

# Soil Science and Practices for Sustainable Landscapes

## Ciencia y Prácticas del Suelo para Paisajes Sostenibles



### Learning Objectives:

- Understand soil physical, chemical & biological processes, in order to
- Adopt sustainable landscape practices that protect and restore soil functions, for cost-effective, efficient landscape installation and maintenance.



Green Gardening Program 2015

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# Why build healthy soils?

- Keep soil loose and fertile for healthy plant growth
- Help prevent plant disease
- Store water and nutrients in plant root zone
- Save time and money (less water, fertilizer & pesticide needs)

Soils without compost



Soils with compost amendment



Compost improves  
all soil types.





# Healthy soils are good for the environment too!

Protect streams, wildlife, & our climate:

- Allow rainwater to soak into soil, slow runoff that erodes streams
- Reduce need for fertilizers & pesticides
- Reduce irrigation needs
- Filter out urban pollutants
- Store carbon from atmosphere into soil
- Grow trees & other “green infrastructure”



# Class Outline

## Soil Science:

- Washington soil types, and urban soil challenges
- soil physical, chemical & biological processes
- water and nutrient management

## Sustainable Soil Practices:

- protection, restoration & amendment,
- plant selection & placement
- fertilization, mulching & watering

## Activities:

- determining soil texture by feel
- reading soil lab test reports
- reading fertilizer bag
- soil-in-water shake-&-settle test
- mulch, compost, & soil sample examination

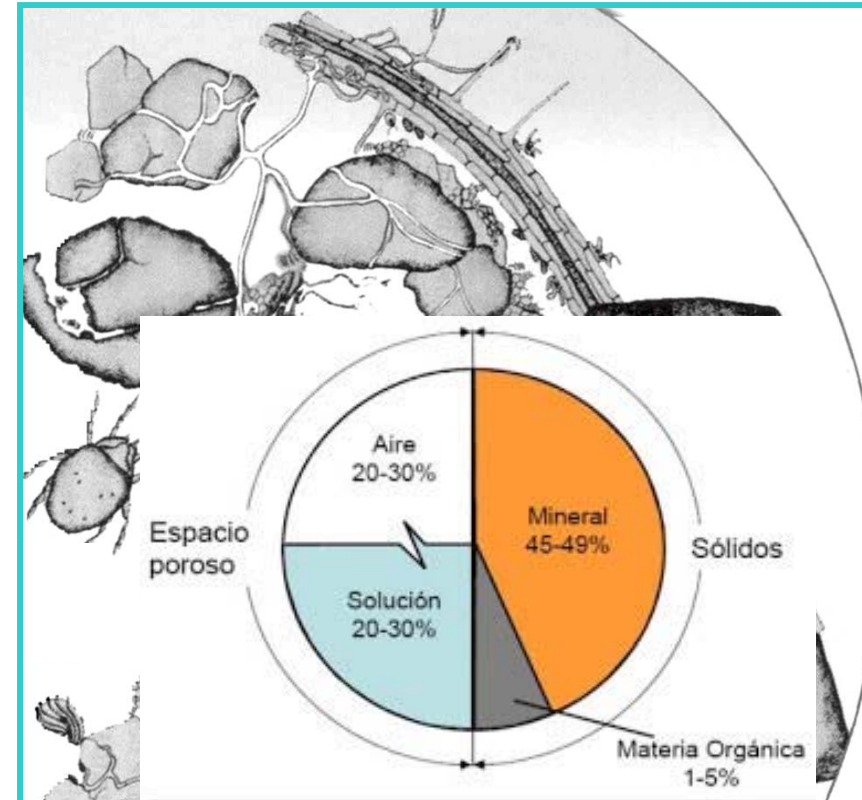
Best practices =  
key points for successful,  
sustainable landscapes



# Understanding soil: texture, structure, organics, & pore space (provides infiltration and water capacity)

## Soil components:

- “The Dirt” (mineral particles)
  - sand, silt, clay, rock
- Air and Water in pore spaces
- Organic Matter and Soil Life
  - plant debris, bugs, fungi, bacteria
  - create essential soil functions



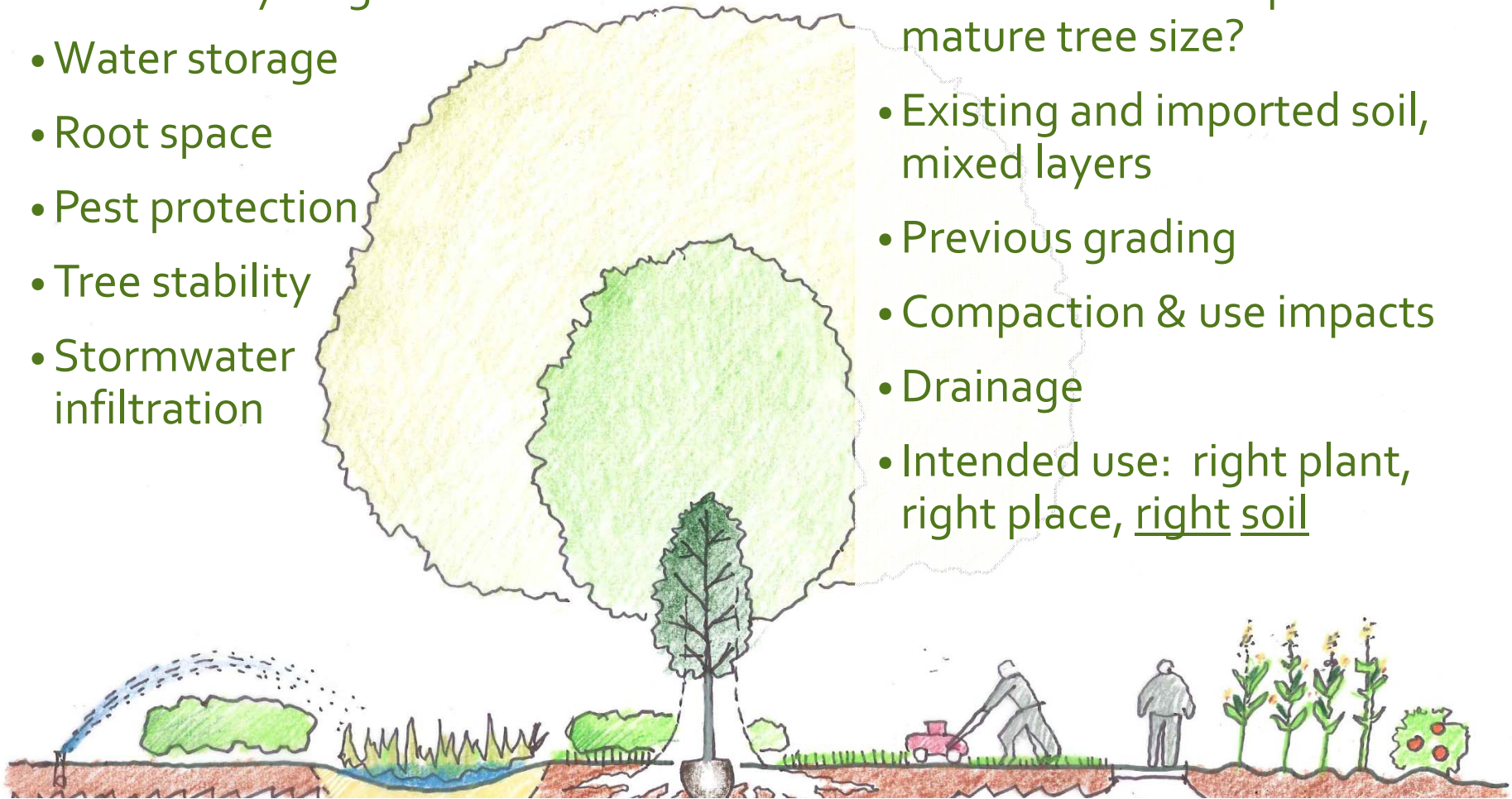
### Healthy soil is

- half mineral (sand, silt, clay, rocks)
- half pore space (air & water)
- plus a small but essential amount of organic matter and soil life

# Soil Functions and Soil Challenges

- Nutrient cycling
- Water storage
- Root space
- Pest protection
- Tree stability
- Stormwater infiltration

- Soil volume – adequate for mature tree size?
- Existing and imported soil, mixed layers
- Previous grading
- Compaction & use impacts
- Drainage
- Intended use: right plant, right place, right soil



# Sub-Soils in the Washington: Leftovers from glaciers & volcanoes



**Glacial till:** unsorted, un-stratified mixtures of clay, silt, sand, gravel, and boulders; deposited in moraines, and under ice

**Hardpan:** till compacted under glacier

**Outwash soils:** layers sorted by particle size by water  
- sand / gravel / rocks

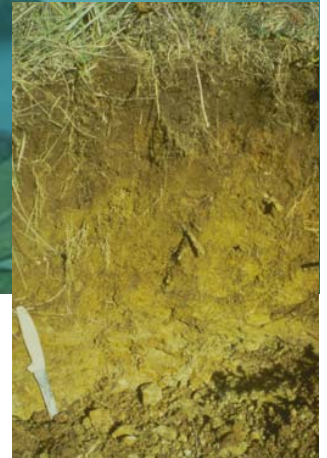




# Water deposited soils

**Lake/marine bed soils:** clay or silt that settled out in lakes & estuaries

**River bottom (alluvial) soils:** deposited by flooding



# Volcanic soils

**Volcanic ash:** light, fertile, holds moisture  
– mostly blown east of mountains

**Mudflows:** mixed size, compact - like till



*Learn about Washington soils at:*  
<http://puyallup.wsu.edu/soils/soils/>



# Disturbed soils in urban areas



- Topsoil layer removed
- Compaction
- Subsoil or fill layers
- Debris or toxins?





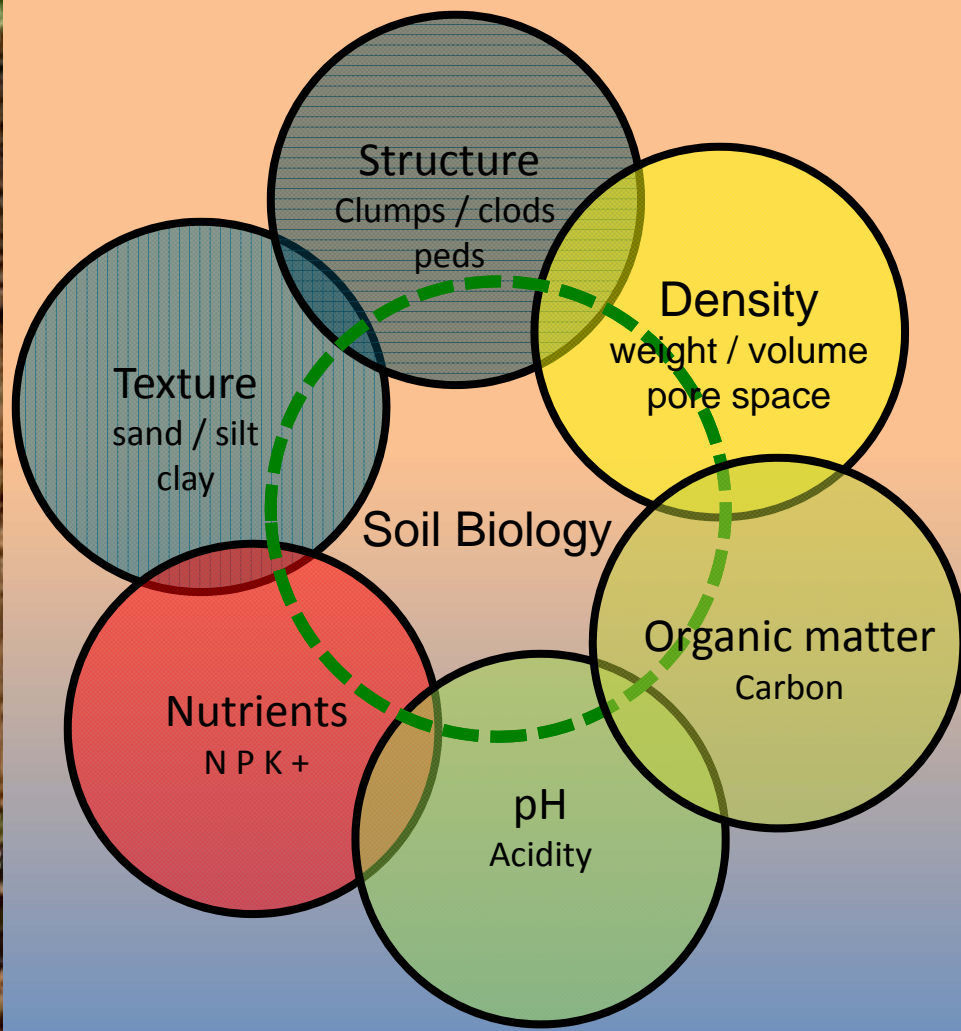
# Soil horizons (“soil profile”): develop from mineral “dirt” & rock

- Organic duff (O) and Topsoil (A) horizons created by biological processes
- Subsoil (B) created by physical and chemical processes from Substratum (C) or Bedrock (R)

