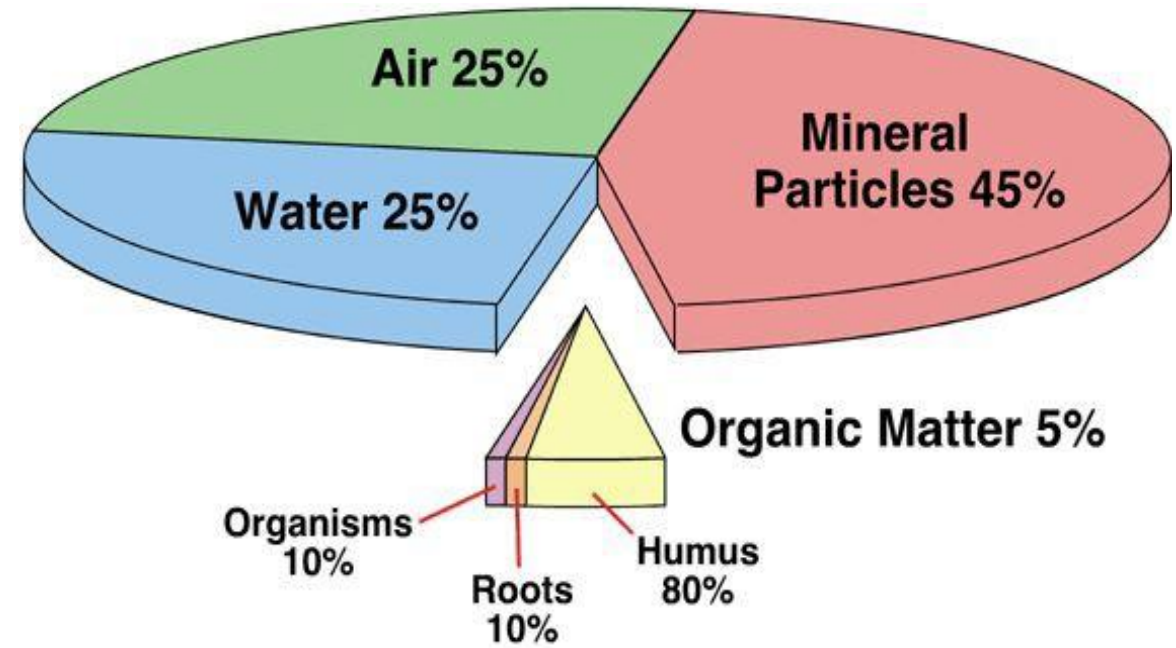
Even if your “soil” is stoney or gravelly, building its health will be beneficial. A healthy soil can contribute to:

1. Reducing floods and need for flood control projects,
2. Recharging aquifers and groundwater,
3. Maintaining stream and river flows along with their biodiversity,
4. Reducing irrigation needs,
5. Reducing heat stress,
6. Providing resilience to droughts,
7. Improving recreational opportunities, and
8. Maintaining healthy landscapes in rural and urban areas,
9. Improving public health.



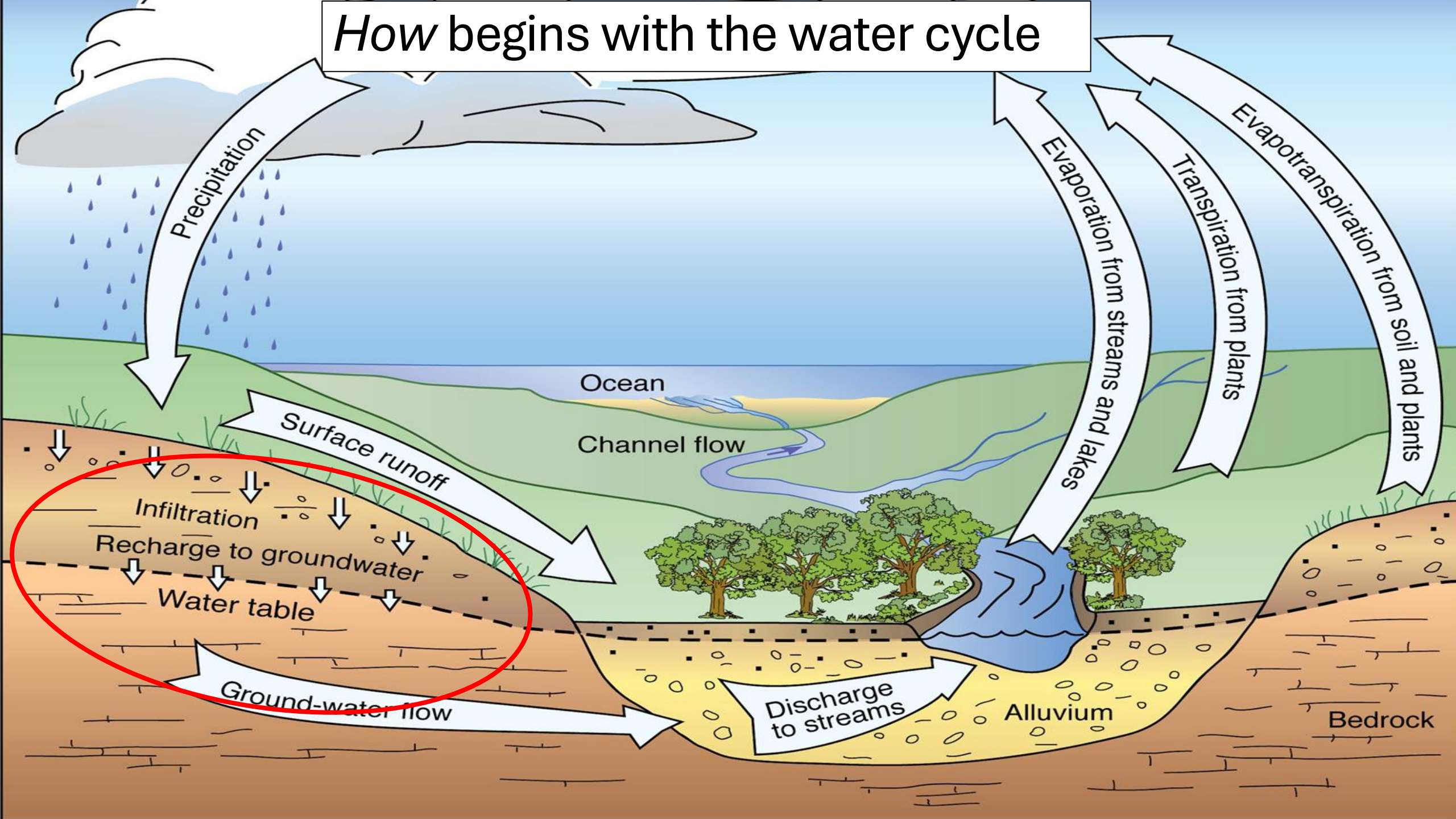
The basics of soil

- ▶ Soil is a mixture of:
 - Mineral particles
 - Organic matter
 - Air and water
- ▶ While all of these are important, it is the soil organic matter (SOM) that creates healthy soils and landscapes.
- ▶ The goal is to increase the amount of SOM and protect it from ***erosion, high temperatures, compaction***, etc.



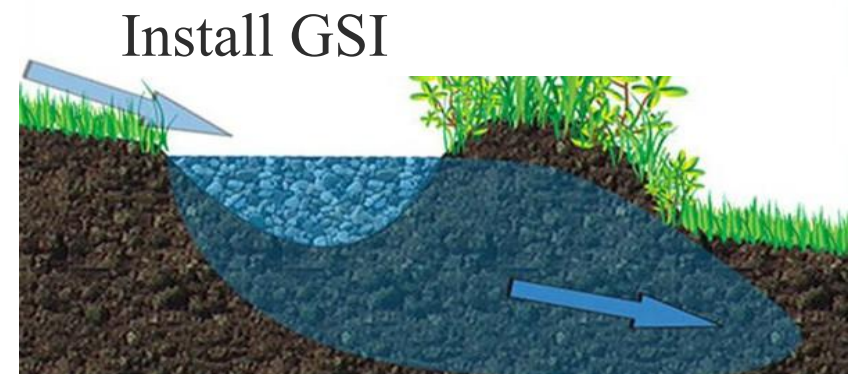
Soil Organic Matter (SOM) is the key.

