

# Soil Health, Carbon Farming: Tools in soil building



Renewable  
Sonoma

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WEST MARIN  
COMPOST

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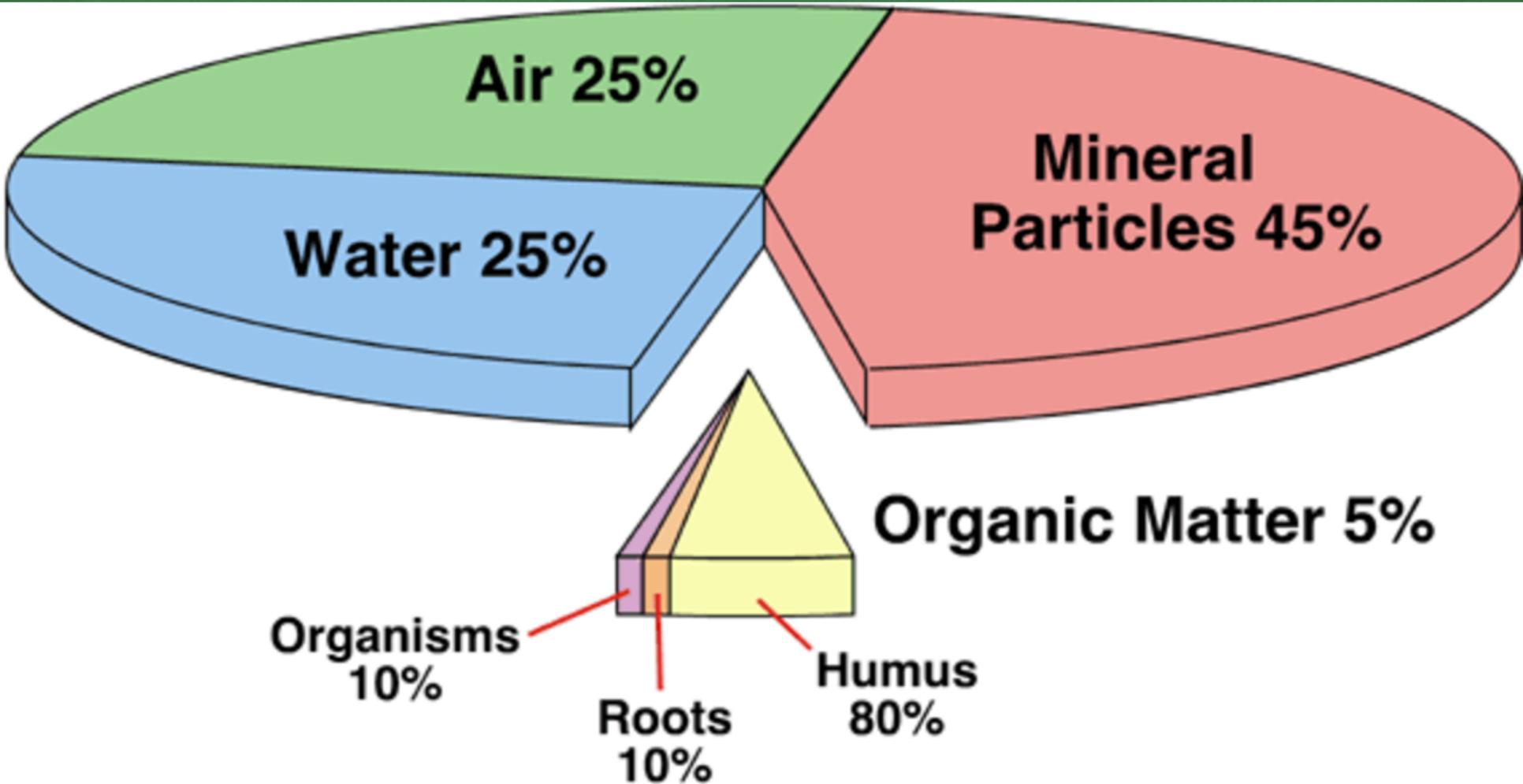
## Soil Health

1. promotes a resilient population of soil organisms
2. has a symbiotic relationship with plant roots
3. is in balance with plant pathogens , insect and weed infestations
4. recycles, conserves and fix nutrients
5. provides good soil structure to maximize root penetration
6. improves soil water management
7. 'maximizes' crop production