<http://soils.usda.gov>

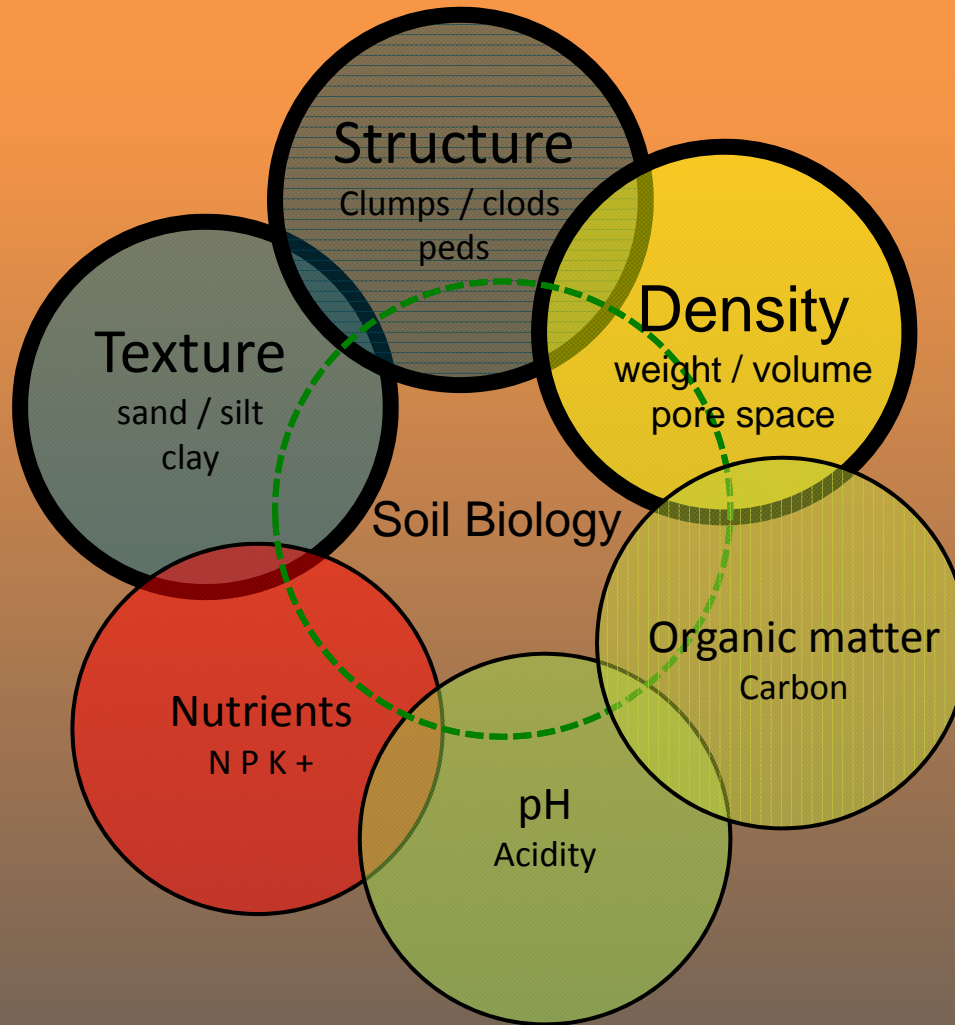


# Soil properties & processes



Air and water movement / soil profile

# Physical properties of soil

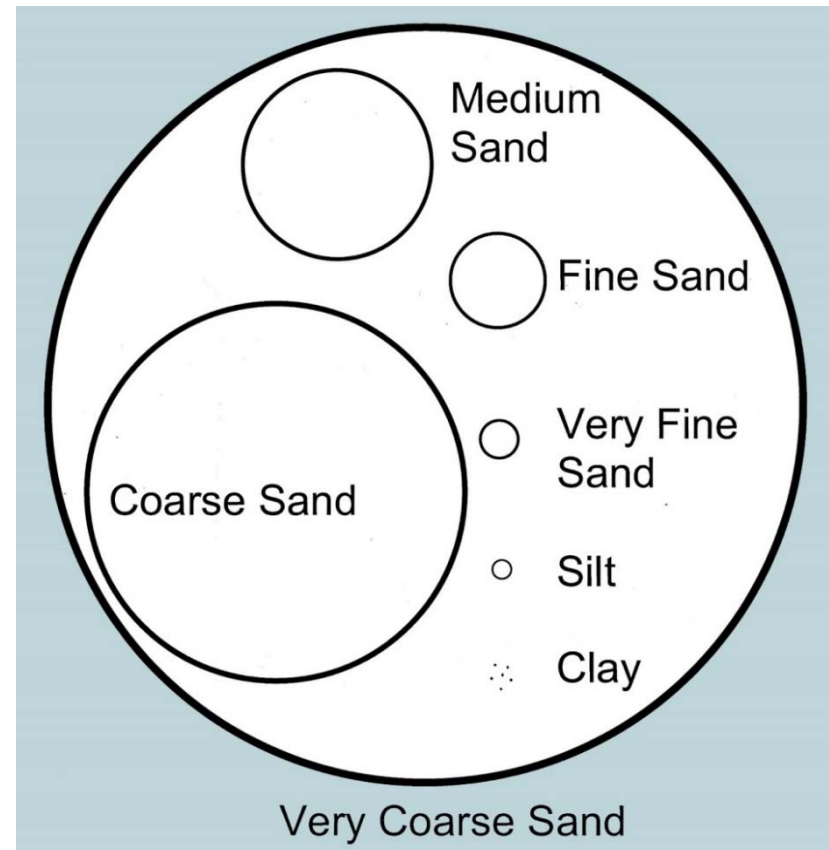
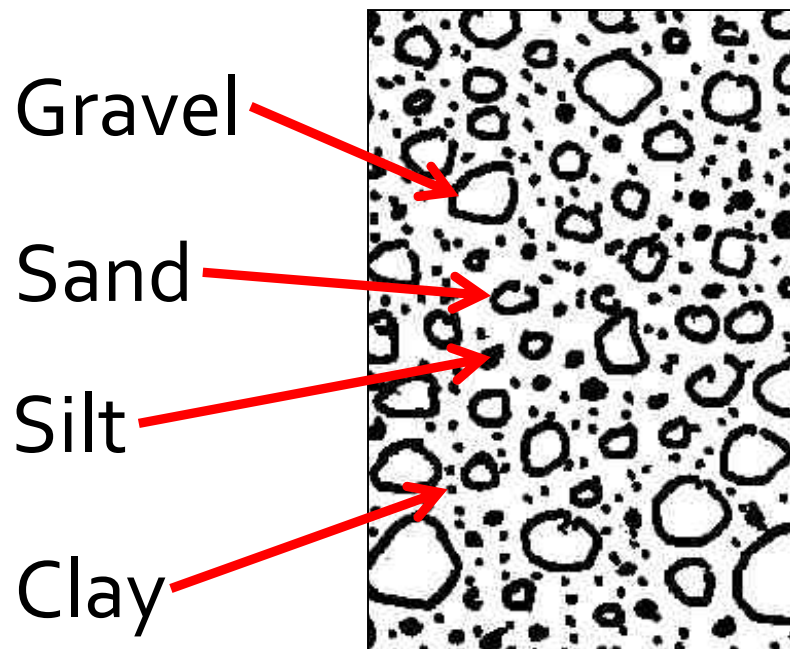


Air and water movement / Soil Profile



# Soil Texture = particle size

- **Sandy soils** absorb water quickly, but hold less water and nutrients.
- **Clay soils** absorb water slowly, but hold more water and nutrients.



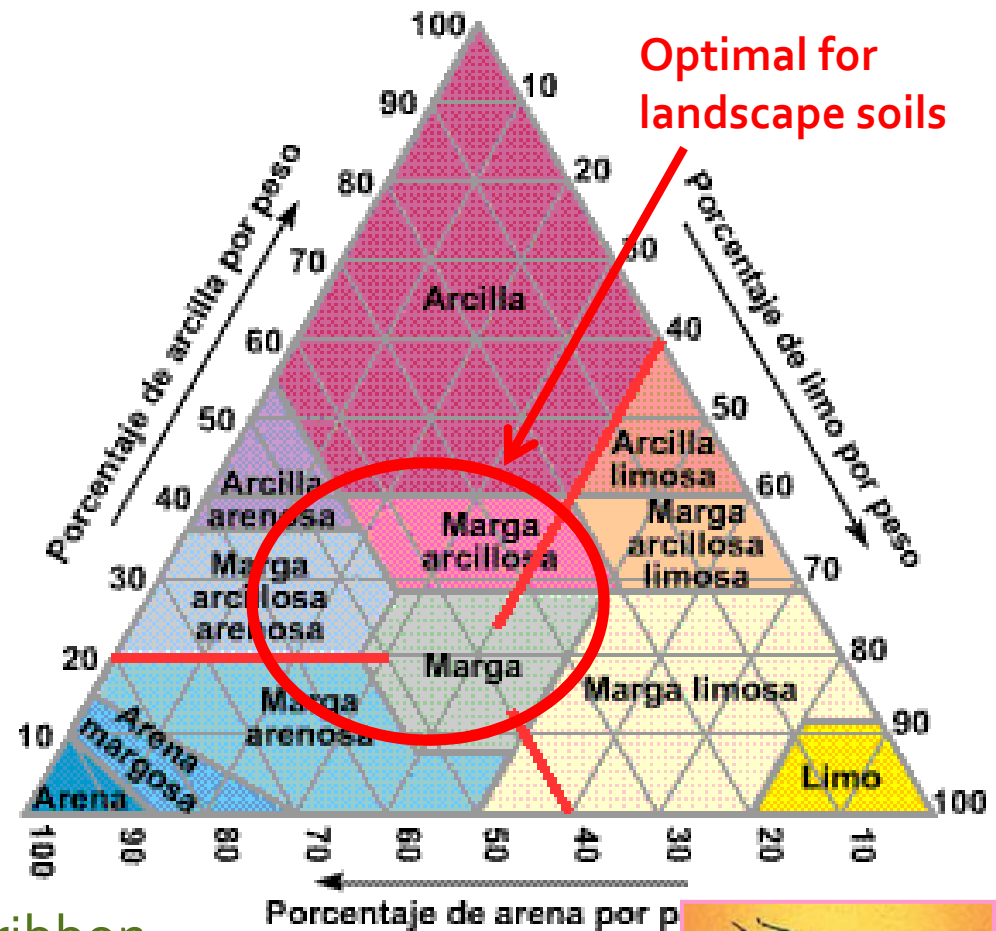
**Compost** helps all soil types absorb and store more water and nutrients in plant-available forms.

# Soil Texture Test

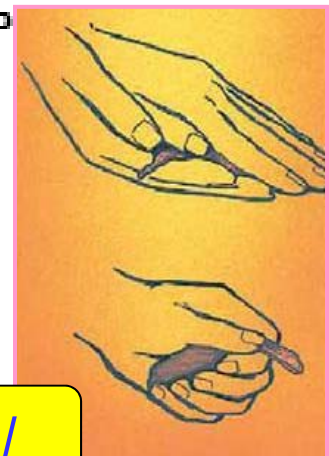
## Ribbon + feel test:

Moisten soil, roll between hands, then squeeze out with thumb:

- Sand: no ribbon, grainy
- Sandy loam: ½ inch ribbon
- Loam: thick 1 inch ribbon
- Silt: makes flakes rather than ribbon
- Silty clay loam: thin, breaks easily, has floury feel
- Sandy clay loam: stronger, has grainy feel
- Clay: long (3 inch) ribbon, has smooth feel



Optimal for landscape soils



See video at <http://puyallup.wsu.edu/soils/soils/>

# Soil Structure = strength, clods & pore spaces

- Soil life, roots, and clay stick smaller particles together into larger aggregates, clods or “peds”
- Soil life creates pore spaces, for air, water and root movement.

Peds = Clods

Macro-Pores

Micro-Pores



Don't grind up your soil!  
Mix loosely to preserve  
the peds & pore spaces.

Don't till wet soil – it  
compacts the pores.



Sandy soil - little structure

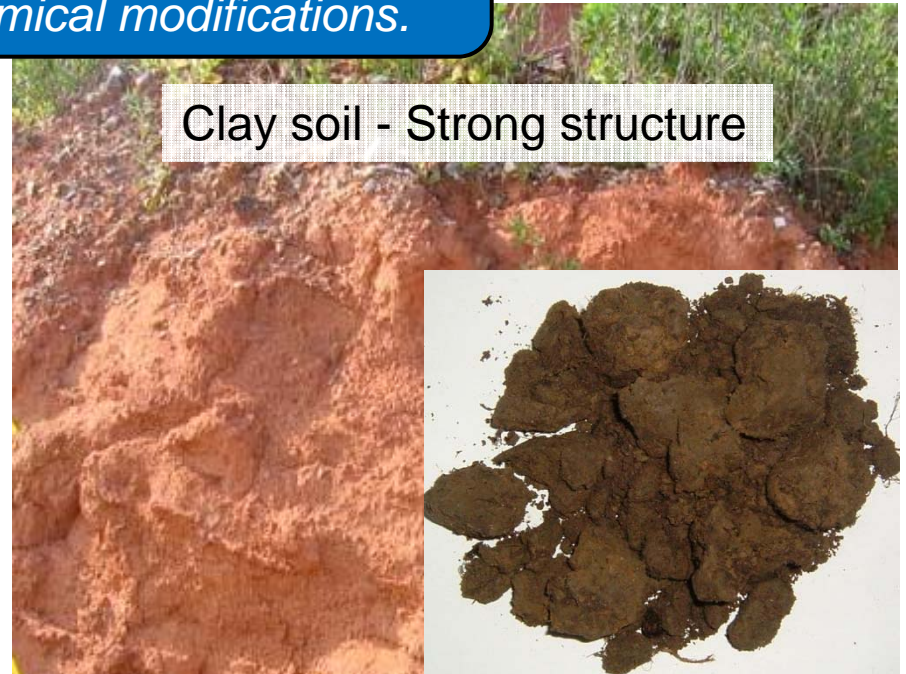


*Organic amendments (compost) improve structure in all soil types, through biological activity and bio-chemical modifications.*

Silt soil - Weak structure

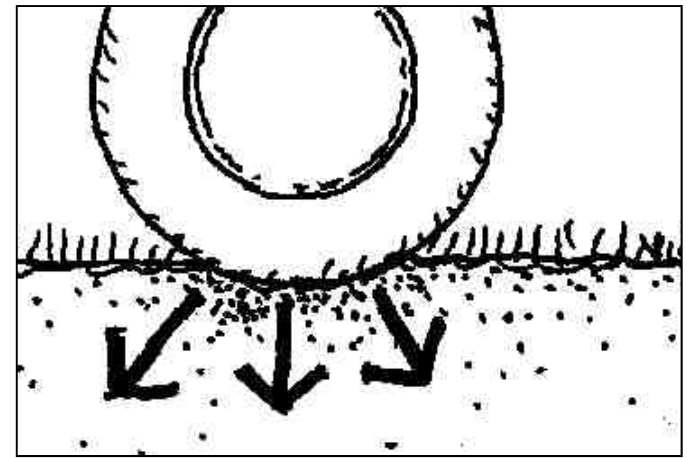


Clay soil - Strong structure

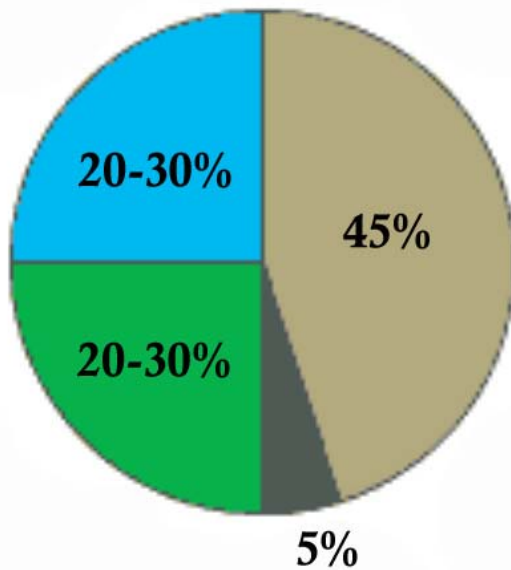


# Density or Compaction

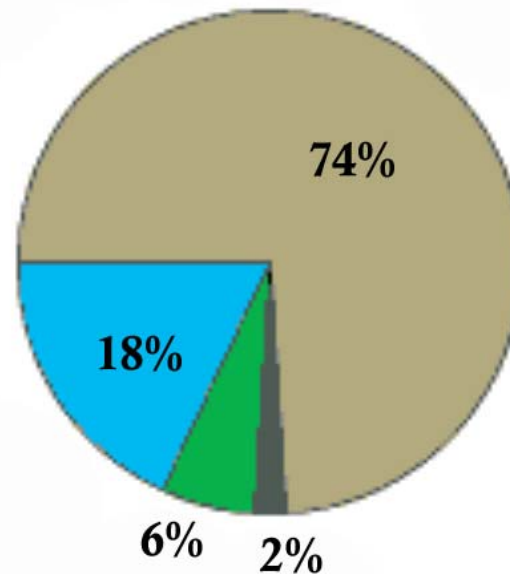
As compaction increases, pore space for water, air, and roots decreases.



Healthy soils



Compacted urban soils



## Soil solid matter

- Mineral
- Organic

## Soil pore spaces

- Water
- Air

Nutrients move by air and water, and roots need space, so compaction can cause nutrient deficiencies.



# Compaction & grading impacts

- Tree root damage = breaking hazard & early death
- Reduced air & water penetration
- Reduced resistance to disease
- Less beneficial soil life
- Less nutrient availability
- Less root space
- Poor plant growth!





# Causes of soil compaction

- Topsoil removal
- Loss of organic matter
- Vehicle and foot traffic
- Excessive tilling, especially wet soils
- Overuse of soluble fertilizers and pesticides, which damage soil life.

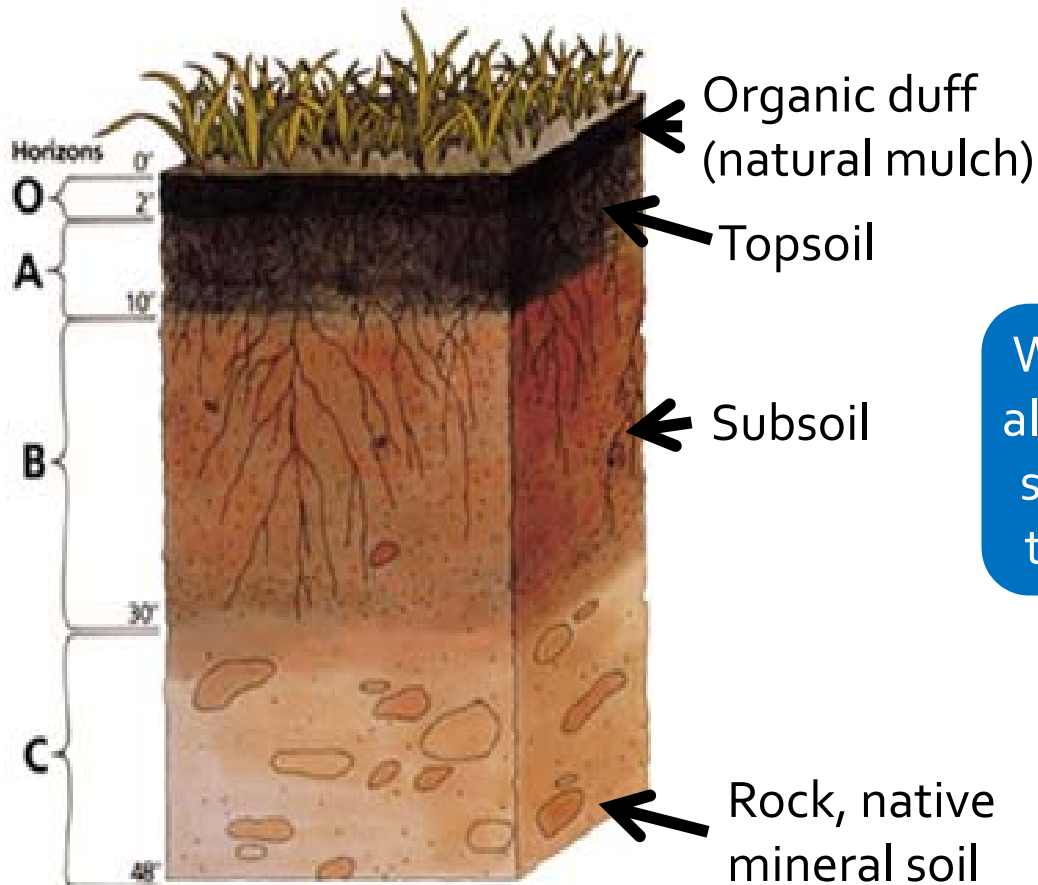


## Restoring compacted soils:

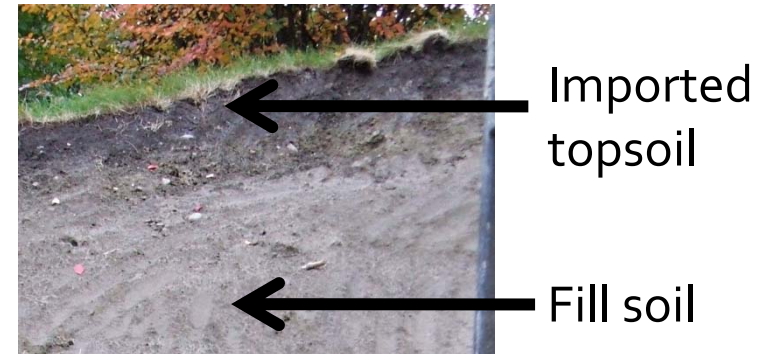
- Rip or loosely till to incorporate compost, but leave clods intact
- Maintain mulch layers on beds, and mulch mow lawns, leaving clippings to feed soil life
- Reduce use of soluble fertilizers and pesticides.