How begins with the water cycle



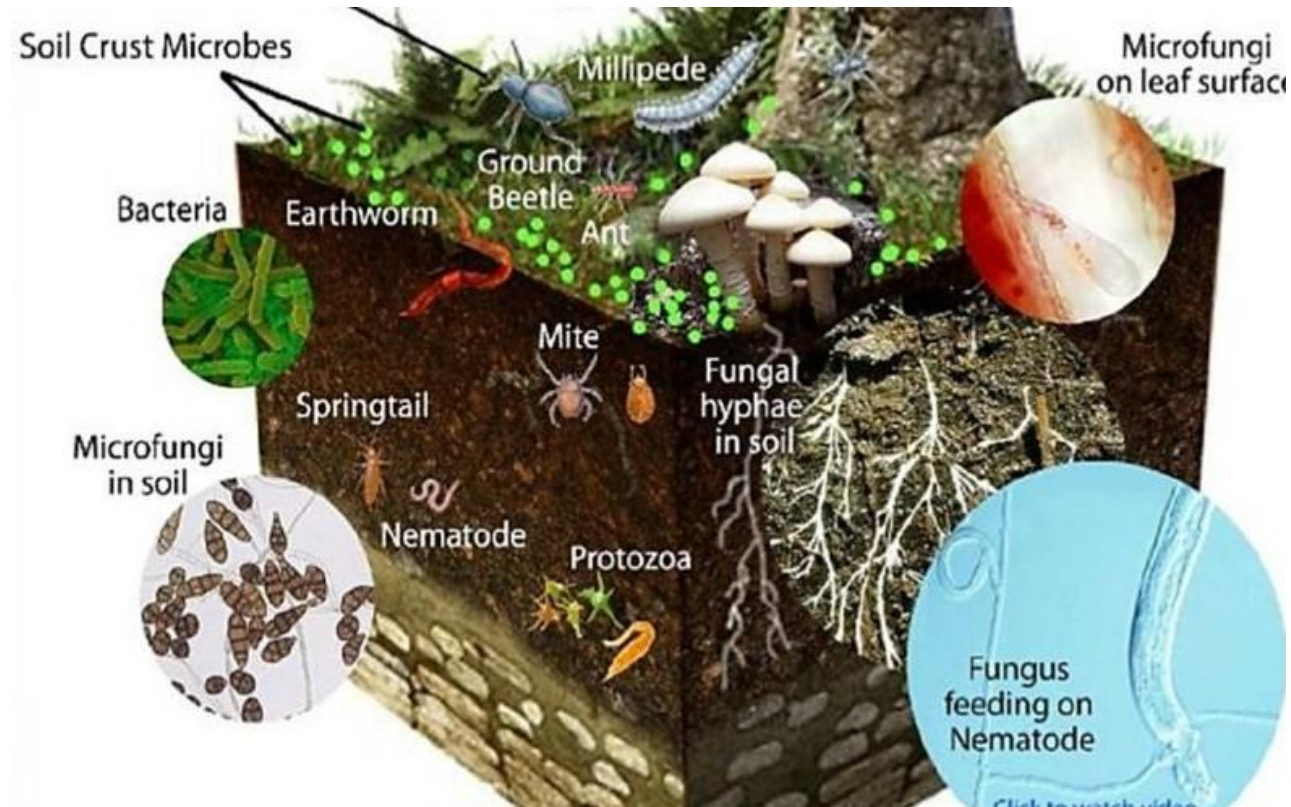
Using landscape practices as a strategy to build healthy soils

- Adopt practices that will allow more rain to soak into the ground.
- Main practices include:
 1. Keep the soil covered and maximize biodiversity.
 2. Modify mowing or grazing practices.
 3. Install green stormwater infrastructure (GSI) such as a berm, rain garden, bioswale, etc.



SOM turns soil into a Living Ecosystem

- The SOM plays a crucial role as it fuels the life within soil.
- This life is what creates a “healthy” soil:
 - a) Plenty of air pockets that allow stormwater to enter and gases to escape.
 - b) Sponge-like qualities that hold water in the root zone.
 - c) Removal of pollutants while recharging groundwater, aquifers, creeks and rivers with filtered water.



What are some examples of organic matter in the soil?

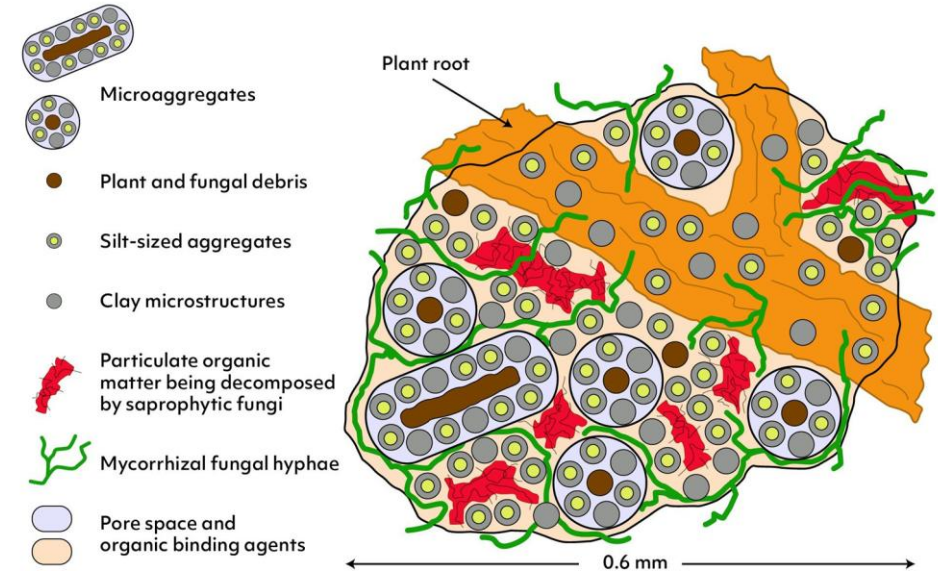
Healthy soils have good “Aggregation”

A soil aggregate is a **group of soil particles that stick together**, forming larger structures that:

- Improve water holding capacity and drought resistance.
- Protect soil from wind and water erosion.
- Allow for nutrient transport including oxygen.
- Assist with soil carbon sequestration.
- Provide habitat for microorganisms.