## Benefits of Compost

1. Diversity of microorganisms
2. Promotes healthy plant growth
3. Tool in IPM
4. Nutrient management
5. Improves soil structure
6. Soil moisture management

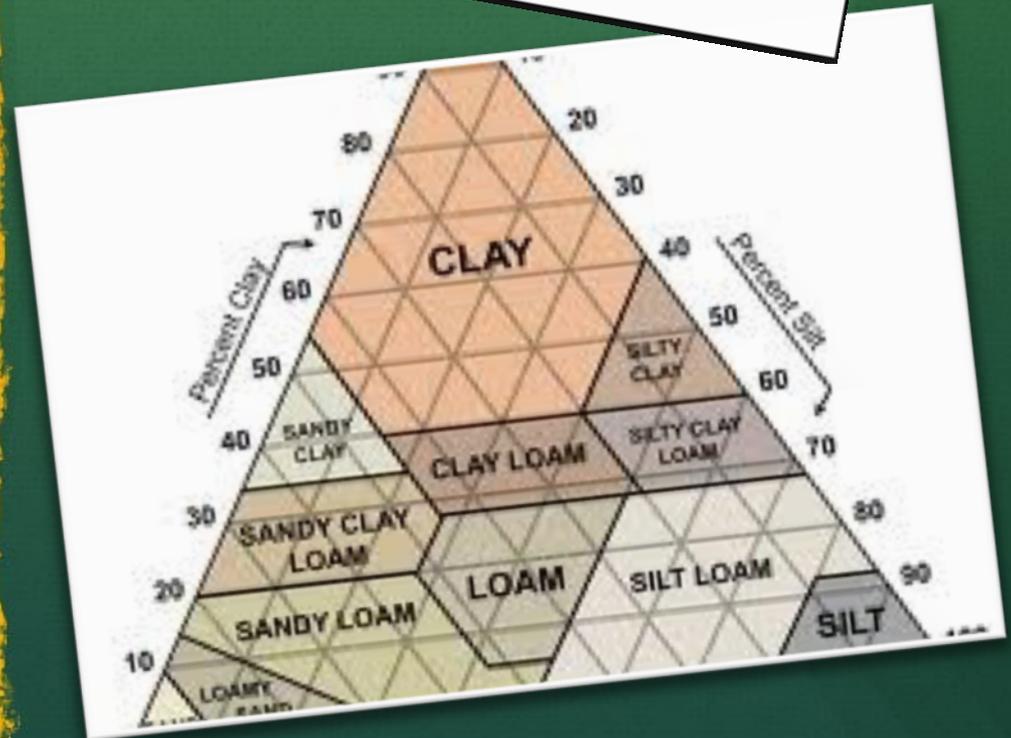
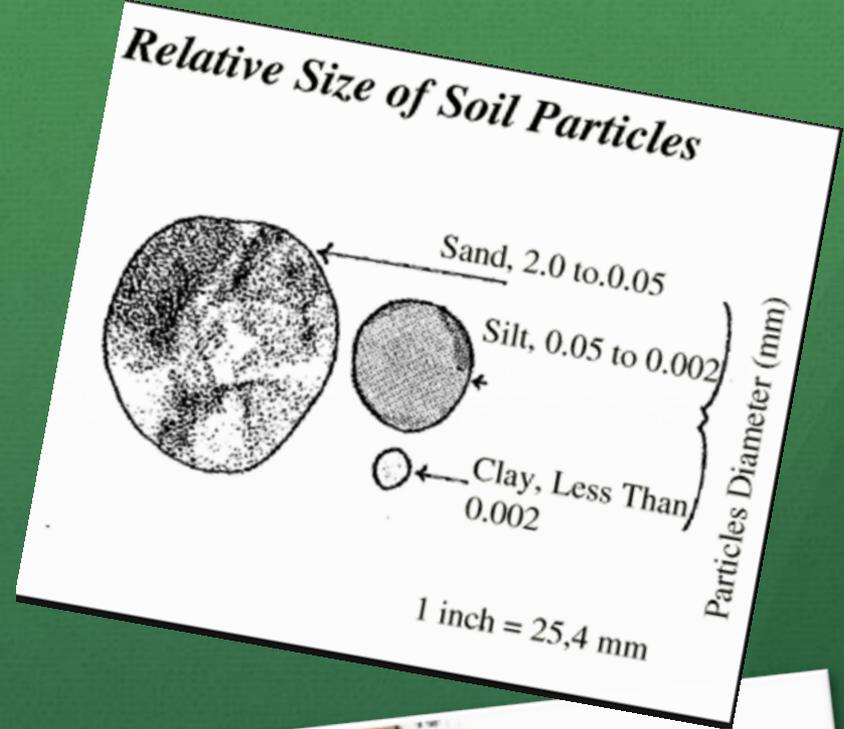
# What is in the soil?