# Soil profile

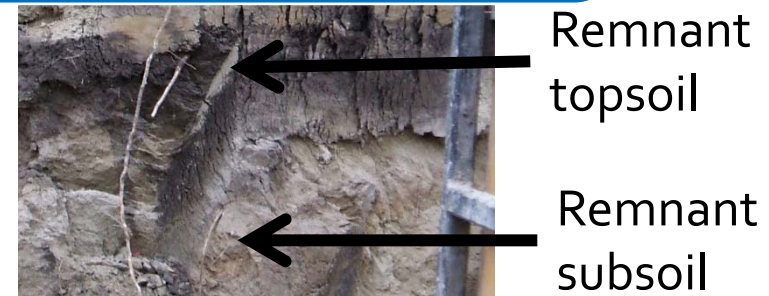
Adding fill layers can create “interfaces” = sharp changes in soil texture that limit air, water, and root movement.



Natural soil profile



When adding fill is necessary, always rip or till new layer into several inches of lower layer, to avoid interface problems.



Disturbed urban soil





Changes in soil type



Examining a soil profile with a Dutch soil auger



Examining a soil profile with a soil probe / core sampler

*Only works 6 -12" deep, so better for lawns than trees.*



**Compacted vs. Amended**

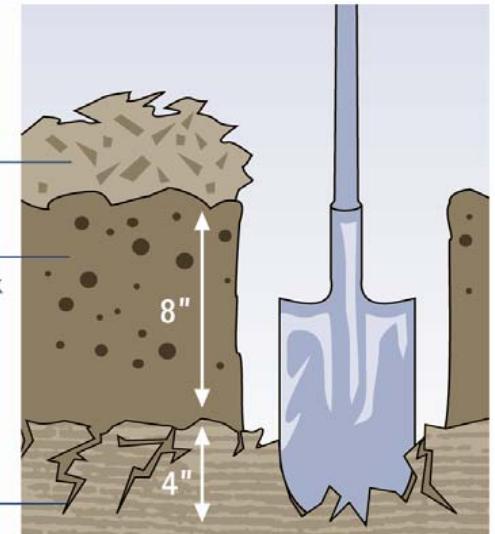
Examining soil profile with shovel

**MULCH**

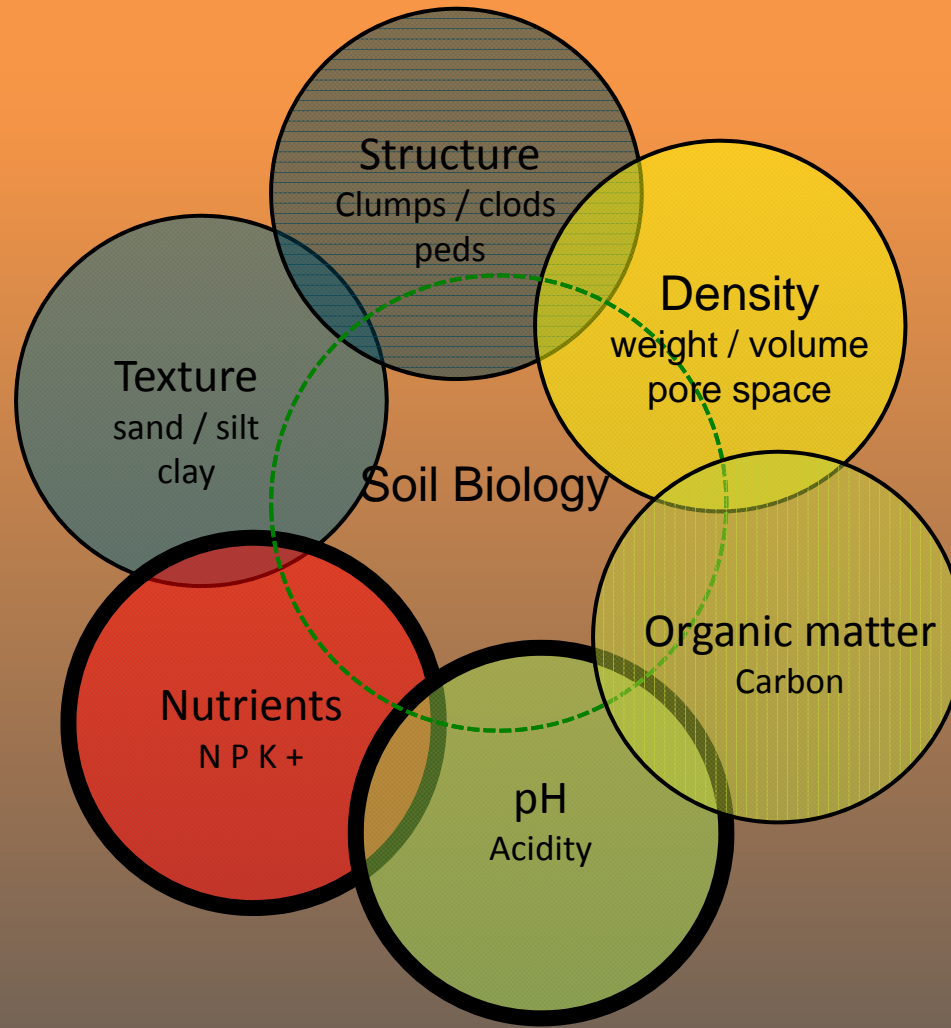
**LOOSE SOIL**

with visible dark organic matter

**LOOSE OR FRACTURED SUBSOIL**



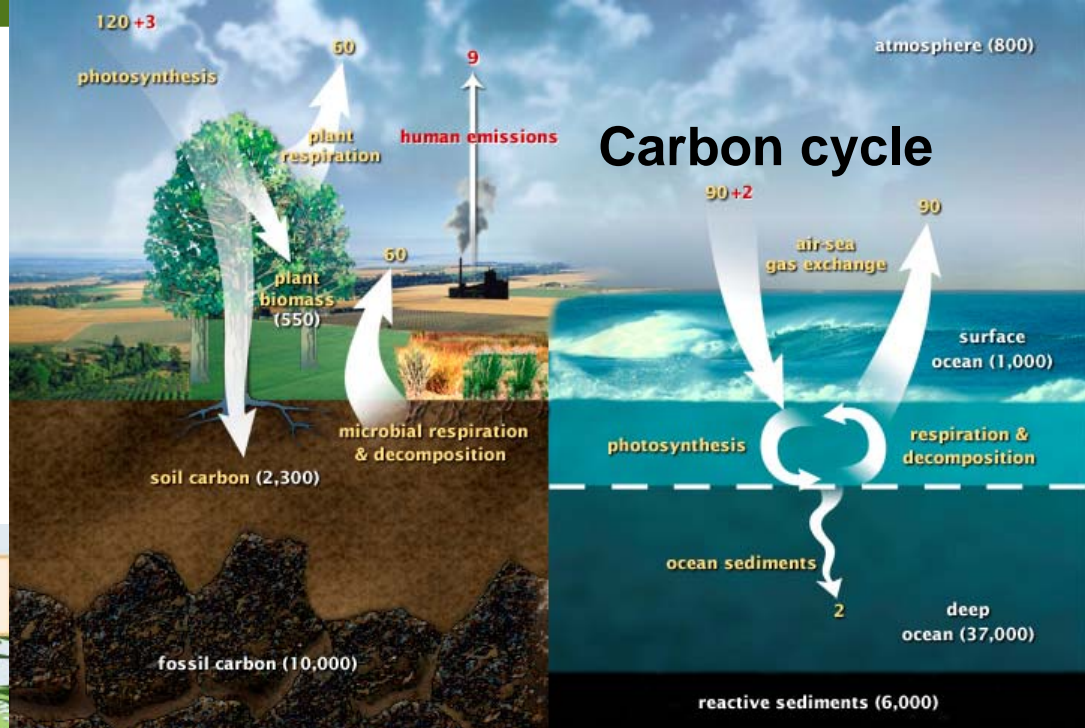
# Chemical properties of soil



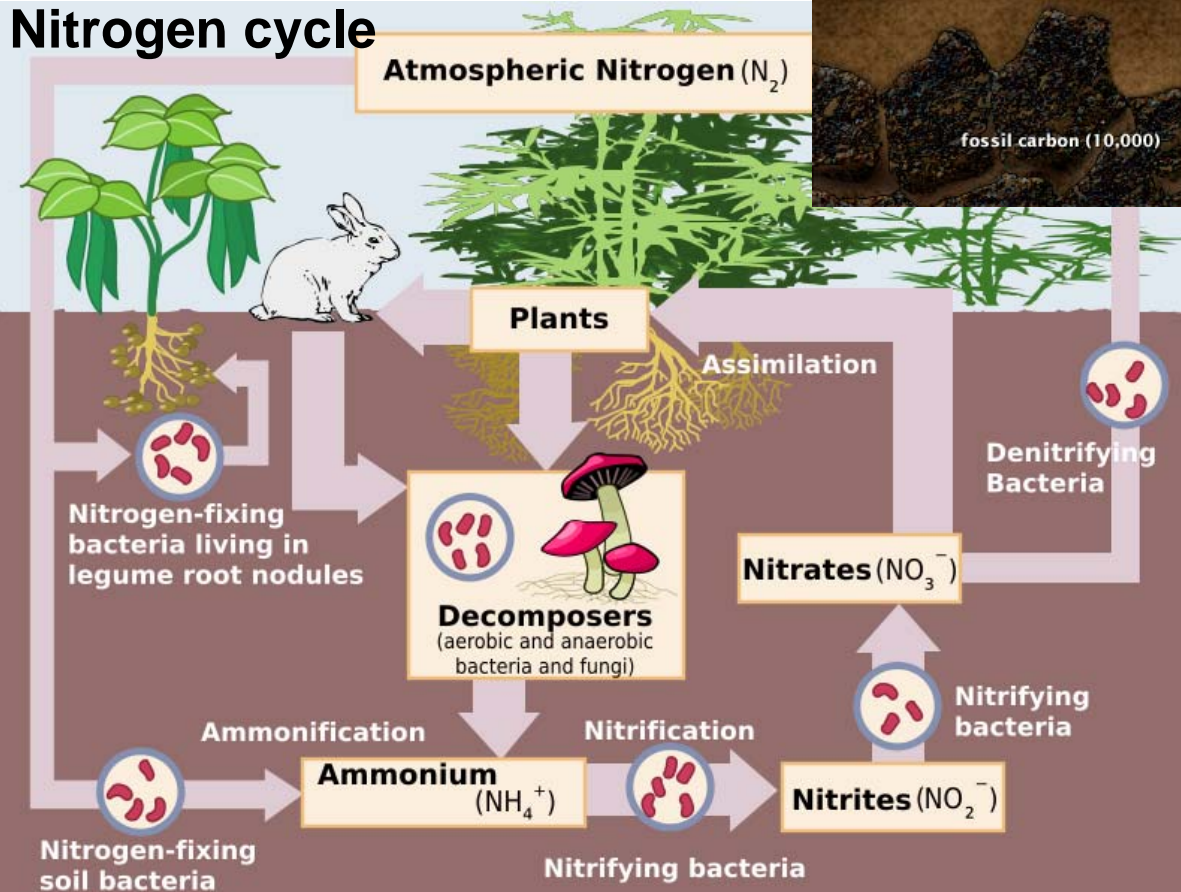
Air and water movement / soil profile



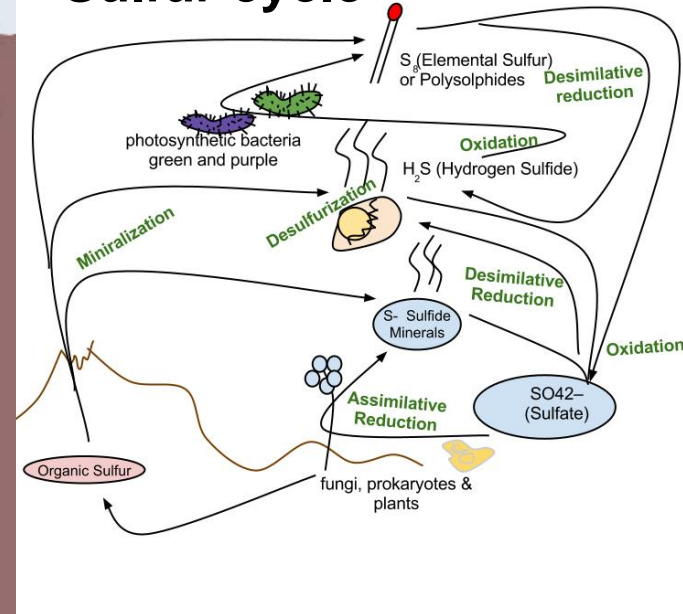
# Chemical properties of soil = endless cycles



## Nitrogen cycle



## Sulfur cycle





# Elements (nutrients) required by plants

## air & water

### Base elements

Oxygen (O)

Hydrogen (H)

Carbon (C)

## soil (bacteria fix N from air)

### Macronutrients

Nitrogen (N)

Phosphorus (P)

Potassium (K)

Calcium (Ca)

Magnesium (Mg)

Sulfur (S)

### Micronutrients

Boron (B)

Chlorine (Cl)

Cobalt (Co)

Copper (Cu)

Iron (Fe)

Manganese (Mn)

Molybdenum (Mo)

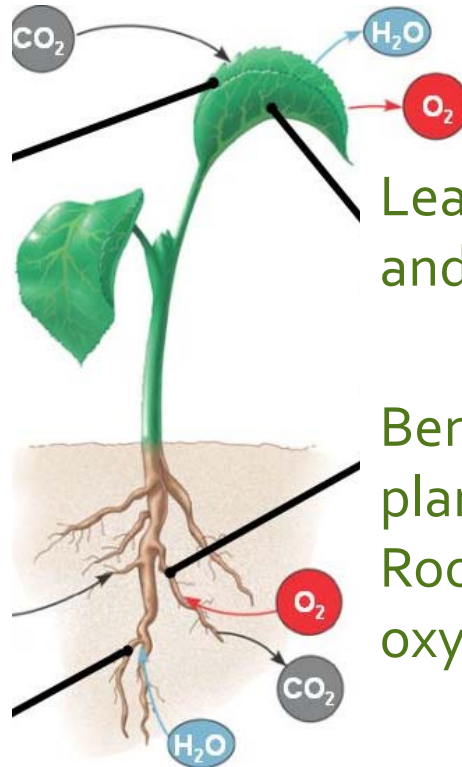
Zinc (Zn)

# How plants get nutrients

Sunlight provides energy for photosynthesis:



Plants use carbon dioxide and water to make sugar and starch, for energy and structures.



Leaf pores absorb carbon dioxide, and expel oxygen and water.

Roots absorb mineral nutrients and water from soil.

Beneficial fungi & bacteria help plants get nutrients and water. Roots also “breathe”: exchange oxygen and carbon dioxide.

image: extension.missouri.edu

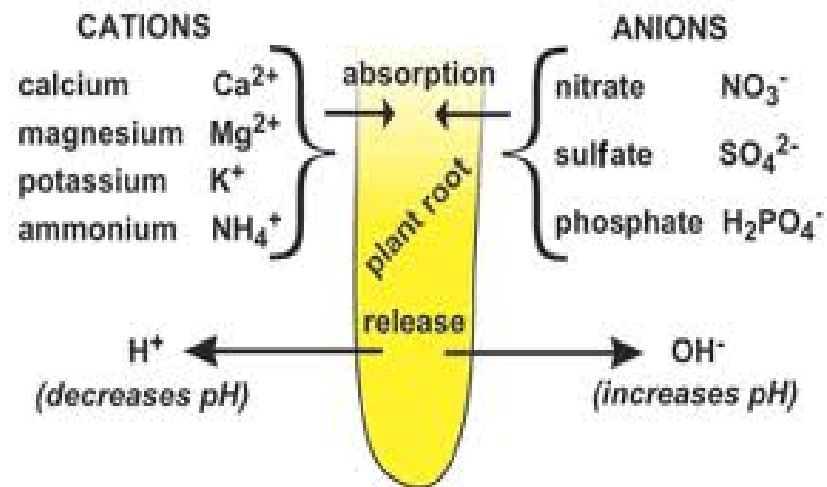
Plants get their essential nutrients from the soil. Fertilizers supplement, but don't replace soil fertility.