CONCEPTUAL DIAGRAM OF A MACROAGGREGATE

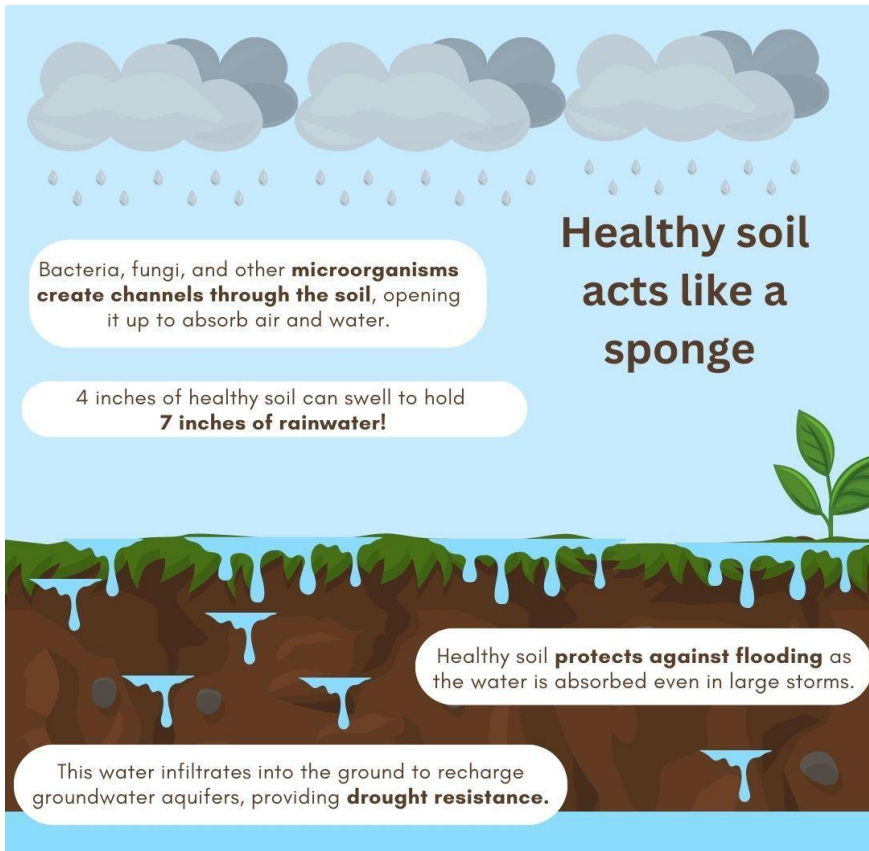
From Jastrow and Miller, 1998, in *Soil Processes and the Carbon Cycle*, CRC Press.



Which soil has the best aggregation?

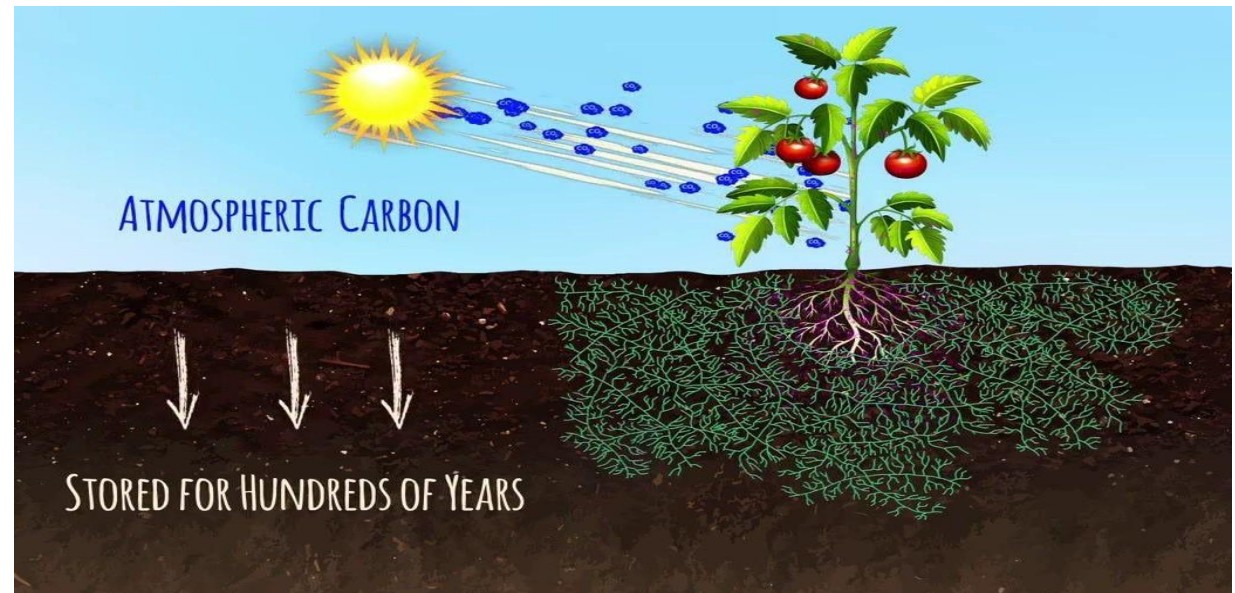


Healthy soils reduce flooding and cool the air



- This increase water storage in the soil is water that is held loosely so it is easily available for plant growth.
- This increase will also remove an additional 29 tons of CO₂ from the air per acre which will lower summer temperatures.

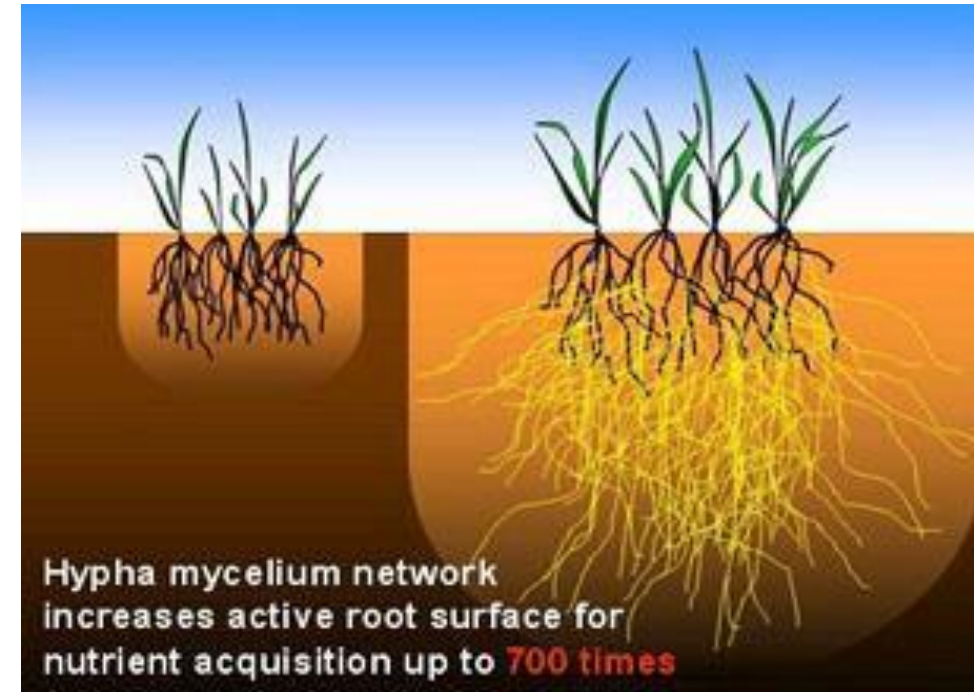
A 1% increase in SOM can store an additional 20,000 gal of water per acre per rain event.



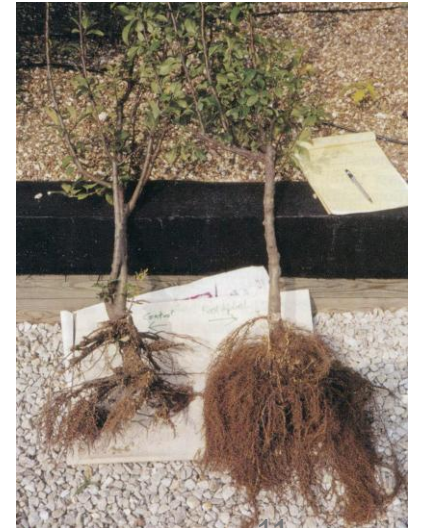
Healthy soils support healthy plants and landscapes

A healthy soil contains a variety of bacteria, fungi and other organisms that assist plants to access the water and nutrients they need for healthy growth.

- Turning minerals into a form of nutrients that plants can use, just like our gut bacteria.
- Mycorrhizae, which live in association with plant roots, increase the volume of soil that roots can utilize up to 700 times.
- They are vital for tree survival in Central Texas.