# Soil Structure

Can't change texture.  
What does soil structure do?

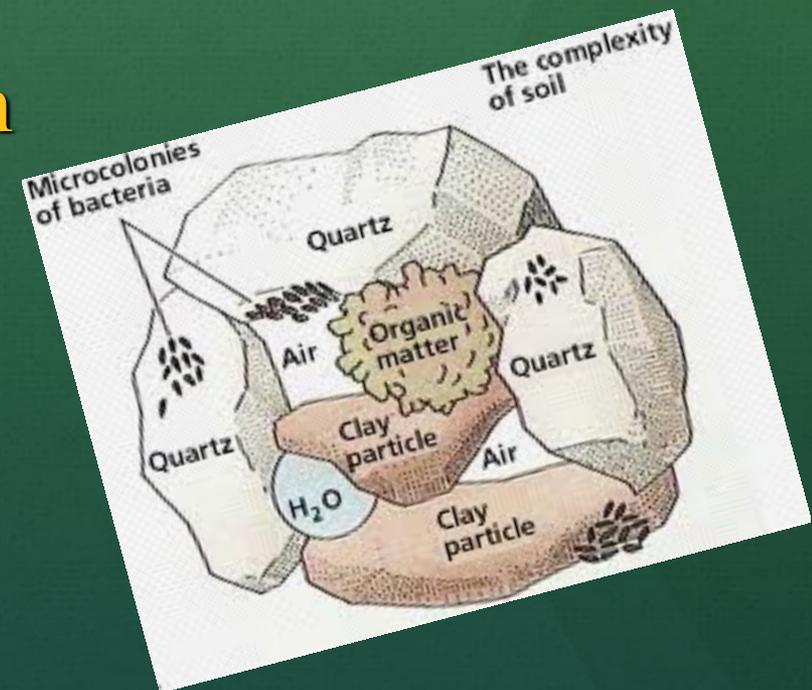
Affects water infiltration rate and water holding capacity, erodibility. Enhances root penetration, optimizes soil aeration, stimulates microbial diversity



# Soil Aggregation

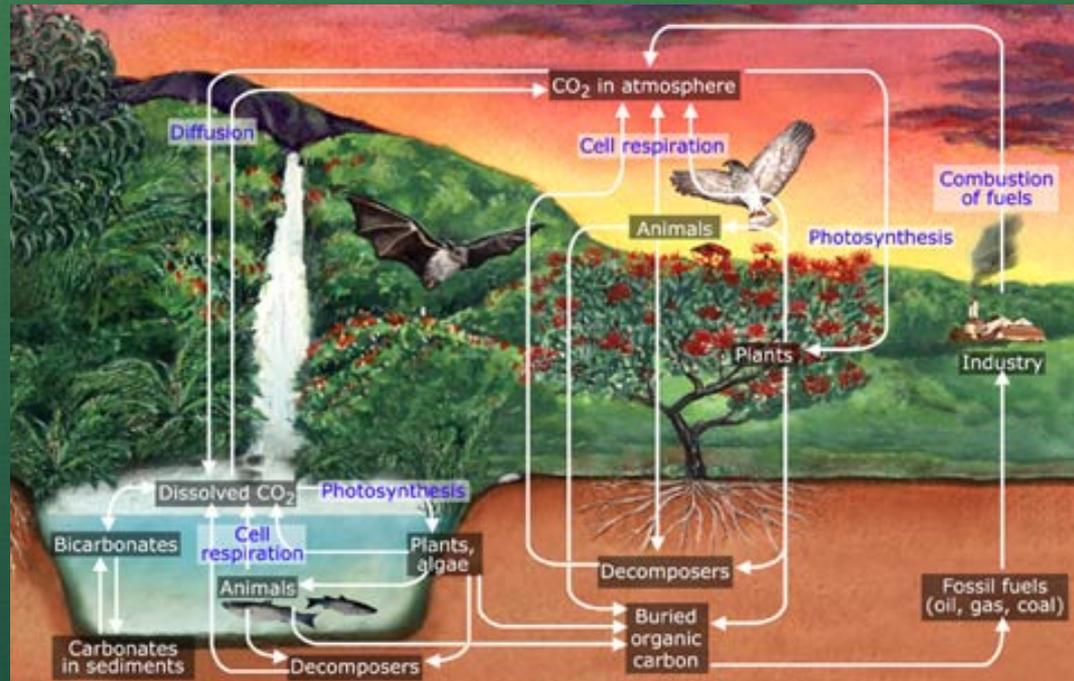
- Tilt, Friability, Soil Structure
- Aggregation Formation
- Aggregation Destruction
- Soil Aeration
- Root Penetration