# Cation Exchange Capacity (CEC)

**Cations** = positively charged nutrients, dissolved in water in soil

**Cation Exchange Capacity (CEC)** is the ability of soil particles to hold and release nutrients for use by plants and micro-organisms.

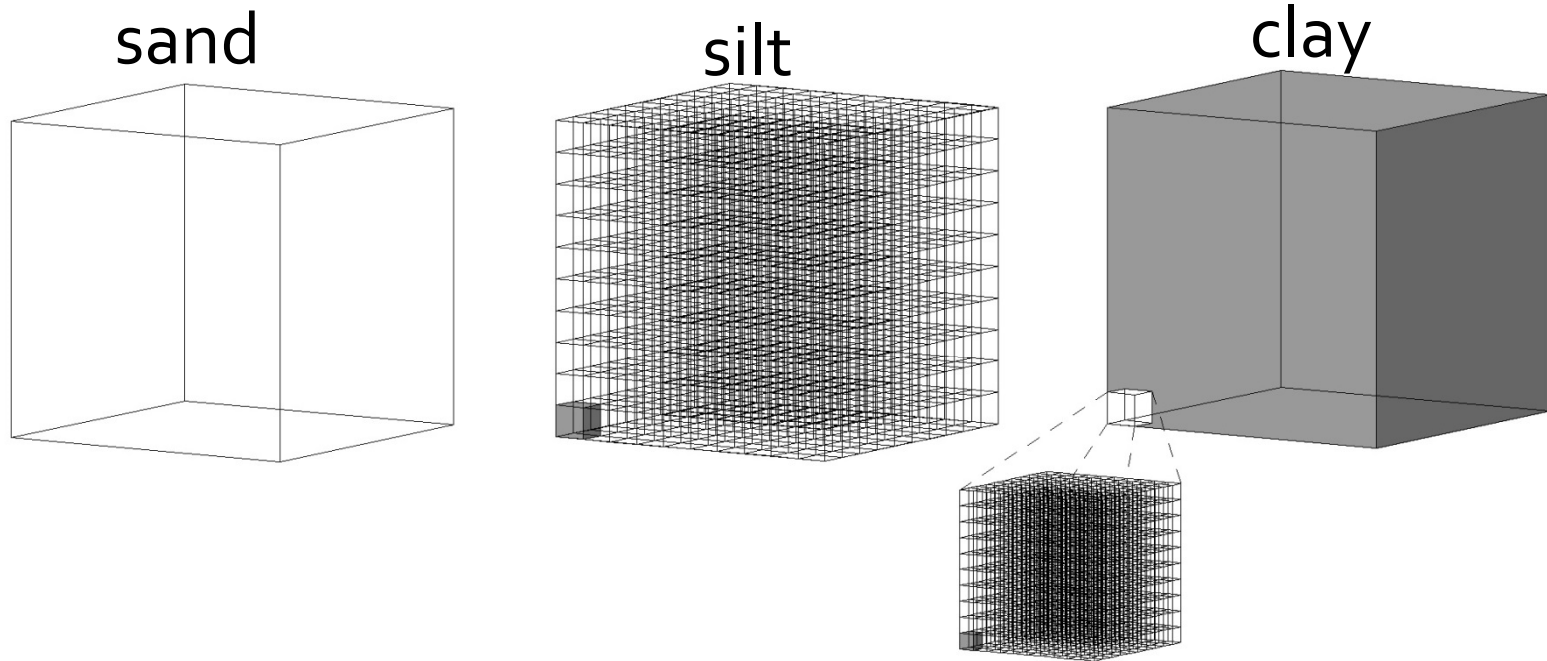
CEC determines which nutrients are available for uptake by plant roots and which nutrients remain in soil and are not available to plants.





# Clay and organic-rich soils provide more nutrients

Clay or silt soils have more surface area than sand, so have more Cation Exchange Capacity = more nutrient availability



Compost and soil organic matter (“humus”) increase CEC nutrient-holding capacity, from a CEC of 5 in sandy soils up to 200!

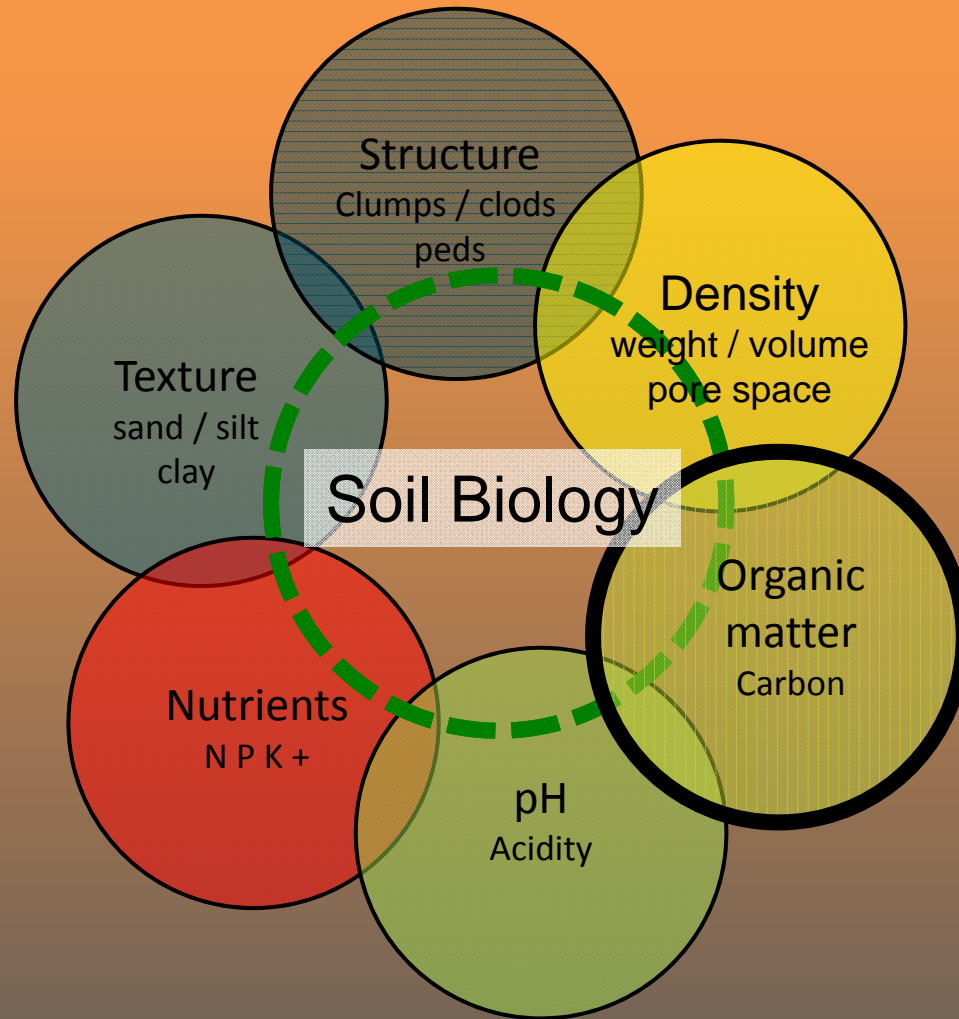
# pH = Acidity ↔ Alkalinity

**Lowering pH** (increasing acidity) increases availability of cations, but decreases availability of anions

*Humus (compost) buffers soil pH towards 6.3 to 6.8, which is optimal for nutrient availability.*

<b>Acid</b>	<b>pH range</b>	
Ultra acid	1.8 - 3.4	Toxic to most plants
Extremely acid	3.5 - 4.4	Restrictive to most plants
Very strong acid	4.5 - 5.0	
Strongly acid	5.1 - 5.5	Acid-tolerant plants
Moderately acid	5.6 - 6.0	
Slightly acid	6.1 - 6.5	Best nutrient availability for most plants
<b>Neutral = 7</b>	6.6 - 7.3	
Slightly alkaline	7.4 - 7.8	Alkaline-tolerant plants
Moderately alkaline	7.9 - 8.4	
Strongly alkaline	8.5 - 9.0	Restrictive to most plants
Very strongly alkaline	9.1 - 11.0	Toxic to most plants
<b>Alkaline</b>		

# Organic & Biological properties of soil

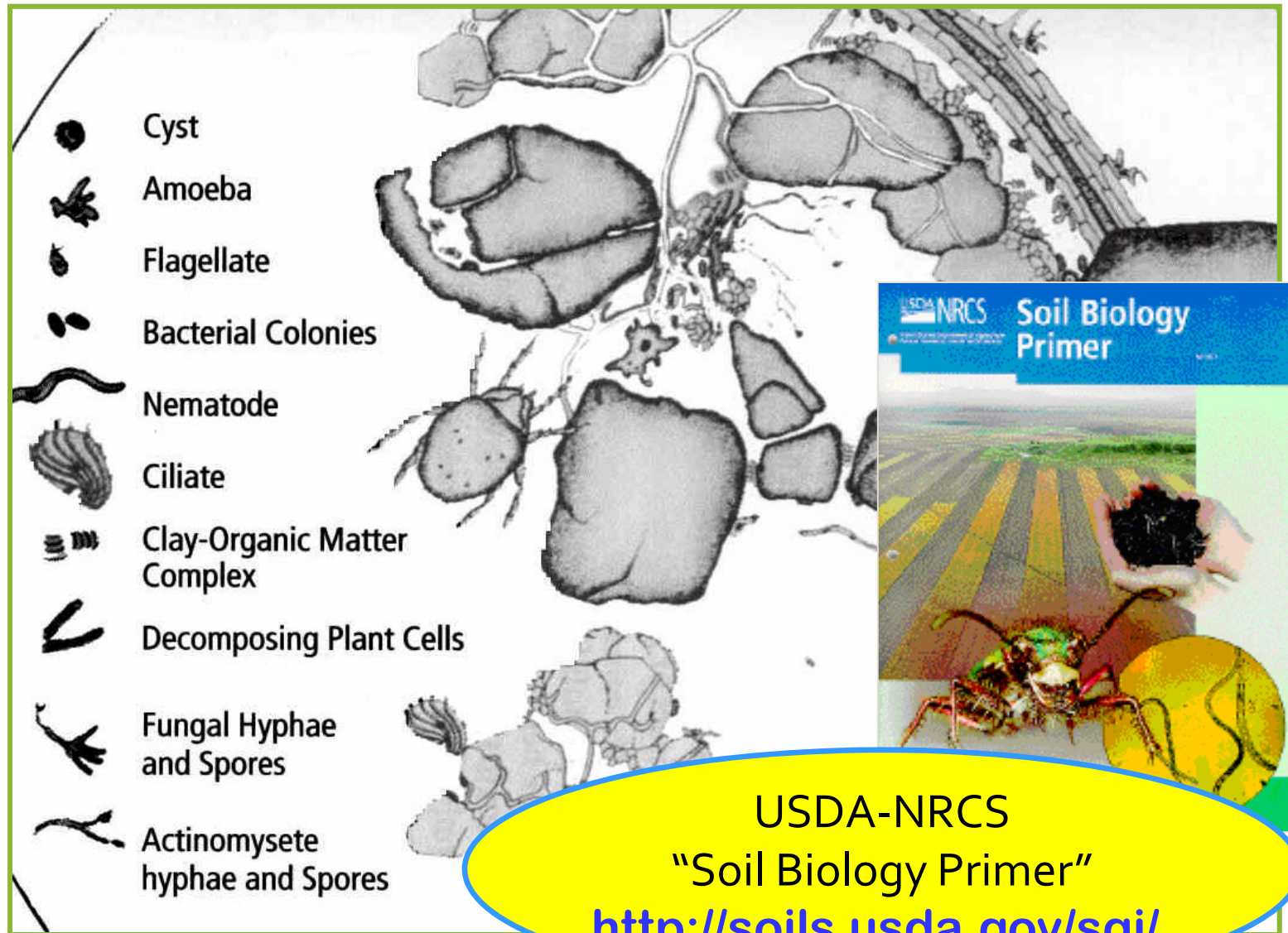


Air and water movement / soil profile



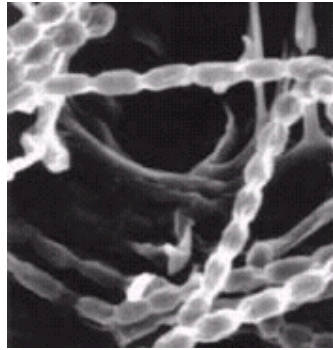
# Soil life provides essential functions

Soil  
is  
alive!

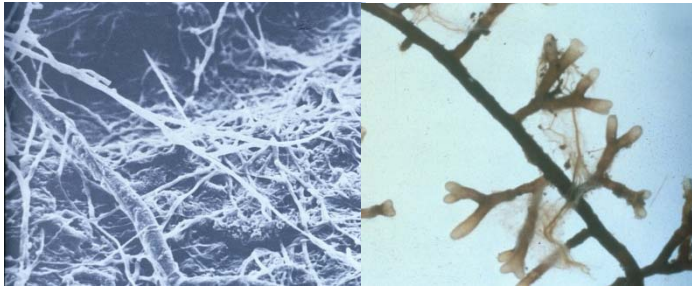


# Common organisms in the soil ecosystem

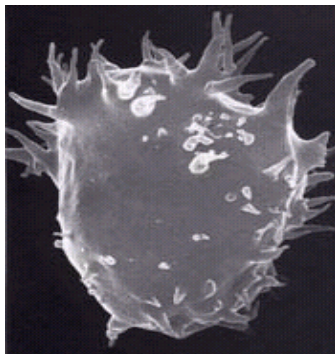
Bacteria



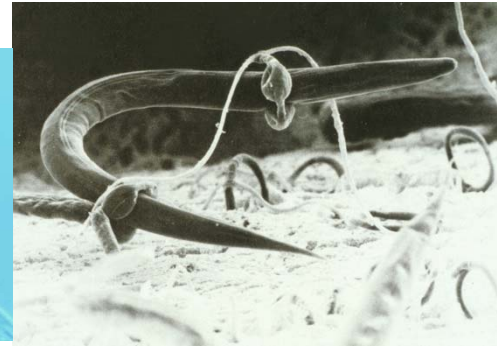
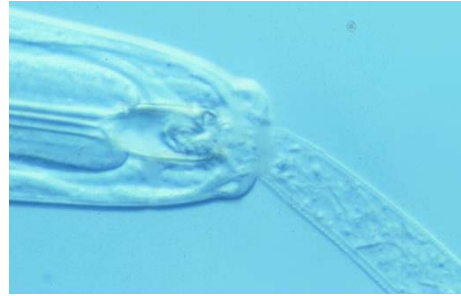
Fungi



Protozoa



Nematodes



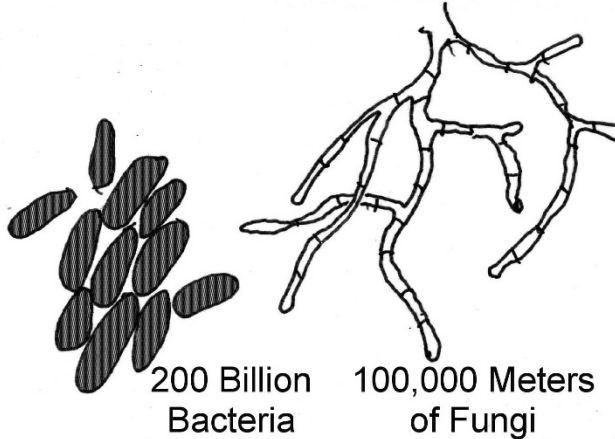
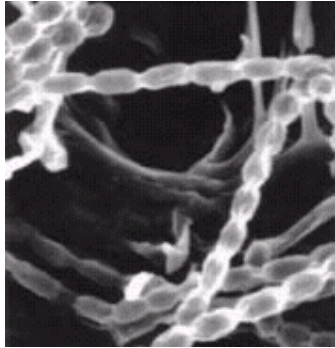
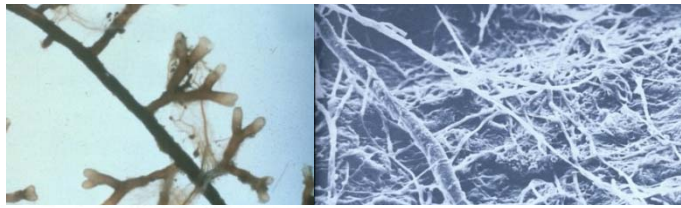
Arthropods



Earthworms



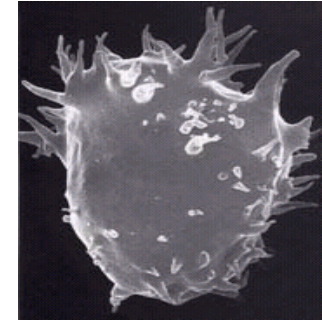




200 Billion Bacteria

100,000 Meters of Fungi

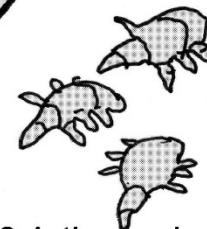
20 Million Protozoa



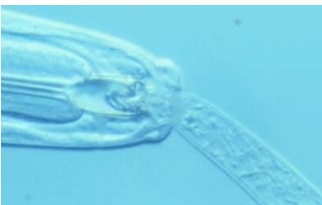
Avoid broadcast use of herbicides, insecticides, and fungicides, to protect beneficial soil life.