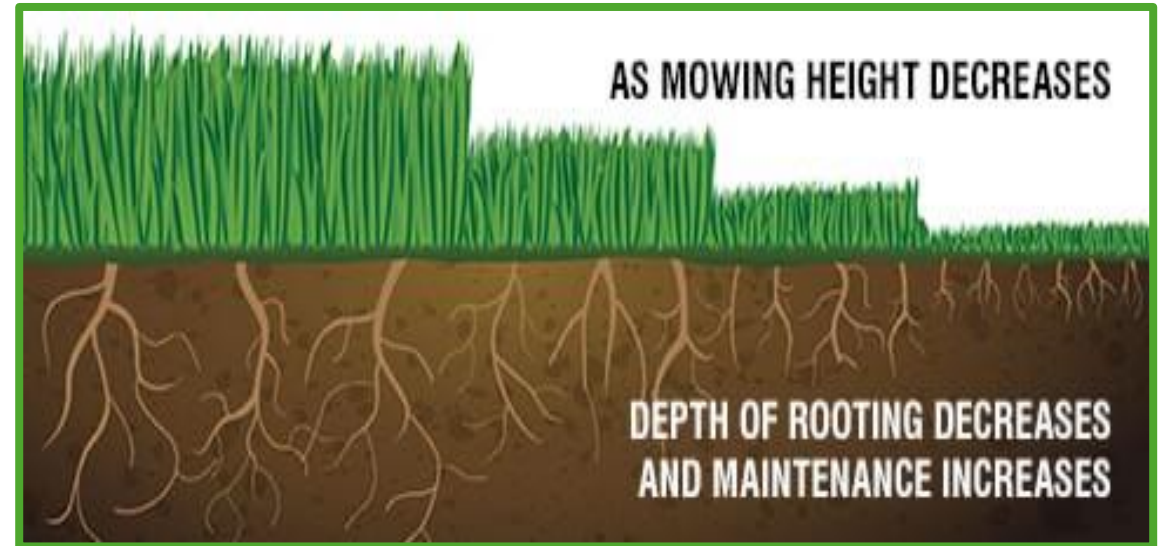


Soil biodiversity assists plants to develop drought tolerance.



Mowing/Line Trimming on Non-Irrigated Areas

- 4" is the preferred minimum height height. As the slope increases, the higher the vegetation should be
- Cut no more than 30% of the new growth at one time.
- Reduce or stop mowing during droughts and allow taller vegetation of 5"-6".
- Avoid "scalping".
- Avoid mowing when the soil is wet and saturated. Alternative is line trimmers



Higher vegetation protects the soil and plant roots from erosion, extreme temperatures while maintaining soil moisture and reducing weeds.

Possible Issues

1. When the turf is one species, it can be easier to maintain at a uniform height.
2. When the turf is allowed to grow, the roots will be more vigorous making the vegetation grow faster.
3. Strict mowing schedules will not work.
4. Public acceptance.



How this strategy creates healthy soils

- Plants depend on their roots to survive, especially in dry weather.
- Therefore, the more robust the root system, the more drought tolerant the plant.
- Taller plants with their more robust root systems are a constant source of SOM which continually feeds the soil microbes.
- Taller vegetation is better able to:
 1. Slow stormwater so that it will soak into the ground.
 2. Remove pollution from the air and water.
 3. Prevent soil erosion and weeds.
 4. Assist in maintaining soil health.



Mulching and amendments

- Organic mulches will protect and replenish SOM as it breaks down.
- Adding mulch within landscape beds and around trees especially larger ones trees can be beneficial.
- Adding fall leaves and then applying bark mulch provides additional benefits.
- Adding compost around trees, in landscape beds and in turf areas will increase SOM.

Compost can be a *quick start* in creating a healthy soil.



Proper mulching around trees will promote stronger and deeper roots.



Creating Low Impact Maintenance Areas

- Low Impact Maintenance Areas (LIMAs) can play a big role in creating healthy soils:
 1. Reduce emissions from mowing.
 2. Reduce labor costs.
 3. Quickly build SOM.
 4. Slow stormwater promoting infiltration.
 5. Remove pollutants from stormwater.
 6. Sequester and store more soil carbon.
 7. Increase biodiversity.
- Locations where LIMAs are located can direct the type of maintenance required.



This pocket prairie site in the Houston medical center requires high maintenance.



This pocket prairie site is less maintenance demanding.

To Mow or Not to Mow: *If Mow, When and How?*

- Reasons to reduce mowing include:
 - a. Maintain biodiversity, wildlife food sources and cover.
 - b. Avoid disrupting feeding, mating and ground nesting sites for birds such as... Killdeer, Lesser finches, Nighthawks, etc.
- Effects of mowing:
 - a. While less mowing can lead to domination by grasses...
 - b. Over mowing while it can promote annual wildflowers, will reduce soil health and increase erosion.
 - c. Compromise: just mow patches regularly for annual wildflower color including Bluebonnets, Wine cups, etc.
- If mowing is needed:
 - a. Avoid between mid-February to July for bird migration and nesting and wildflower reseeding.
 - b. Maintain a minimum height of 5"-6"
 - c. Avoid mowing when soil is wet and saturated.



**TO MOW OR
NOT TO MOW**

Maintenance along rivers, creeks and lakes

- The riparian zone is the transition between the body of water and the upland.
- Maintenance of this area directly impacts water levels, flood control, water quality and the quality of recreational activities such as swimming, fishing and birding.
- These areas have a greater ability to accumulate SOM than uplands.

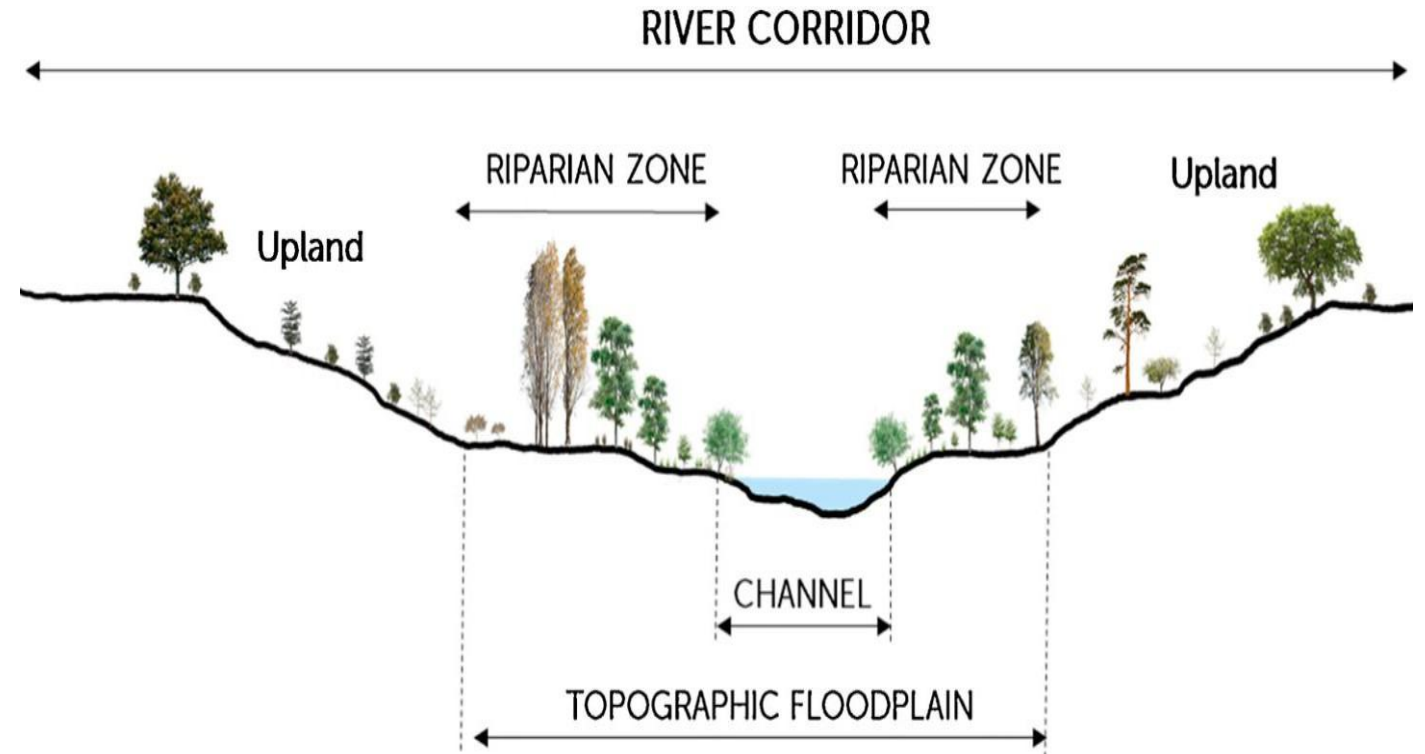


Fig. 7. Cross section of a symmetric natural corridor.