90% of roots in top 18" of soil

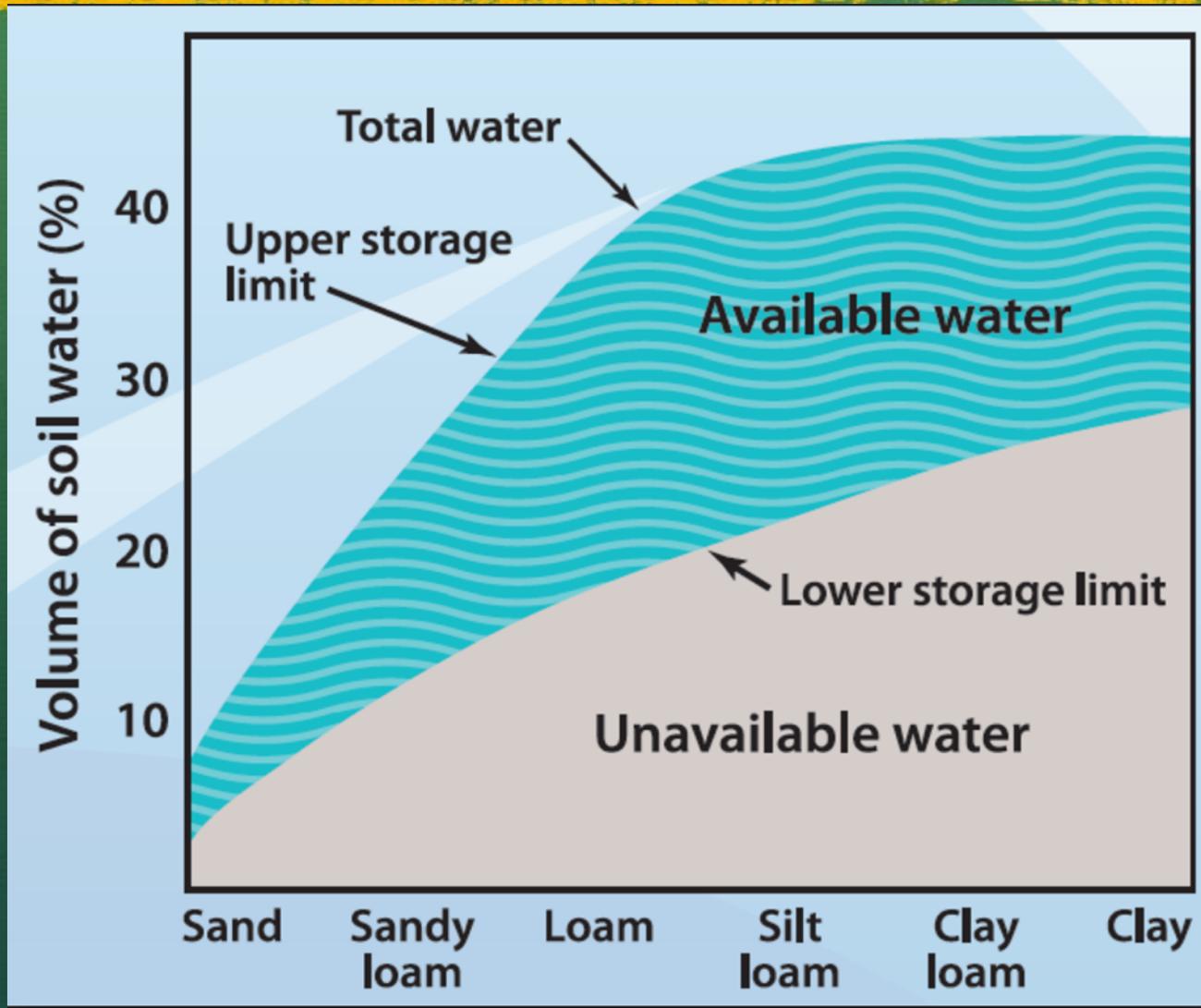


# Nutrient Management

- Increase CEC
- Immobilize Water Soluble Nutrients
- Long Term Nutrient Release
- Nitrogen Fixing Micoorganisms