100,000 Nematodes



50,000 Arthropods





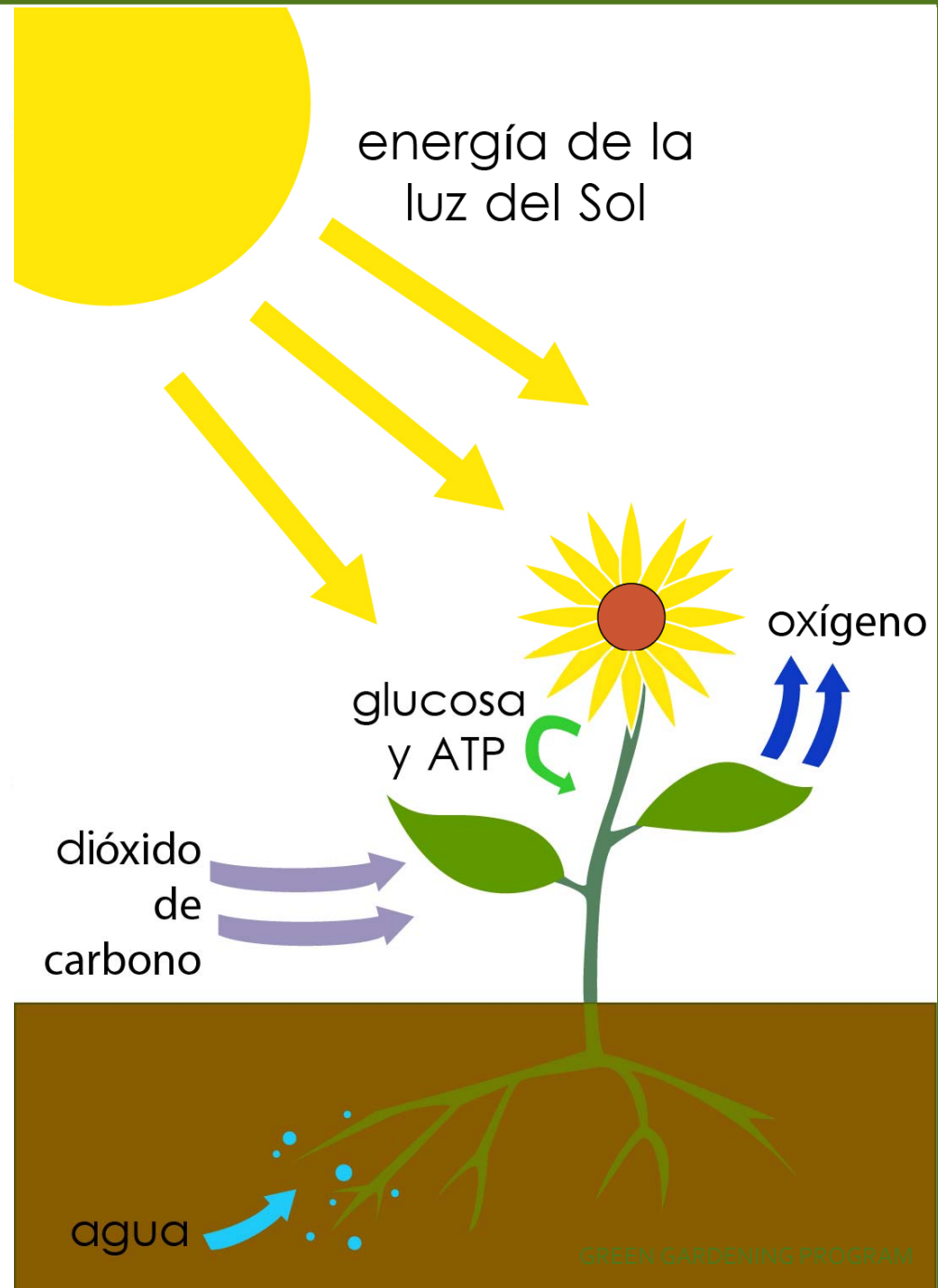
# What fuels the soil ecosystem?

## Plant **photosynthesis**:

Sunlight + CO<sub>2</sub> + water → carbohydrates (sugars)+ energy

Plants release 20-30% of their carbohydrates into their root zone to feed beneficial soil organisms (bacteria & fungi).

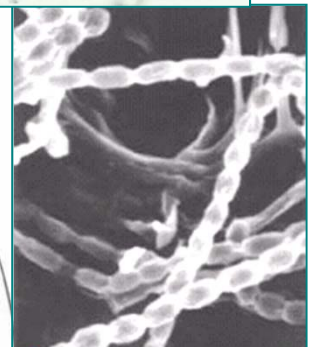
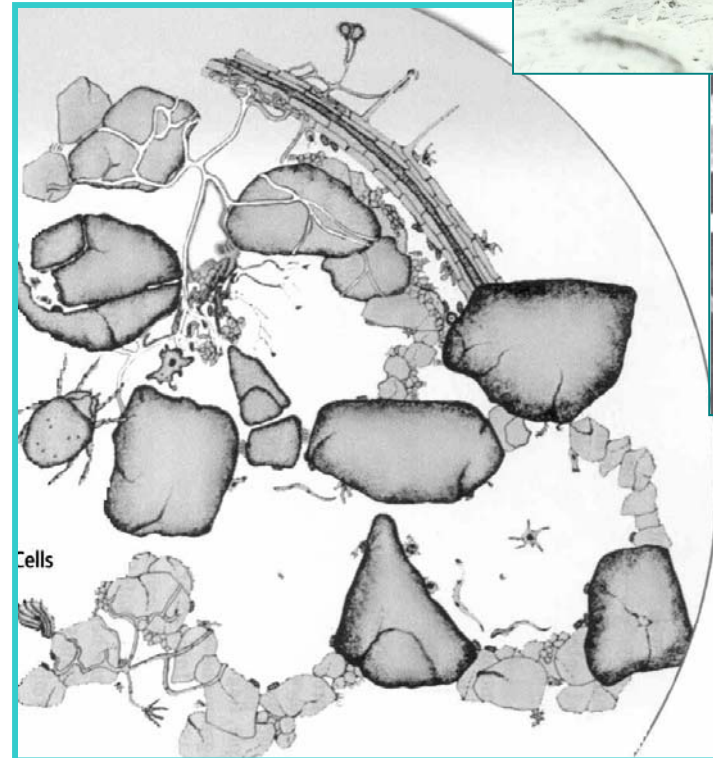
Dead plants, leaves & roots also feed soil life.



# Restore soil life, to restore soil functions

## Soil organisms create:

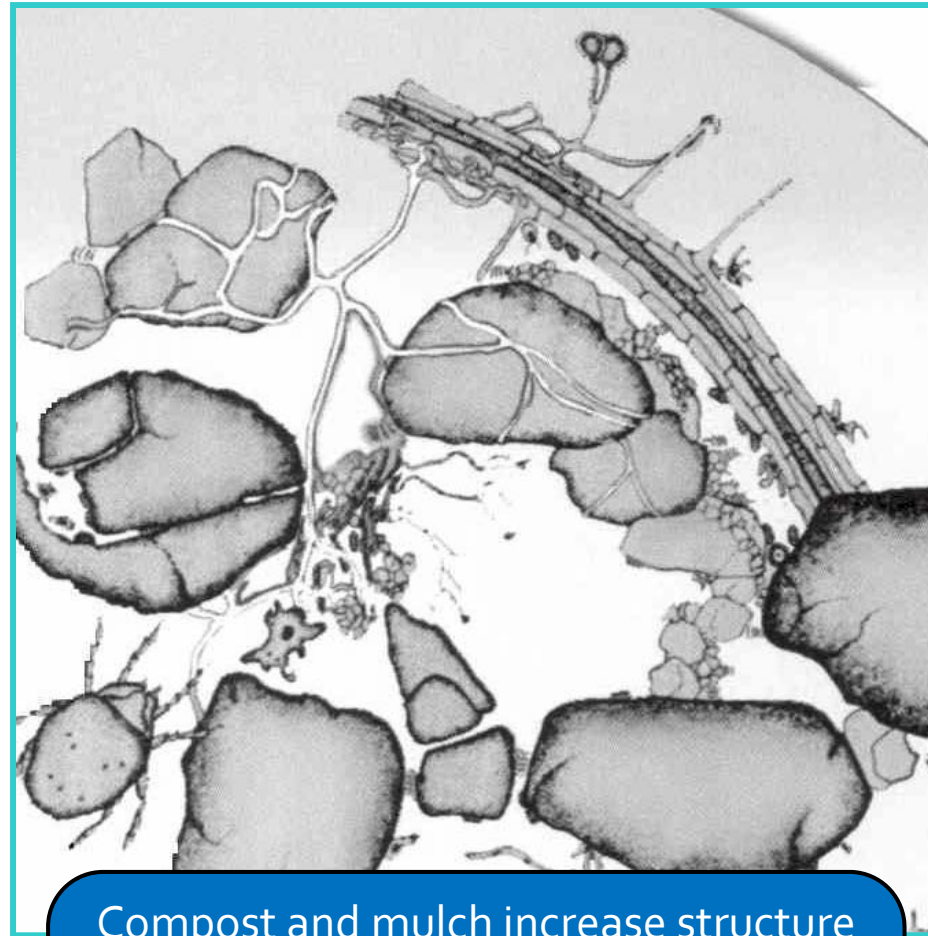
- Soil structure
- Fertility = nutrient cycling
- Plant disease protection
- Bio-filtration of pollutants
- Erosion control
- Storm water detention & moisture capacity



Compost helps restore healthy soil function, by feeding and providing homes for the beneficial soil organisms.

# How does soil life create soil structure?

- Bacteria secretions glue clays, silts and sands together into micro-aggregates.
- Micro-aggregates are bound together by fungi and roots.
- Spaces are made by moving arthropods & earthworms, and decaying roots.
- Only when all organisms are present can roots and water move into the soil easily.



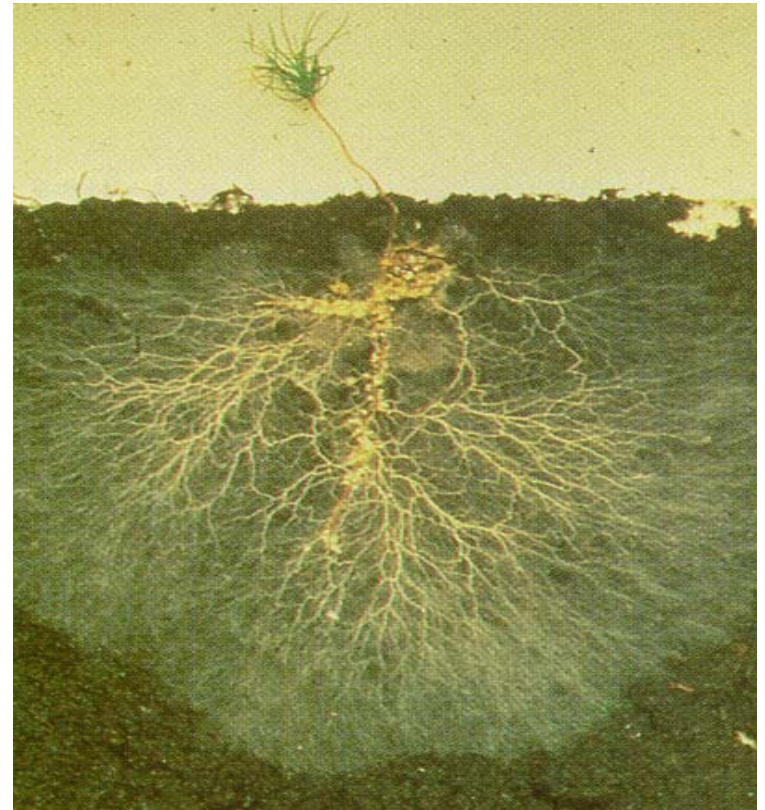
Compost and mulch increase structure and pore space. That increases soil water holding capacity, helping protect plants from summer drought.



# How does soil life provide fertility (nutrient cycling)?

- Soil ecosystem stores nutrients in living & dead organic matter
- Nutrients are released in root zone as organisms eat and excrete “waste” (nitrogen, etc.)
- Mycorrhizal fungi\* bring nutrients and water to roots of plants

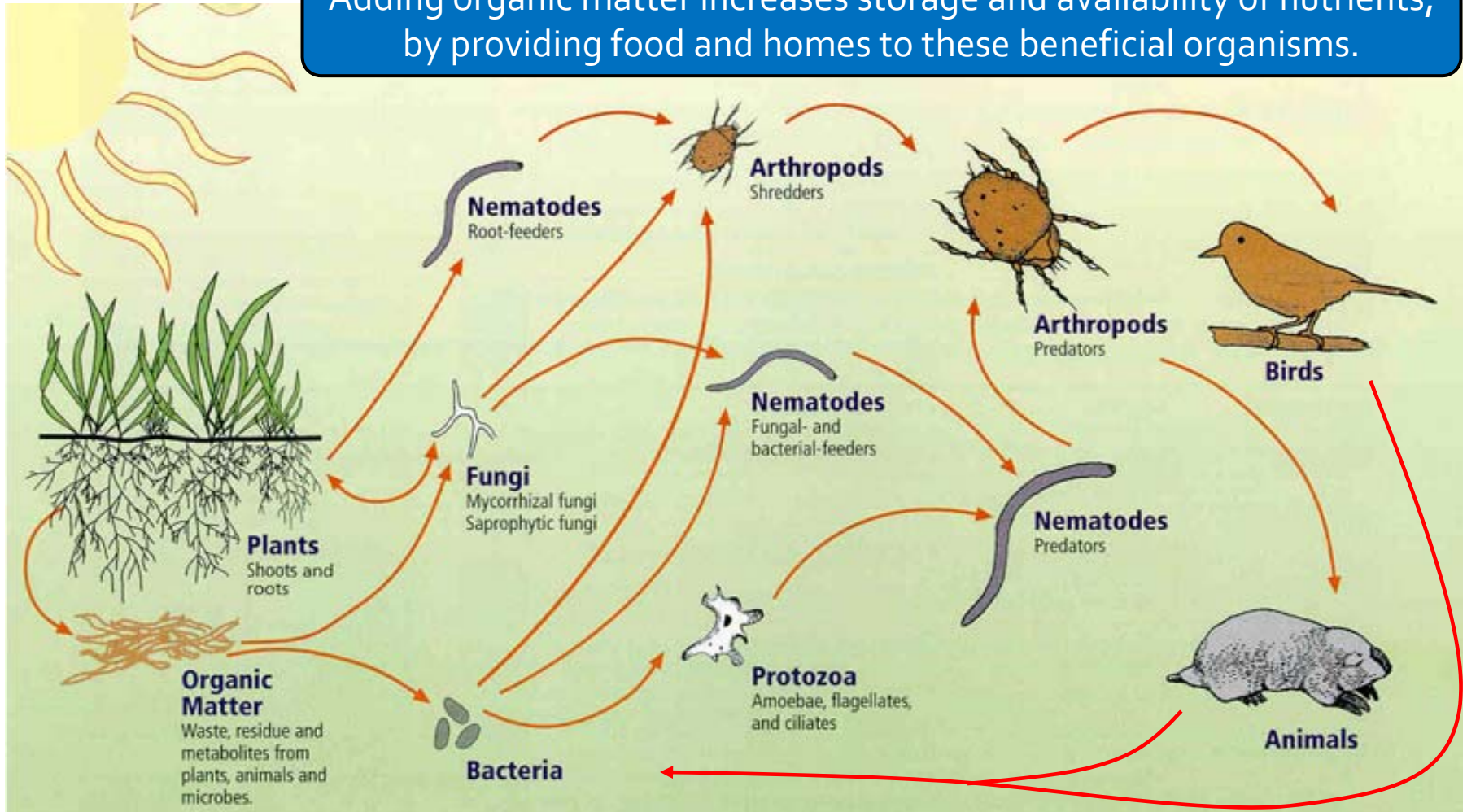
\*“Mycorrhizal” means “root fungus”. Most plants have these beneficial fungi in their roots. They grow out into the soil to bring water and nutrients to the plant, and protect the plant from disease. The plant provides carbohydrates (sugar) to the fungus.