Maintenance of riparian zones

- It is crucial to leave a LIMA buffer of at least 10'-15' from the water's edge.
- The buffer width should be wider for steeper slopes.
- Trees provide additional bank stabilization while cooling the water with shade.
- Vegetative buffers also filter pollutants from stormwater and create habitat for fish and other aquatic wildlife.
- Maintenance of these areas follows the previous section on LIMAs except avoid using *mowing equipment in a LIMA*.



Mowing to the water's edge causes the bank to erode.



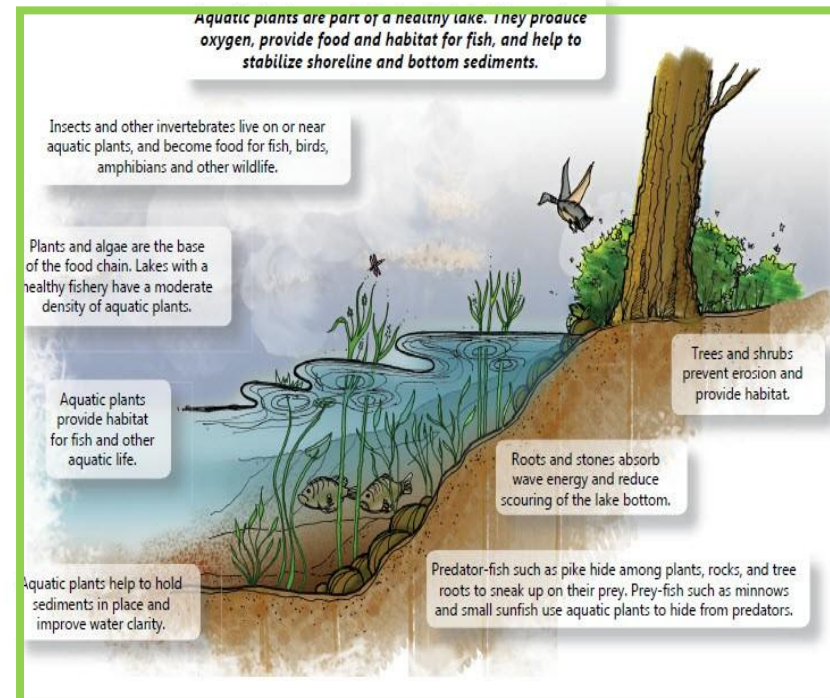
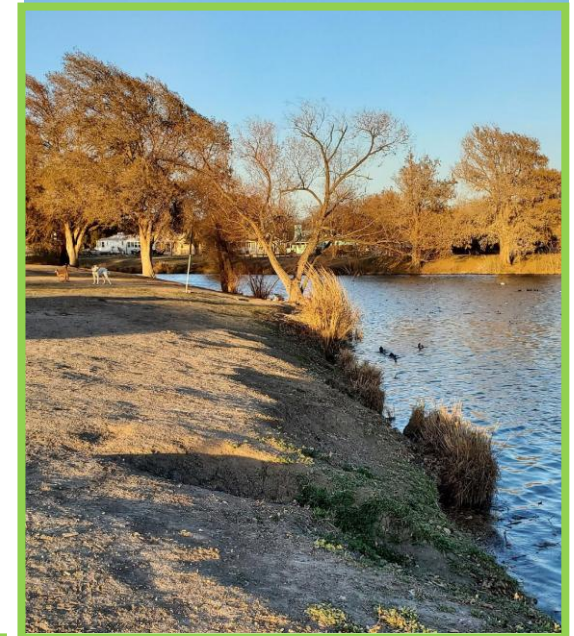
Vegetation protects the bank.

Bankside management

- Uncontrolled access to the water's edge leads to soil degradation and water pollution.
- Access can be managed with vegetation:
 1. Leave a minimum of 10' from top of bank.
 2. Establish physical barriers with natural materials and allow vegetation to grow and or install new riparian plants.

The lack of vegetation on this bank has lead to:

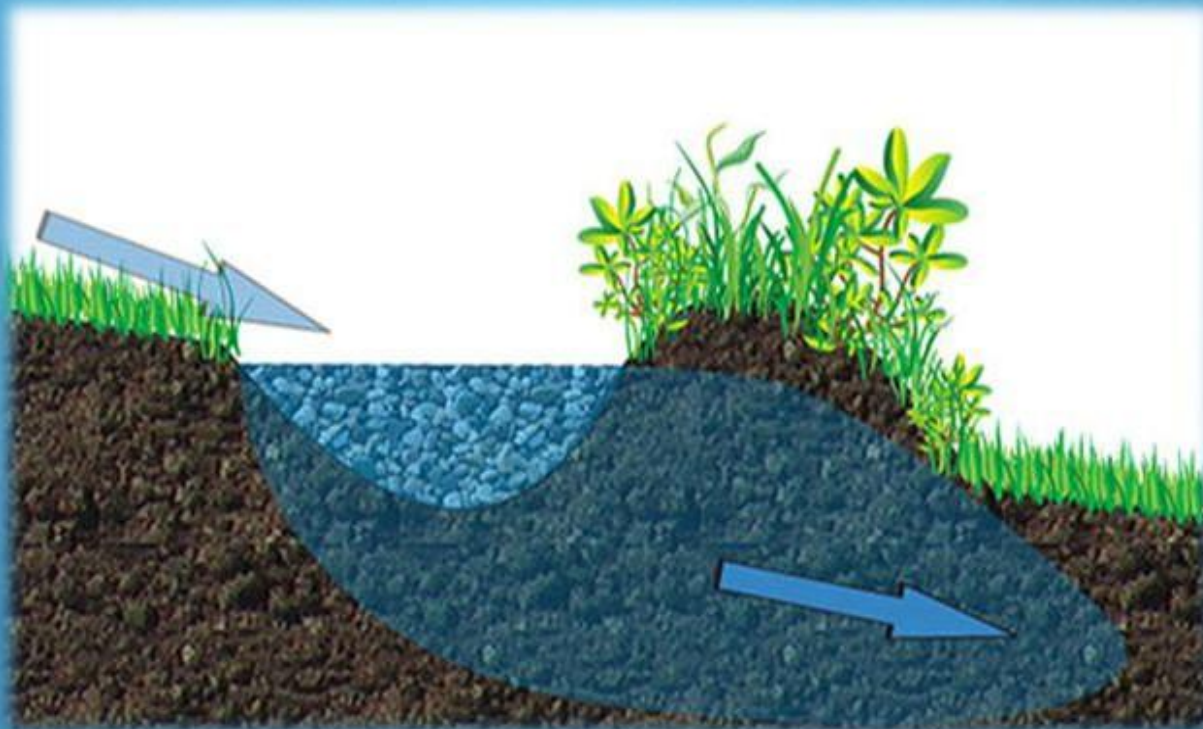
1. Erosion,
2. Sediment filling the lake,
3. Impaired water quality.