# The soil food web

Nutrients are stored when organisms eat & grow, and released to plants when organisms excrete excess nutrients, or die and decay.

Adding organic matter increases storage and availability of nutrients, by providing food and homes to these beneficial organisms.

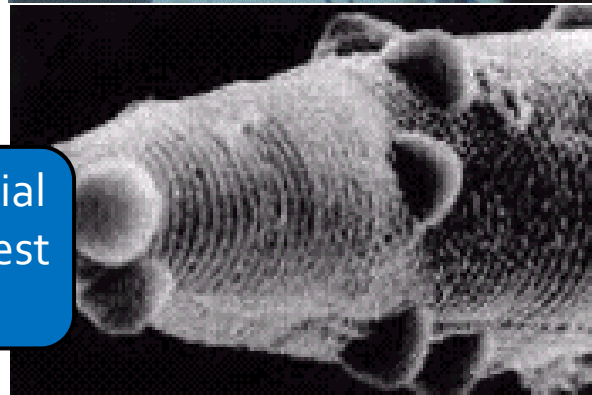
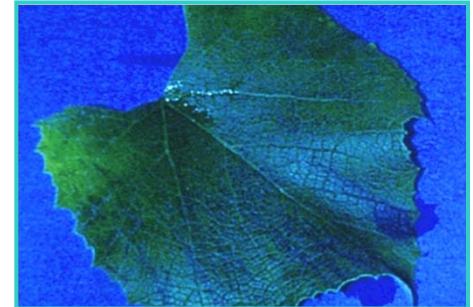
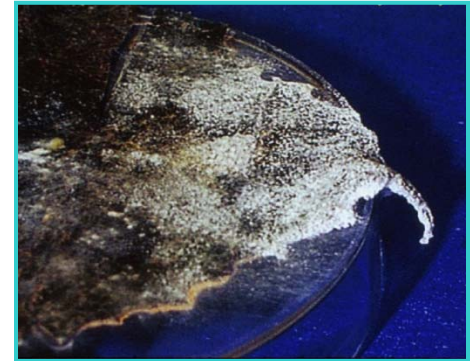
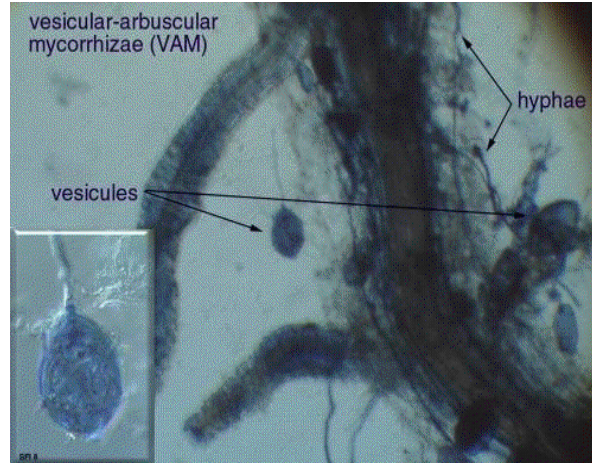




# How does soil life provide plant disease protection?

Diversity  $\Rightarrow$  predation, parasitization & competition with the few disease-causing organisms

- Bacteria cover leaf surfaces, block infection
- Mycorrhizae prevent root infection
- Many organisms prey on the few disease-causing organisms



Pesticides often disrupt beneficial organisms, causing increased pest problems over time.



# How can we restore soil organisms, to improve soil moisture & nutrient capacity, and plant growth?

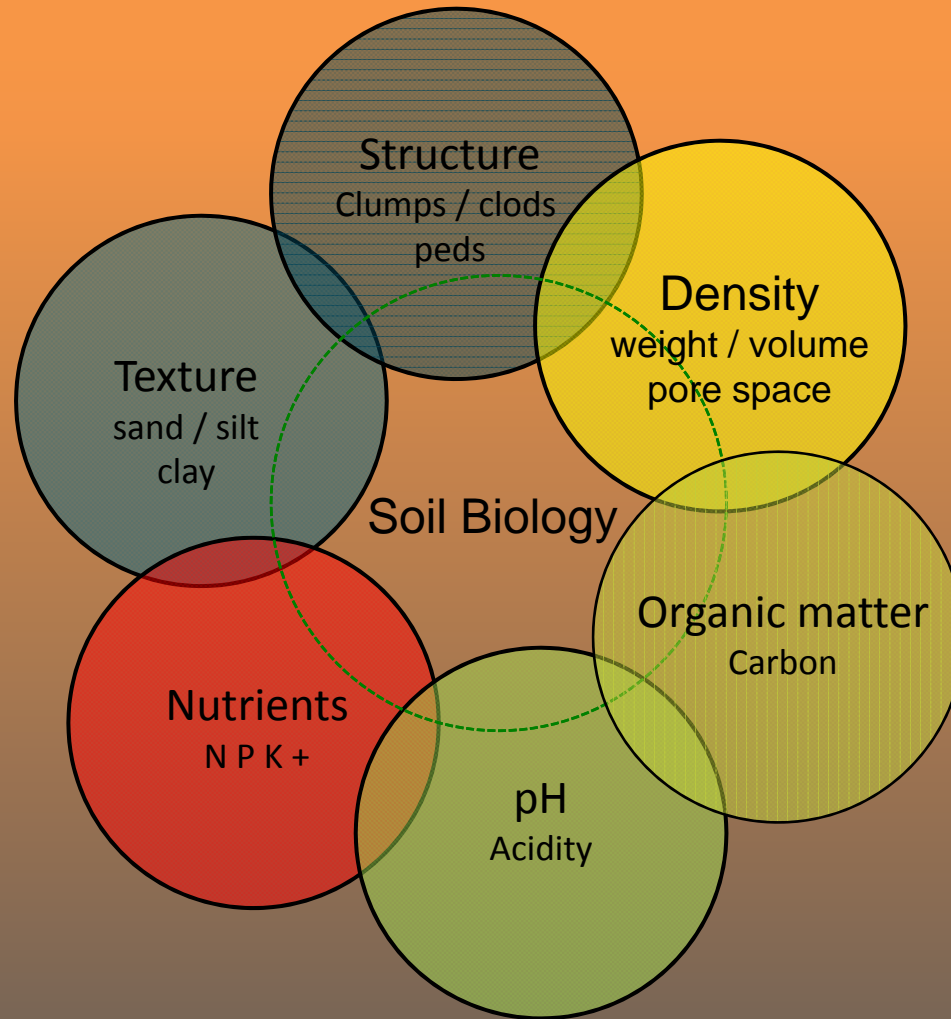
- Prevent /reduce compaction (keep heavy machinery off)
- Reduce intensive use of pesticides & soluble fertilizers
- Incorporate compost into soil, leave grass clippings & leaf litter, and mulch regularly, to feed soil life



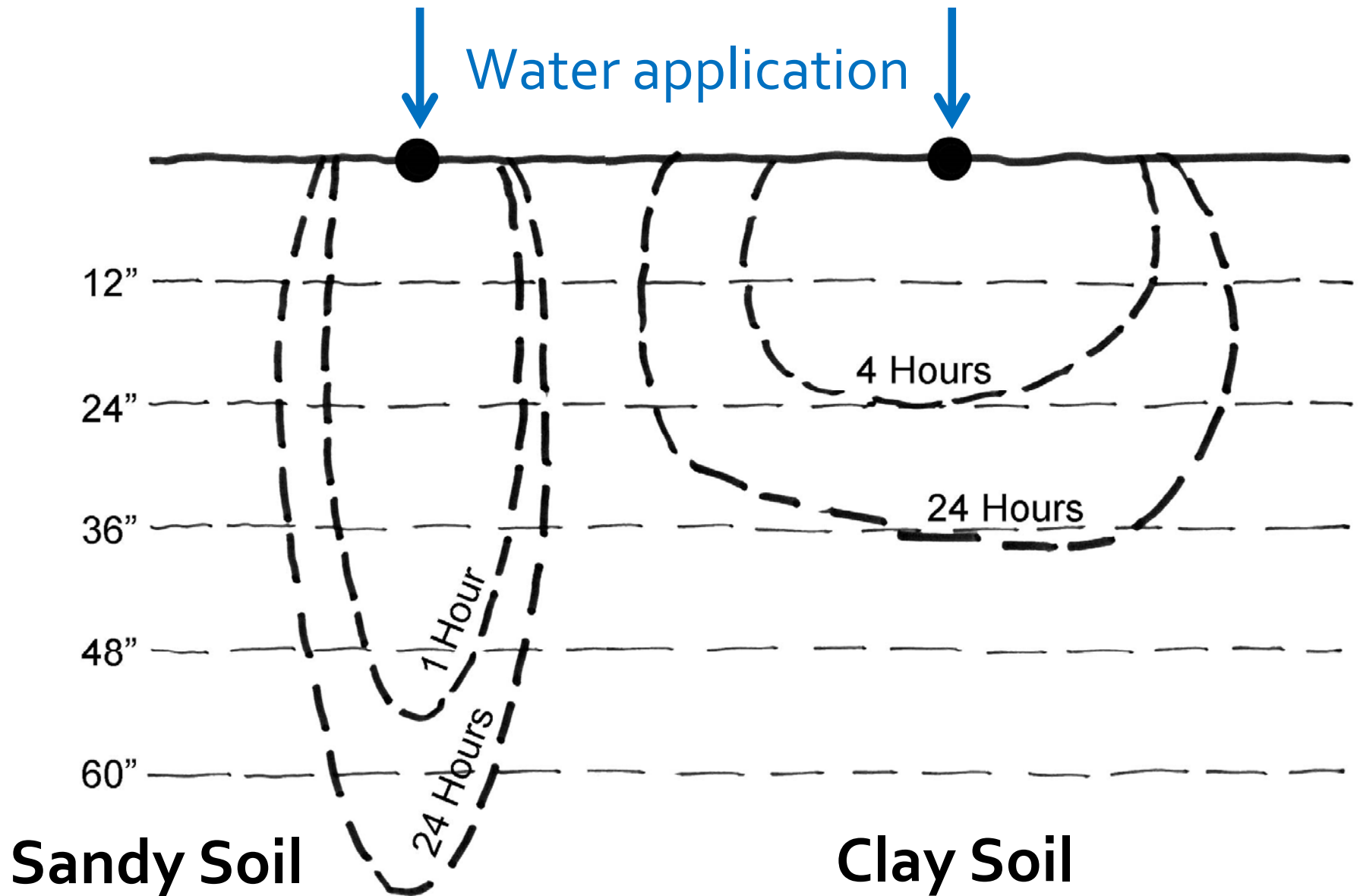
organic matter + soil organisms + time  
creates ⇒

soil structure, fertility, disease prevention, & water capacity

# Air and Water movement in soil



# Water penetration & spread in different soils

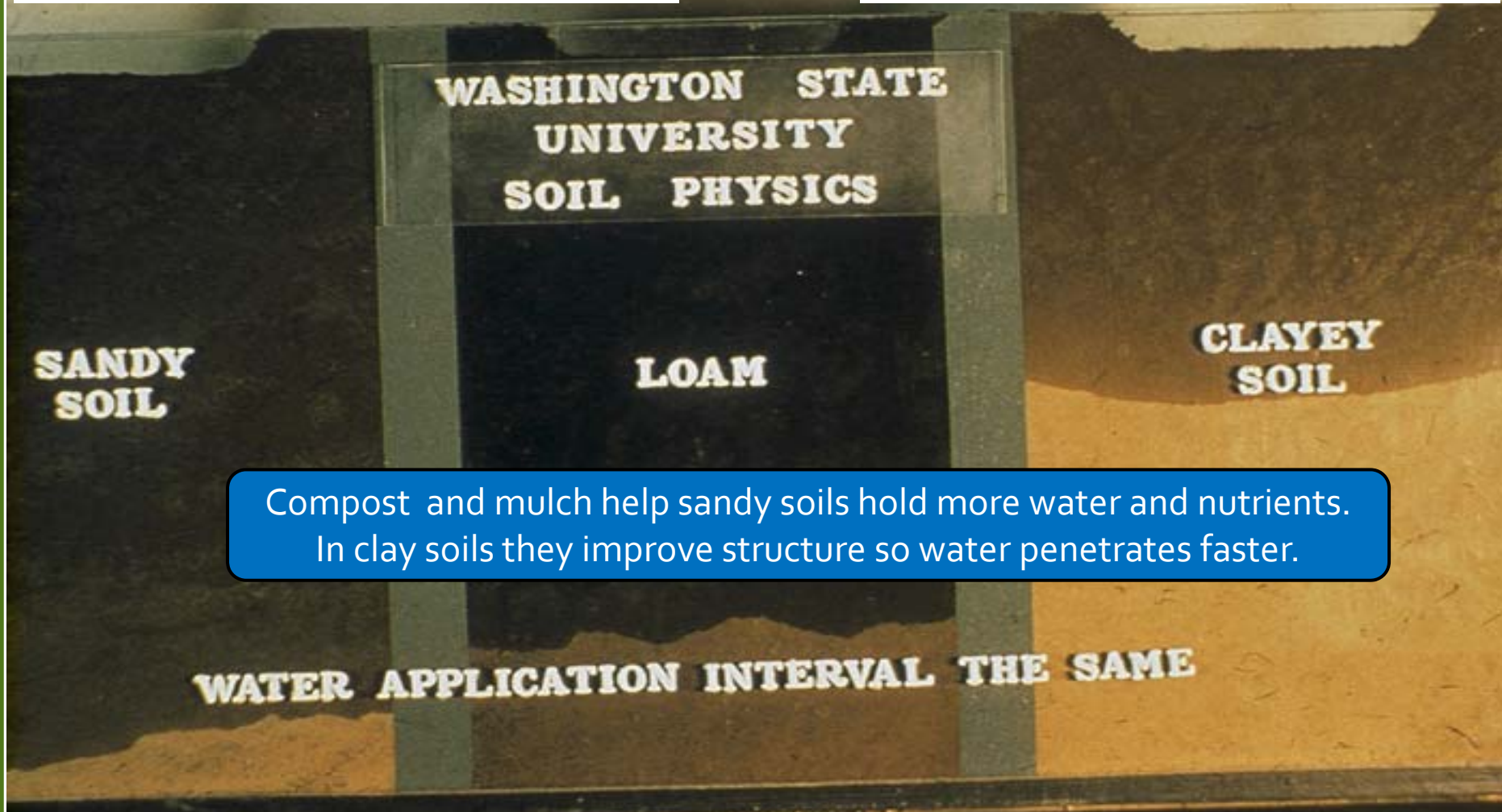




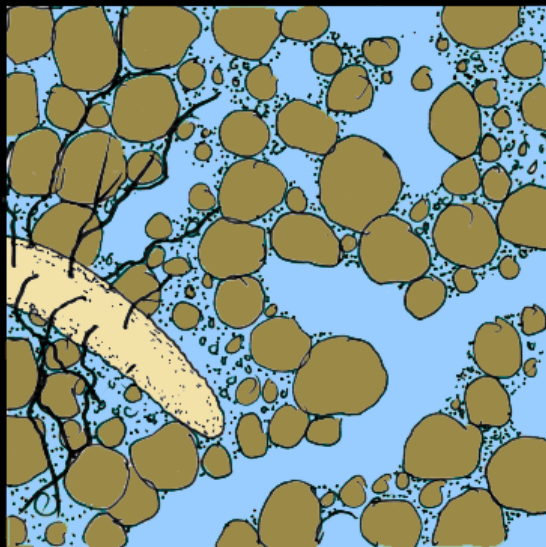
# Water penetration rate & capacity

Sandy soils infiltrate faster, but can hold less water.

Clayey soils infiltrate slower, but can hold more water.

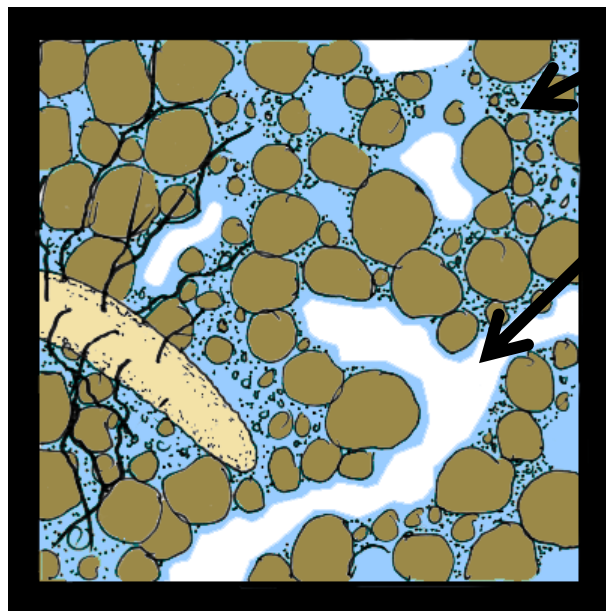


**Plant available water**  
= field capacity minus wilt point.



**Saturation Point**

*all pores full*

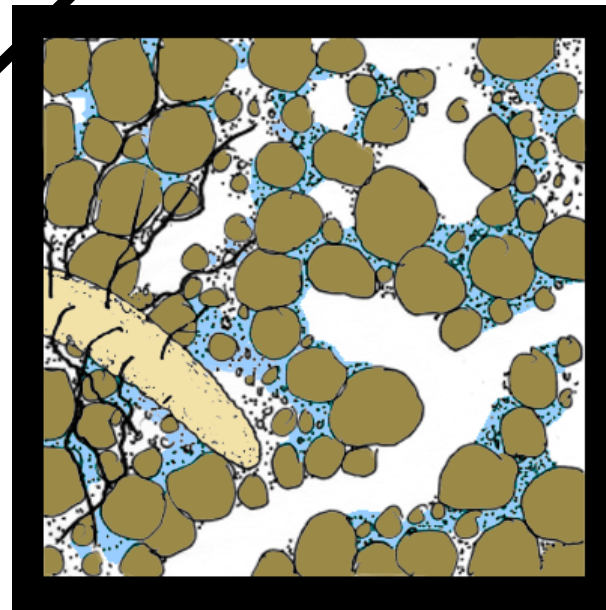


**Field Capacity**

*gravitational water  
has drained out*

*Micro-pores*

*Macro-pores*



**Wilt Point**

*remaining water  
held in micro-pores  
too tightly for plants  
to suck it out*

Soil organic matter and compost  
increase plant-available water storage  
in all soil types.





## Plants breathe through leaves and roots

- Soil pore spaces allow water and air to enter, and roots to grow
- Plant roots and beneficial soil organisms exchange gases into soil pores and atmosphere
- Compact or saturated soil reduces gas and water exchange, damaging plants



### Smell your soil:

Stinky (ammonia) smell and gray or yellow color indicate anaerobic conditions from compaction or poor drainage.



# Common mistakes that damage soil and plants

Layering different soil types. "Interfaces" limit air and water movement.

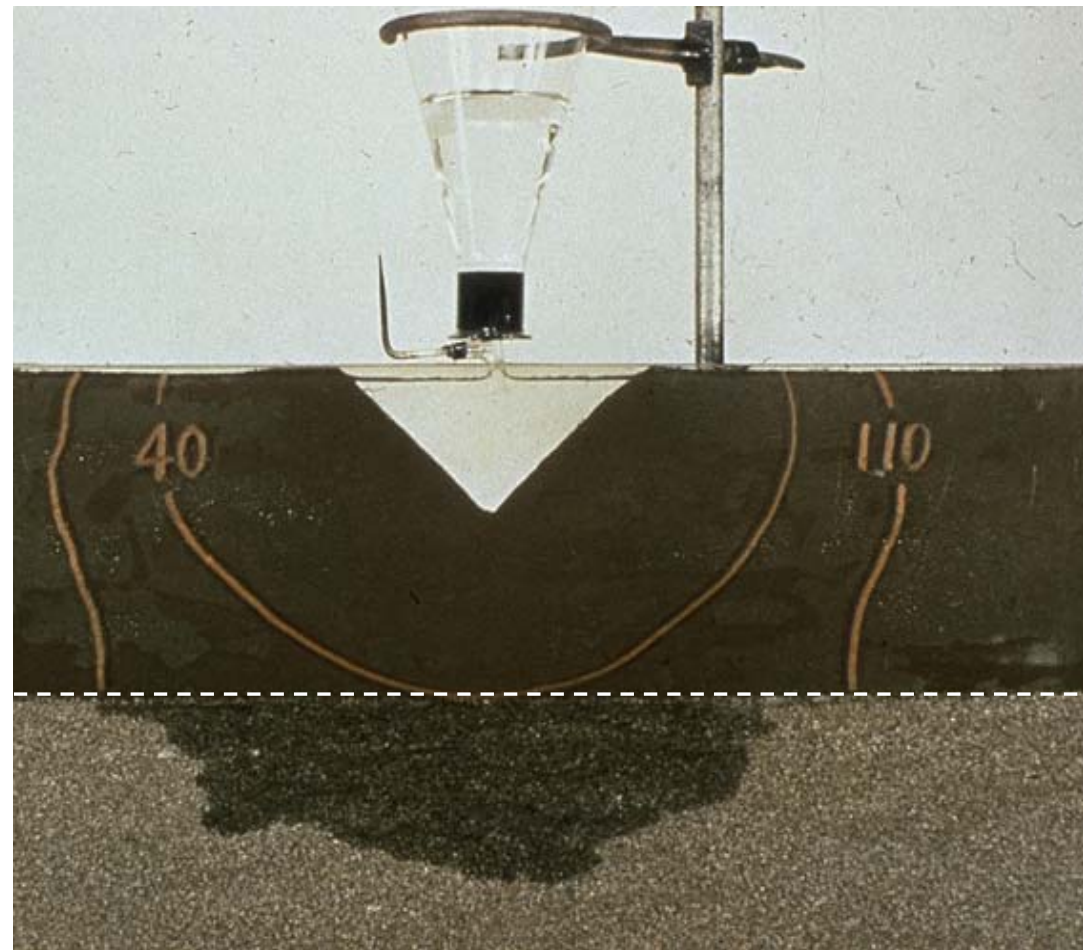
Better to:

- Amend site soil
- If importing soil, till or mix a few inches to reduce interface problems

Fine grained soil

Interface

Coarse grained soil



# Common mistakes that damage soil and plants

Adding sand to heavy clay reduces structure and pore space.

– better to amend clay with 10-15% compost





*using soil science*

# Soil Best Practices for Landscaping – design, installation, and maintenance

- Efficient
- Cost effective
- Healthy for people and wildlife
- Sustainable
- Successful:  
beautiful landscapes  
year 'round





# Site & soil assessment

## Look, smell, feel:

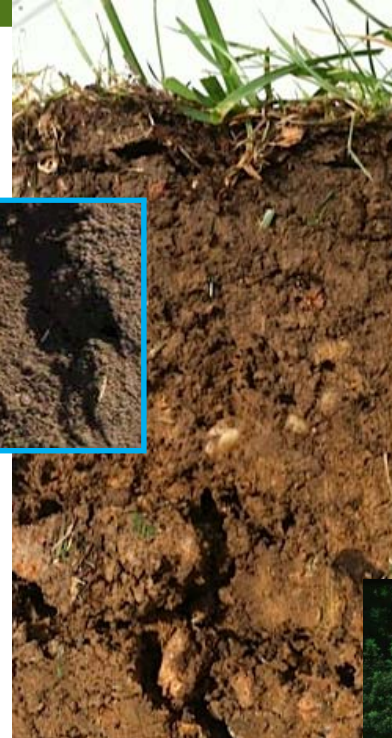
- Core sample or dig holes
- Soil texture-by-feel
- Smell: earthy or stinky?
- Color, particle size, organic matter
- Root penetration, structure
- Compacted layers? Drainage?

## Lab tests:

- Organic matter: 3-6% optimum
- NPK and micro-nutrients
- Lab's recommendations

## Plant conditions:

- Leaf color
- Compare growth
- Persistent plant problems?



# Collecting samples for lab tests

- Use clean core sampler or trowel, and plastic bucket, to avoid contamination
- Collect samples at rooting depth
- Remove upper 1-2 inches with leaf litter, or sod & thatch from lawns
- Collect 10-12 samples, then mix in plastic bucket, then take 1-cup sample
- Spread sample to dry overnight
- Then plastic bag sample for lab
- Fill in lab form with location, and intended use (lawn, vegetables, trees etc.)



*Learn how to collect samples, and how to interpret results (in English or Spanish) at :*

<http://puyallup.wsu.edu/soils/soils/>



# Plants as indicators of soil differences and problems

Examples:

- Early fall color indicates stress
- Trees planted at same time, but show different growth





# Falta de Nutrientes

## guía rápida

### CALCIO

Las hojas nuevas aparecen atrofiadas o deformadas. Las hojas existentes permanecen verdes.

nuevos

viejos

### HIERRO

Las nuevas hojas son blanquecinas o amarillentas mientras las nervaduras permanecen verdes. Las hojas maduras son normales.

### POTASIO

Amarillamiento en las puntas y bordes de las hojas, luego estos bordes comienzan a secarse.

### MANGANESO

Puntos amarillos y/o agujeros entre las nervaduras de las hojas.

### MAGNESIO

Las hojas bajas se vuelven amarillas hacia adentro manteniendo las nervaduras verdes.

### NITROGENO

Las hojas superiores son verde claro. Las inferiores amarillentas (incluyendo las nervaduras) y las hojas más viejas presentan además marchitamiento.

### DIOXIDO DE CARBONO

Zonas blancas en las hojas y crecimiento detenido. El avance produce la muerte de la planta.

### FOSFORO

Hojas de un verde apagado y más oscuro de lo normal, luego se tornan rojizas o púrpura. Finaliza con la pérdida de hojas.



Deficiencias may be caused by low organic, poor drainage, compaction, or incorrect pH.

Get a soil test to verify nutrient deficiencies.

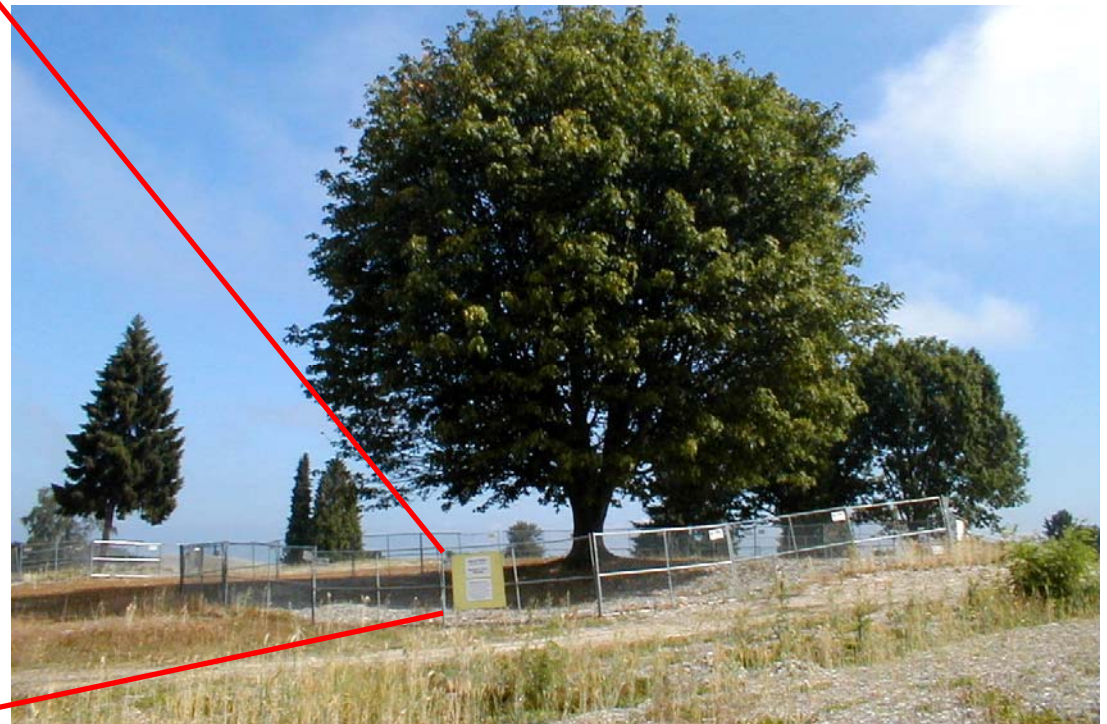
Learn signs of nutrient deficiencies and other plant problems at :

<http://hortsense.cahnrs.wsu.edu> en español "Suelos, fertilizantes y nutrición de plantas"

<http://smallfarms.wsu.edu/espanol/suelo-composta/index.html>

# Protecting soil & vegetation during construction

- Fence soil protection zones – especially tree roots
- Inform all contractors: no stockpiles, equipment, or storage in protection zones





# Protecting soil & vegetation during construction

- If temporary vehicle access is required, place steel plates, plywood, or 6" coarse wood chips or rock





# Restoring construction-damaged soils

- Rip or scarify to 12 inch depth to correct compaction
- Till in 2-3 inches of compost to 8-12 inch depth
- Or spread compost-amended stockpiled or imported topsoil
- Mulch after planting



Learn more at :  
[www.BuildingSoil.org](http://www.BuildingSoil.org)

# Compost erosion control methods during construction

Learn more at :

[www.BuildingSoil.org](http://www.BuildingSoil.org)

- WA State approved compost blankets and socks
- “2 for 1” value – use compost for erosion control, then till in to restore soil
- No disposal costs
- Faster planting, better growth





# Improving soil function in existing landscapes

## Key steps:

- 1) Amend soil with compost when re-landscaping
- 2) Mulch beds annually with leaves, chips, compost, etc.
- 3) Mulch-mow lawns (leave clippings)
- 4) Top dress lawns with compost
- 5) Choose “natural organic” fertilizers
- 6) Base fertilizer use on soil tests and plant needs





# Amend soil before planting

**WHEN** Before planting lawns, annuals, perennials, trees and shrubs.

**HOW** Use shovel or fork, or rototiller or excavator for large areas. Amend the whole bed, not just small planting holes, to promote root growth.

## HOW MUCH

- Lawns: 1-2" of compost, tilled in 6" deep
- Gardens: 2-4" compost, tilled in 10-12" deep

☑ Use more compost on sandy soils, less on heavy clay



# Amend soil before planting

**WHAT** Best materials: yard debris compost, or composted biosolids or manure. Leaves or fresh manure O.K. if tilled in 1-2 months before planting.

- Other materials: aged bark or sawdust, peat moss, coconut coir – OK if adding nitrogen source
- “Topsoil” mixes O.K. if bought from reputable supplier.

## GOOD COMPOST?

- Earthy smell
- Brown to black
- No weeds
- Purchase from WA-permitted composter



WA-permitted compost facilities listed at:

[www.ecy.wa.gov/programs/swfa/organics/soil.htm](http://www.ecy.wa.gov/programs/swfa/organics/soil.htm)



# Mulch plantings regularly

**WHEN** At least once a year:

- Spring on trees and shrubs to prevent weeds.
- Early summer on gardens to hold moisture, stop weeds, and feed plants. (Let soil warm up first.)
- Fall on beds to prevent erosion and winter weeds.

**WHERE** Whole beds, paths, 3 ft. or larger ring around trees & shrubs in lawns.

## HOW

- Remove weeds & grass before spreading mulch.
- Keep mulch away from plant stems.
- Use weed barriers like cardboard to control aggressive weeds.





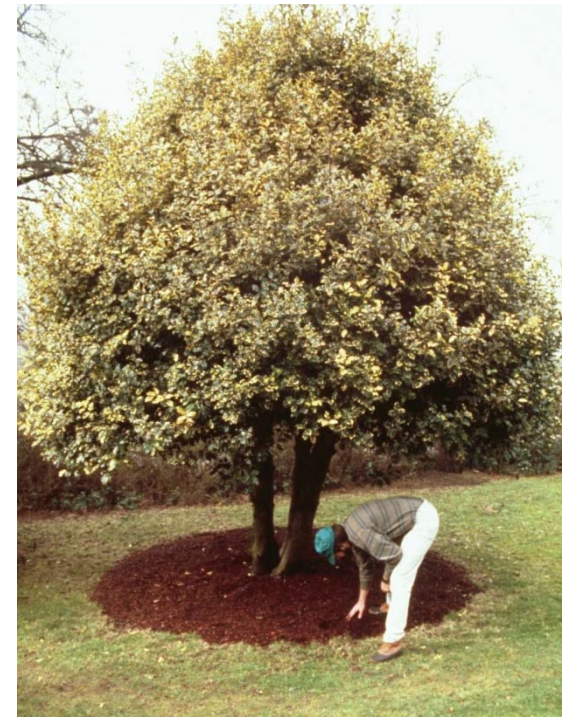
# Mulch plantings regularly

## HOW MUCH

- 1-2" Compost, leaves, sawdust, fine bark, grass clippings
- 2-4" Wood chips or coarse bark

## WHAT

- Woody mulches (arborist chips, bark) for woody plants (trees, shrubs).
- Non woody mulches (compost, leaves, grass clippings, composted manure or biosolids) for non-woody plants (annuals, perennials, berries, roses).



**TIP:** Place weed barriers (cardboard, newspaper) under mulch to help control aggressive weeds. Avoid using plastic or fabric weed barriers.