Creating a living bank leads to improved biodiversity, recreation and water quality.



Slow it, Spread it, Sink it



Green Stormwater Infrastructure can increase benefits

- All properties have a slope where stormwater flows to the lowest point.
- Leaving vegetation taller will slow stormwater allowing for more water to infiltrate into the the soil.
- Adding a GSI feature will assist in harvesting even more water.



San Antonio home captures rain from the roof and directs it into a downspout. This water will soak into the soil providing moisture for a longer period of time; reducing irrigation.



The gravel channel allows for excess rain to flow out into the grass.



Landscaped median with a sawtooth curb



The San Antonio
Walmart on Bandera Rd

The grade of the parking
lot directs stormwater to
this infiltration area:

1. Slows and filters
stormwater to be used as
irrigation.
2. Reduces the amount of
stormwater that is
directed by curb streets
directly to the creek.

Simple non-engineered strategies to increase vegetation and reduce runoff and erosion.



Landowner used three rows of cedar logs to slow and sink water into the land



A landowner uses cedar slash to protect establishing native plants from herbivory.

Basis of berms across slopes

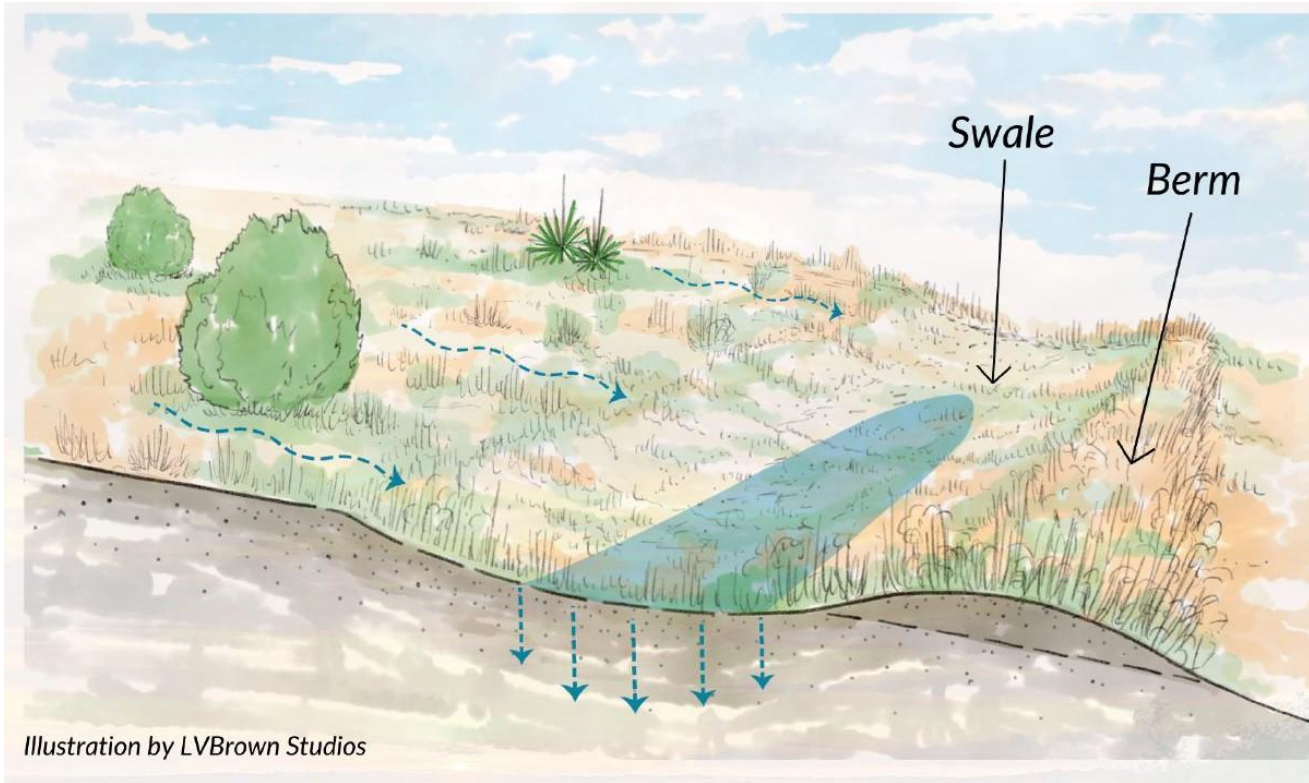
- Create a berm across the contour of a slope.
- Berms can be made of temporary materials such as brush or mulch or a more permanent one with rock.
- To increase effectiveness:
 1. Add a swale or trench
 2. Fill the trench with a more permeable substrate to increase infiltration.
 3. Combine with plantings to increase benefits.



Above branches are laid across the and below shredded woody material is used.



Berms and Swales: Slow and sink large amounts of water into the land. Planting native grasses will enhance effectiveness.



This is why you don't have to water native plants. And those roots act like sponges to control flooding.



Row of Rocks: Slow and sink water flow across a slope showing mild signs of erosion or bare ground. It will also capture sediment proving a seed bed for new vegetation.

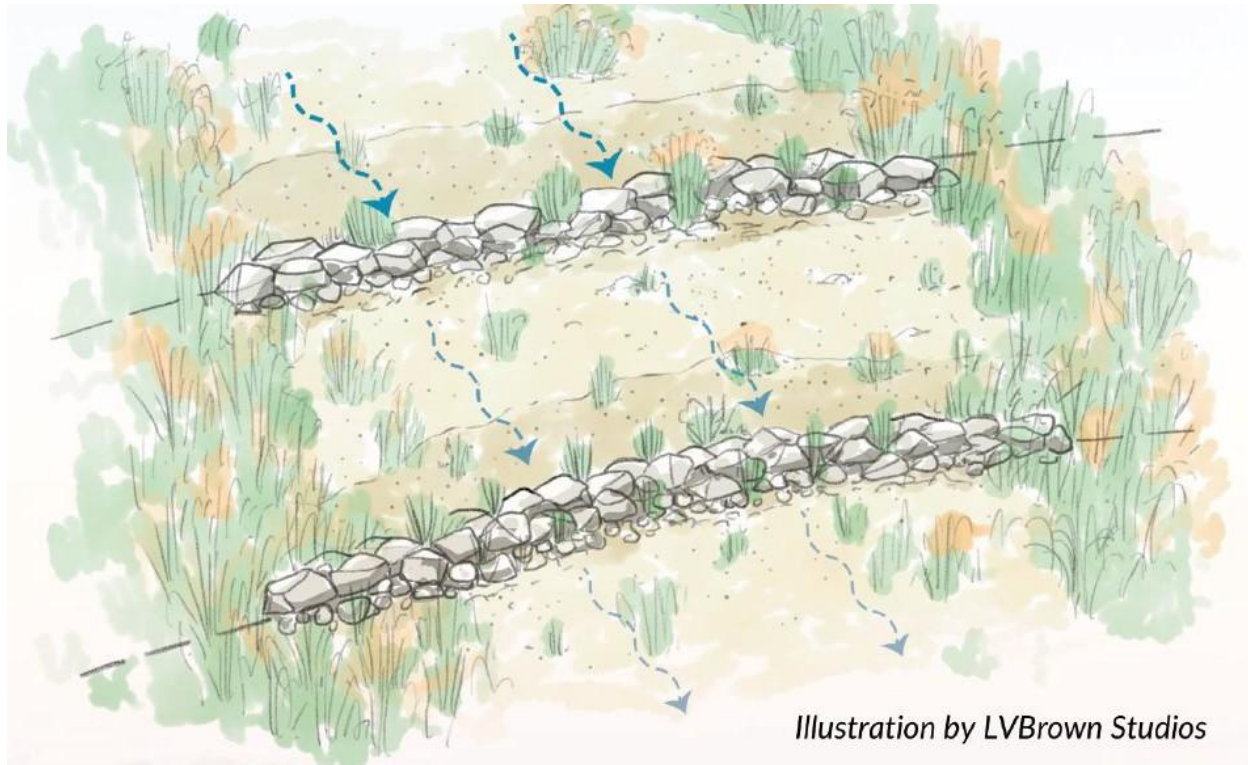


Illustration by LVBrown Studios

Media Luna: Slow and spread concentrated water flow over a slope.