# Mulch-mow lawns (leave clippings)

- Mulch-mowing doesn't cause thatch (build-up of roots and stems)
- Returns free fertilizer, cuts fertilizer needs by  $\frac{1}{4}$  to  $\frac{1}{2}$
- Feeds soil life, improves soil structure, water-holding capacity; helps lawns resist drought damage



*Learn about sustainable lawn care  
(in English & Spanish) at:*

[www.seattle.gov/util/LandscapeProfessionals](http://www.seattle.gov/util/LandscapeProfessionals)



# Top dress lawns with compost

- Aerate spring or fall
- Spread  $\frac{1}{4}$  to  $\frac{1}{2}$  inch compost, rake in
- Over-seed with site-appropriate grass





# Fertilizing

**WHAT** choose “natural organic” or “slow-release” fertilizers

- Too much fertilizer produces excess growth and sets plants up for pest and drought damage.
- Overuse also damages essential soil life.
- Soluble “quick-release” fertilizers may easily wash off into streams and lakes.

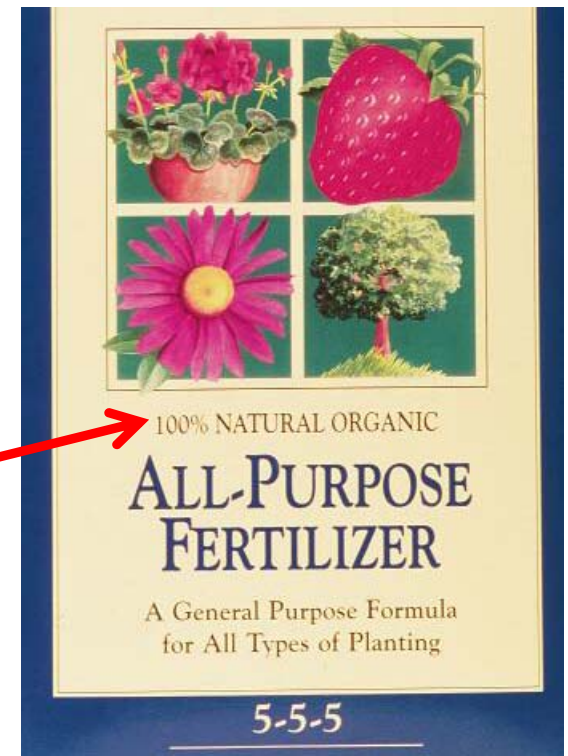
## WHERE

- Most trees and shrubs get all the nutrients they need from regular mulching.
- Lawns and gardens (annuals and perennials) often need additional nutrients = fertilizer or compost.

**TIP:** Feed the soil, not the plant

## TYPES of FERTILIZERS

- **AVOID** Soluble synthetic or “quick-release” – washes off quickly
- **USE** “Slow-release” synthetic or
- **USE** “Natural organic”
- **TIP:** Look for “natural organic” or “slow-release” on the bag



## WHEN to fertilize

- Lawns: May and Sept., plus lime every few years.
- Annuals/gardens & perennials: Mix into soil when planting and mid-season. Base on plant signs or soil test. Lime may be needed every few years.
- Trees & shrubs: only if plants show need, or soil test

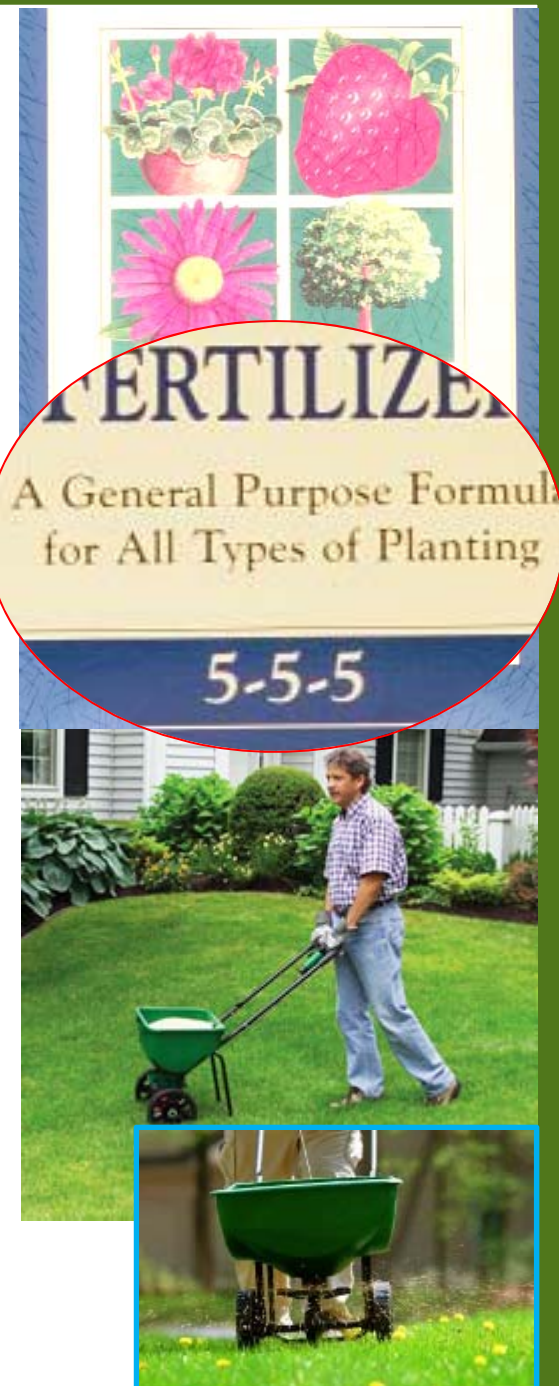
# FERTILIZER NUTRIENTS

Nitrogen (N) – Phosphorus (P) – Potassium (K)

- Numbers are percent by weight:  
5% x 20 lb. bag = 1 lb. N, 1 lb. P, 1 lb. K
- Use fertilizer recommendations from soil test to multiply with area, to compute how much fertilizer to use.

## FERTILIZING TIPS:

- Look for higher non-soluble N on label = slower release
- No/low phosphorus, to protect streams
- Look for micronutrient content
- More is not better – follow recommendations
- Apply twice, in two directions, using  $\frac{1}{2}$  of total each time



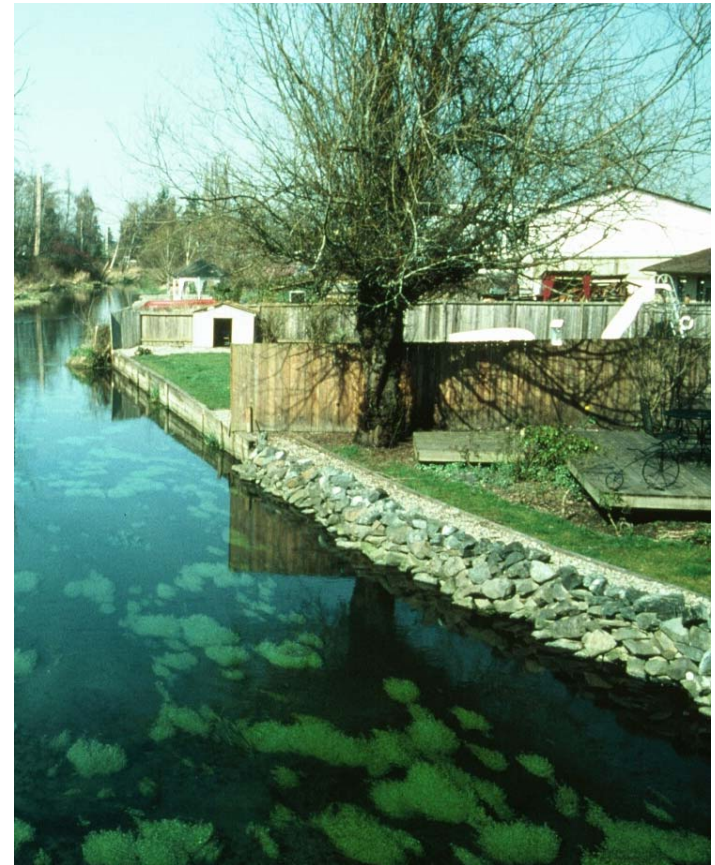


# Base fertilizer use on plant needs & soil test

Observe plants' needs, and get a soil test to diagnose problems, and determine needs for lime or other amendments.

## PROTECTING WATERWAYS

- Natural organic fertilizers are less likely to wash off.
- Never apply any fertilizer (especially soluble synthetics) or pesticide near ditches, streams, lakes, or storm drains.
- Sweep excess off pavement
- Don't apply just before heavy rain



# Watering: Match soil conditions & plant needs

## SANDY SOILS

- Water more frequently but less each time

## CLAY SOILS

- Water less frequently, but slowly, or start-and-stop so water has time to penetrate



## WATERING TIPS:

- Observe plants – water when lawns dull or leaves droop
- Water early morning or late in day to reduce evaporation waste
- Over-watering promotes plant diseases

**Compost** helps all soil types absorb and store more water and nutrients in plant-available forms.

# Plant selection: right plant, right place, right soil

Choose plants that fit your site's conditions:

- Soil type:
  - Sand
  - Silt
  - Clay
- Organic content
- Drainage
- Soil volume  
– room to grow

Select plants that grow well in your soil type and drainage.

Select trees that will grow to mature size in the available soil volume.





# Healthy plants grow in healthy soil

Learn more at: [www.seattle.gov/util/LandscapeProfessionals](http://www.seattle.gov/util/LandscapeProfessionals)  
this presentation is on "Training" page  
publicaciones en español en pagina "Training/Translations"

Questions? Garden Hotline 206-633-0224 [www.gardenhotline.org](http://www.gardenhotline.org)  
(language interpretation available)

Uso eficiente de los recursos en el  
**Paisajismo natural**  
Diseño • Construcción • Mantenimiento

EPOR QUÉ HACERLO A LO NATURAL?

Profesionales en paisajismo de todo el Noroeste han aportado y puesto a prueba estas ideas para un paisajismo sostenible y eficiente en costos y recursos. Pueden aplicarse a cualquier tipo de jardín, desde el diseño convencional de césped y césped, pasando por restauraciones nativas, hasta jardines urbanos innovadores. Integar estas ideas desde el inicio del proyecto, a lo largo de toda la construcción, y en el mantenimiento a largo plazo rendirá máximos beneficios.

**Beneficios**

- Jardines más atractivos
- Mantenimiento más fácil
- Factores más bajos de agua, pesticidas y electricidad
- Menor necesidad de fertilizantes y pesticidas
- Mejor retención y filtración del agua pluvial
- Mejor calidad del aire y del agua
- Mejor hábitat para la vida silvestre y las plantas nativas
- Mayor valor de la propiedad


**5 pasos para lograr jardines exitosos**

- 1) **Planee un suelo sano.** Dónde sea posible, preserve el suelo y la topografía existentes (reocúpulos los árboles). Quite con cuidado los suelos que se hayan perturbado. Evite la compactación. Mantenga los jardines existentes utilizando técnicas de labranza: cortes gruesos, hojas o compost.
- 2) **Plante lo adecuado para su terreno.** Ajuste las plantas que necesitan menos agua, tengan pocas plagas y prosperen en el clima del terreno.
- 3) **Regrese inteligentemente.** Después de cultivar un suelo sano y seleccionar plantas que usen poca agua, agrupe las plantas según su necesidad de agua. Haga un mapa de irrigación más eficiente, tal como grupo o manjares de plantas debajo del estabudo y diseño y asegure de que el sistema de irrigación funcione al fin de reducir el desperdicio.
- 4) **Plantee dos veces antes de usar pesticidas.** La primera selección de plantas, el césped adecuado y las técnicas integradas para controlar las plagas pueden proporcionar suficiente protección. Si las plagas persisten, asegure de aplicar con el fin de reducir el desperdicio.
- 5) **Practique el cuidado natural del césped.** Conozca con mejor criterio, aunque puede aprender desde una adecuada "receta de césped" (con compost) y seguir las instrucciones pueden ahorrar tiempo y dinero.



**GREEN  
GARDENING  
PROGRAM**

Seattle  
**Public  
Utilities**

 **Local Hazardous Waste  
Management Program  
in King County**

**Cuidado sostenible del césped**  
Prácticas naturales de aplicación y mantenimiento  
para profesionales del Noroeste

Resumen de prácticas recomendadas tomadas de "Ecologically Sound Lawn Care for the Pacific Northwest" (Cuidado ecológico del césped para el Noroeste del Pacífico) - consulte dicho manual para encontrar más detalles y obtener el consentimiento, disponible junto con la guía para residentes "Natural Lawn Care" (Cuidado natural del césped) en la parte inferior de la página web: [www.seattle.gov/util/2017](http://www.seattle.gov/util/2017)

**Las prácticas sostenibles o naturales para el cuidado del césped trabajan junto con la naturaleza para crear un césped y profesionales eficientes en costos. Los científicos y profesionales en paisajismo del Noroeste han desarrollado y demostrado estos métodos en una variedad de terrenos.**

**Beneficios:**  
**césped más saludable, clientes más felices**

- Menor necesidad de agua, fertilizante y tiempo para cortar
- Mejor color, calidad y densidad del césped
- Menor resistencia a las enfermedades y plagas
- Mejor resistencia a las enfermedades durante todo el año
- Menor disponibilidad de nutrientes durante todo el año
- Más saludable para las personas, el suelo, los cursos de agua y la vida silvestre
- Bueno para los negocios: clientes satisfechos

Nota: esta guía es para césped sobre un sustrato de tierra. Pese a que los proyectos que se aplican al césped de grava o sobre sustrato de arena son similares, las prácticas varían ligeramente. Las fechas y especies de plantas que se mencionan aquí son para la región del Noroeste del Pacífico. Al estar de acuerdo con la guía, consulte con un profesional de paisajismo local (vea "Recursos" en la parte posterior).

**Recomendaciones clave de esta guía**

- **Esperativas realistas:** El césped en el Noroeste es de un color verde pradera, puede tener algunas manchas, y es denso, saludable y resistente al desgaste.
- **Evalúe los terrenos para clarificar las prácticas y la mejora del suelo.**
- **Elija puntos y prácticas de mantenimiento que se adapten al terreno.**
- **Corte regularmente:** 2-3" para ryegrass/festuca, 1-1 1/2" al berrozo.
- **Corte limpio:** Use los recortes de césped para mejorar el suelo, la salud del pasto y su resistencia a la sequía, y reducir la necesidad de fertilizante.
- **Realice ensayos del suelo cada 2-3 años, y corrija cualquier deficiencia.**
- **Fertilice solo cuando sea necesario, con fertilizantes suaves de liberación lenta.** El césped es el momento clave para fertilizar.
- **Regar profundamente pero con menor frecuencia para desmenuzar raíces más profundas.** Ajuste los temporizadores según la estación y el clima. O permita que el césped que tiene poca riego durante los meses cálidos, regado solo una vez durante cada mes seco.
- **Remueva las áreas de césped sobre áreas dañadas, como: agujeros, grietas, o áreas que se mencionan en el manual.** O repare el suelo y evalúe e plantar (ajuste orgánico). O repare el suelo y evalúe e plantar.
- **Utilice "Zonas" integradas de plagas, malezas y enfermedades.**

# Actividades: videos y guías / Activities: videos and guides

- "Determining Soil Texture by Hand" <http://puyallup.wsu.edu/soils/soils/>  
"Estimando la Textura del Suelo"  
<http://smallfarms.wsu.edu/espanol/suelo-composta/index.html>
- Reading soil lab test reports <http://puyallup.wsu.edu/soils/soils/>  
"La Composición y Análisis de Suelos "  
[https://puyallup.wsu.edu/soils/wp-content/uploads/sites/411/2014/12/SS\\_Composicion\\_Analisis\\_de\\_Suelo.pdf](https://puyallup.wsu.edu/soils/wp-content/uploads/sites/411/2014/12/SS_Composicion_Analisis_de_Suelo.pdf)
- "Suelos, fertilizantes y nutrición de plantas" (presentación con audio)  
<http://smallfarms.wsu.edu/espanol/suelo-composta/index.html>
- Reading fertilizer bag, and fertilizer calculations  
<https://www.youtube.com/watch?v=a5RVGqu6ACE> <https://www.youtube.com/watch?v=gXLYS27JEEg>  
"Cómo Leer una Etiqueta", y "Cómo Calcular Uso de Fertilizante"  
<https://www.youtube.com/watch?v=muj4dj1E6Bk> <https://www.youtube.com/watch?v=rhoDkJ71T7k>
- Prueba de agitación en agua y asentamiento de suelo (para determinar contenido arena, limo & arcilla) / Soil-in-water shake-&-settle test (to determine sand, silt & clay content) <https://www.youtube.com/watch?v=iZvgRMjYpVM>
- Examinación de acolchado, composta & muestra de suelo / Mulch, compost, & soil samples [www.seattle.gov/util/ForBusinesses/Landscapes/TrainingCertification](http://www.seattle.gov/util/ForBusinesses/Landscapes/TrainingCertification)