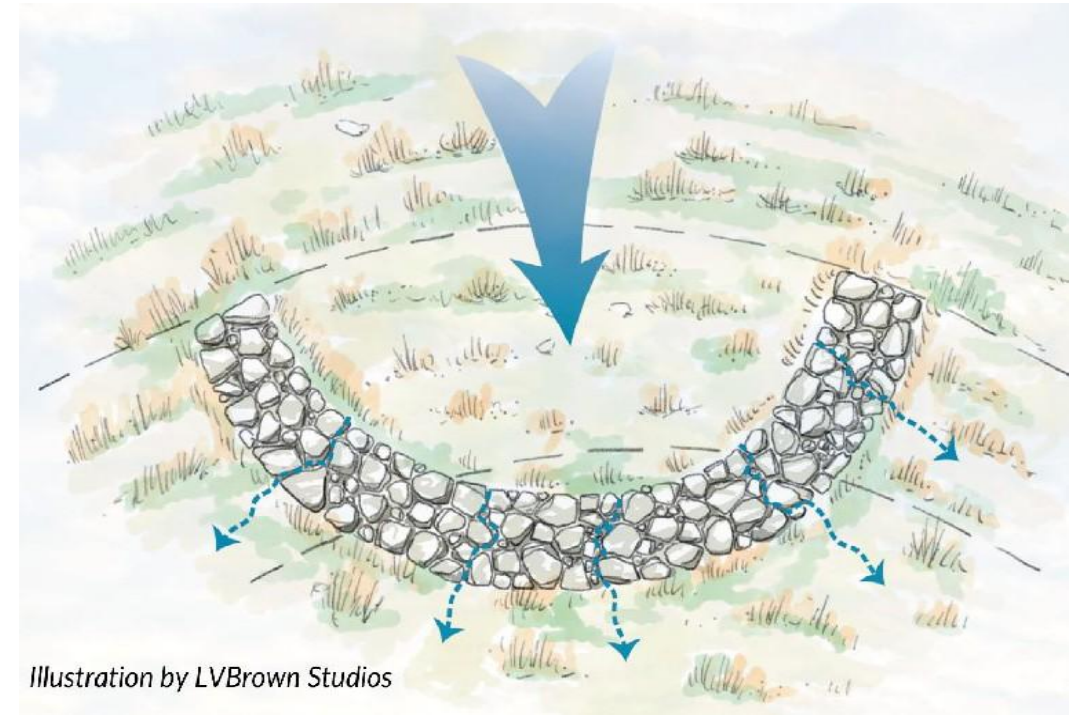


Illustration by LVBrown Studios

Methods to reduce the impact of headcuts from runoff



Severe headcut that will eventually create a gully.

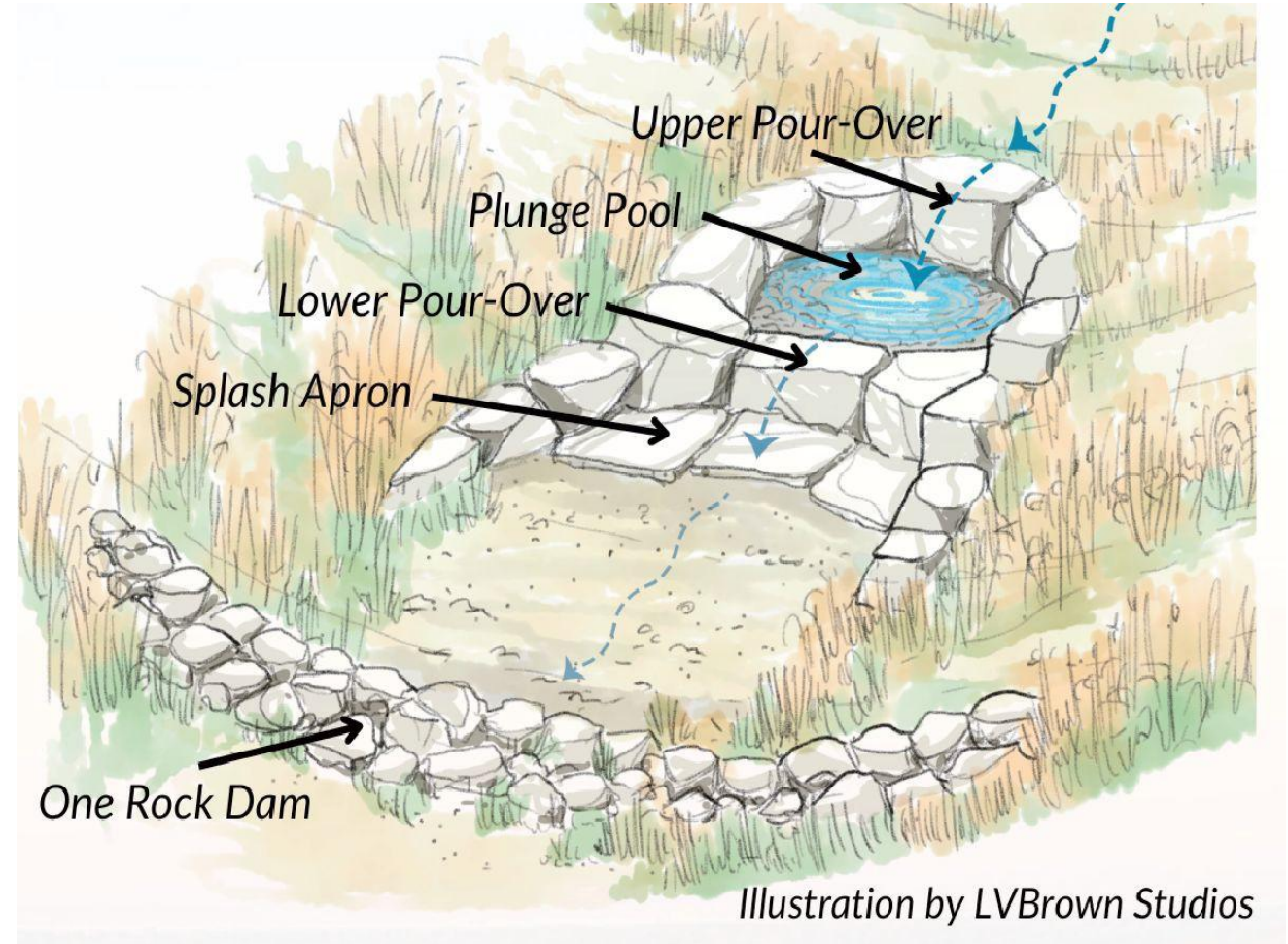


Illustration by LVBrown Studios

Enhanced bioswale along the Blanco River



May 2017

This bioswale will not only slow and spread stormwater but will also reduce erosion and pollution that would negatively impact the Blanco River.

The riparian vegetation will enhance the GSI's effectiveness while protecting riverbanks and creating shade and habitat.

Ryan McGillicuddy with TPWD

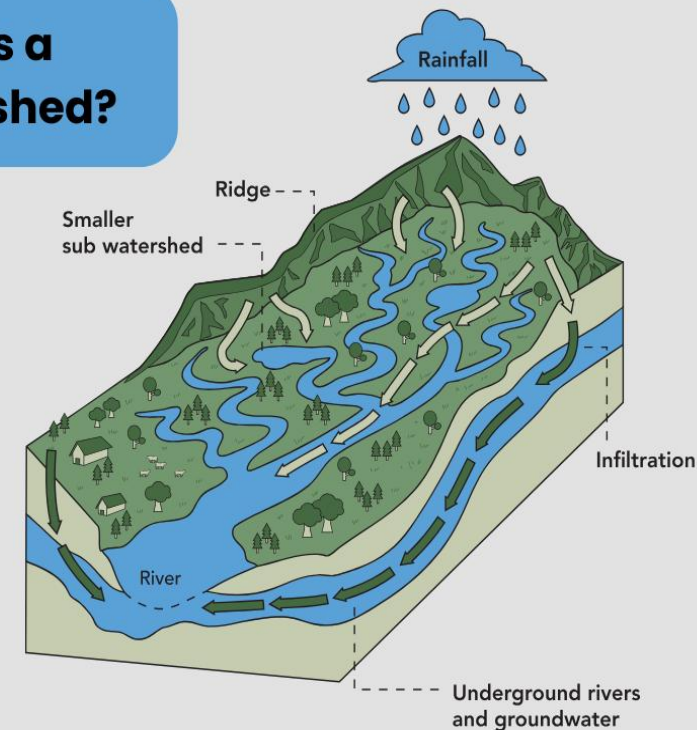


May 2018

Using a watershed approach



What is a Watershed?



7 Ways this Farm Harvests FREE Water

Above is the layout for using multiple GSI strategies for harvesting free water within a watershed maximizing harvesting the rain on this property while minimizing runoff.



A dense field of small, five-petaled flowers in shades of light blue and white. The flowers have dark centers and are set against a background of green foliage. The text "Thank You For Your Attention!!" is overlaid in a large, bold, black font, centered in the upper half of the image.

**Thank You For Your
Attention!!**



What We Do:

- Our organization is made up of 62 member organizations.
- Our goal is to protect the Edwards and Trinity aquifers and their watersheds.
- Implementation of this training will assist in conserving water and protecting these aquifers.

Resources that will excite you!

Programs:

Texas Native Plant Landscape Certification Program <http://www.npsot.org/our-work/class-schedule/>

Books and websites:

- The Soil Will Save Us by Kristin Ohlson. 2014.
- Grass, Soil, Hope: A Journey Through Carbon Country by Courtney White. 2014
- Greater Edwards Aquifer Alliance website: <https://aquiferalliance.org/using-our-green-spaces-to-improve-water-quality-and-create-resilient-com>
- [7 Ways this farm harvests Free water:](https://www.youtube.com/watch?v=TJ3DUI7NvNkies/) <https://www.youtube.com/watch?v=TJ3DUI7NvNkies/>

The Type of Organic Matter Matters

Turn Over Time

Soluble root exudates and decomposition by-products makes up less than 5% of total soil organic matter.

Minutes to days

Fresh or decomposing plant and animal matter with identifiable cell structure. Makes up 2–25% of total.

2 – 50 years

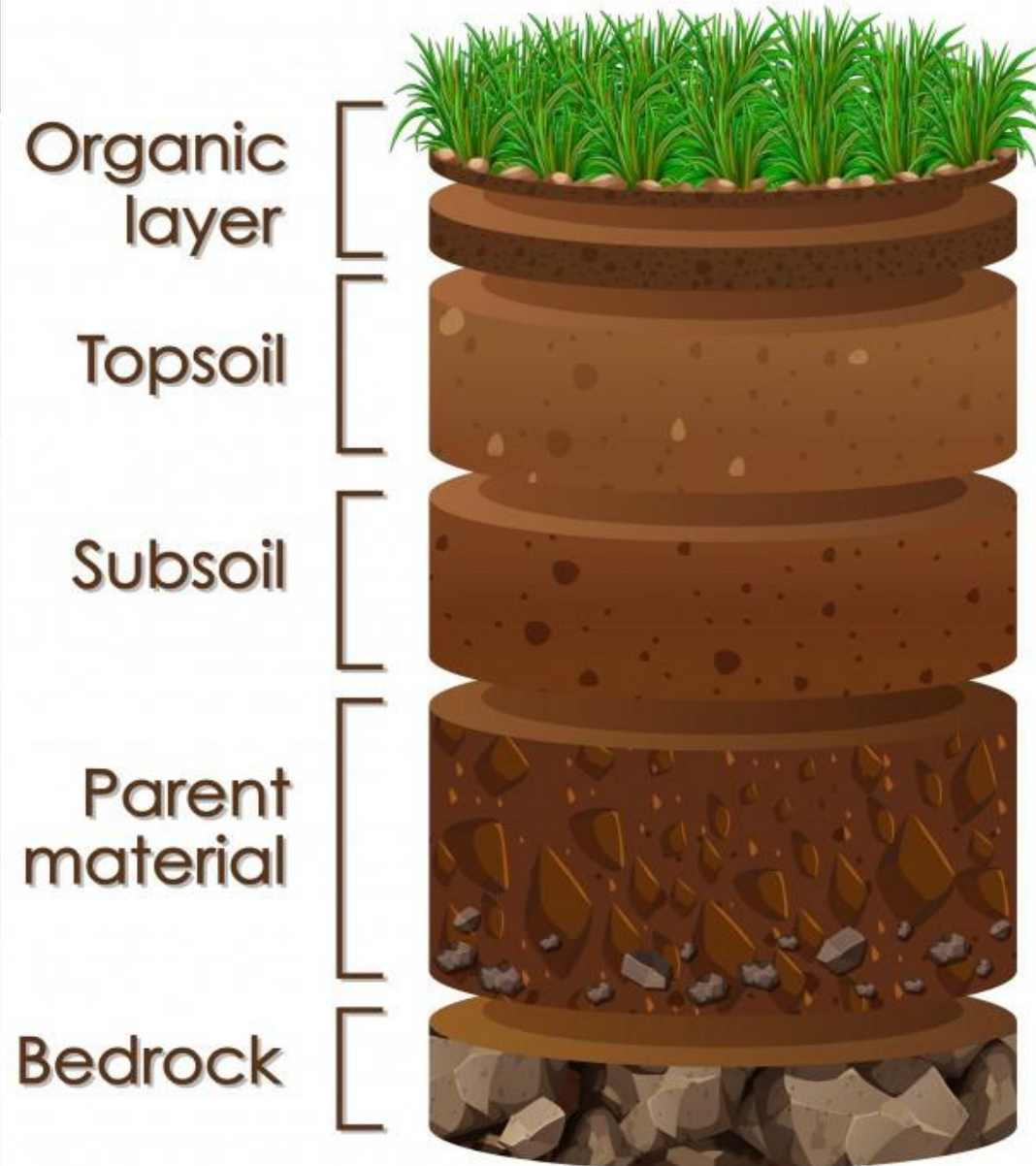
Older, decayed organic compounds that have resisted decomposition. Can make up more than 50% of total.

Decades to centuries

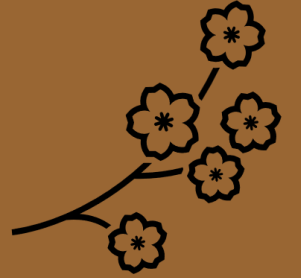
Resistant organic matter found at deeper levels is an important long-term **carbon** sink.

Centuries - thousands of years

Soil Layers on Earth



Keys and Practices to Soil Health



- **Maximize soil cover and allow vegetation to grow taller,**
- **Maximize the presence of living roots in the soil,**
- **Minimize soil and vegetation disturbance, especially soil compaction,**
- **Maximize biodiversity of plants and soil organisms, and**
- **Modify mowing and grazing practices to accomplish the above.**