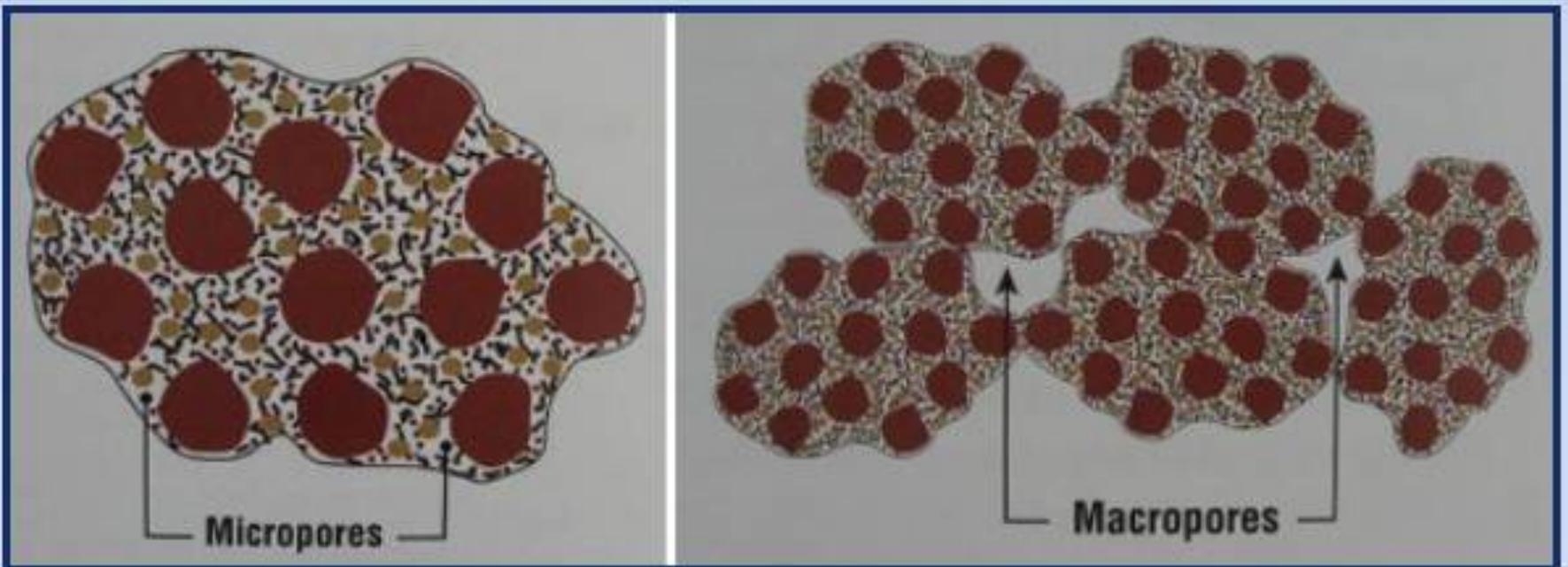


# Soil Moisture Management



# Soil Water Availability

- Increased Water Holding Capacity (Sandy)
- Increased Water Permeability (Clay)

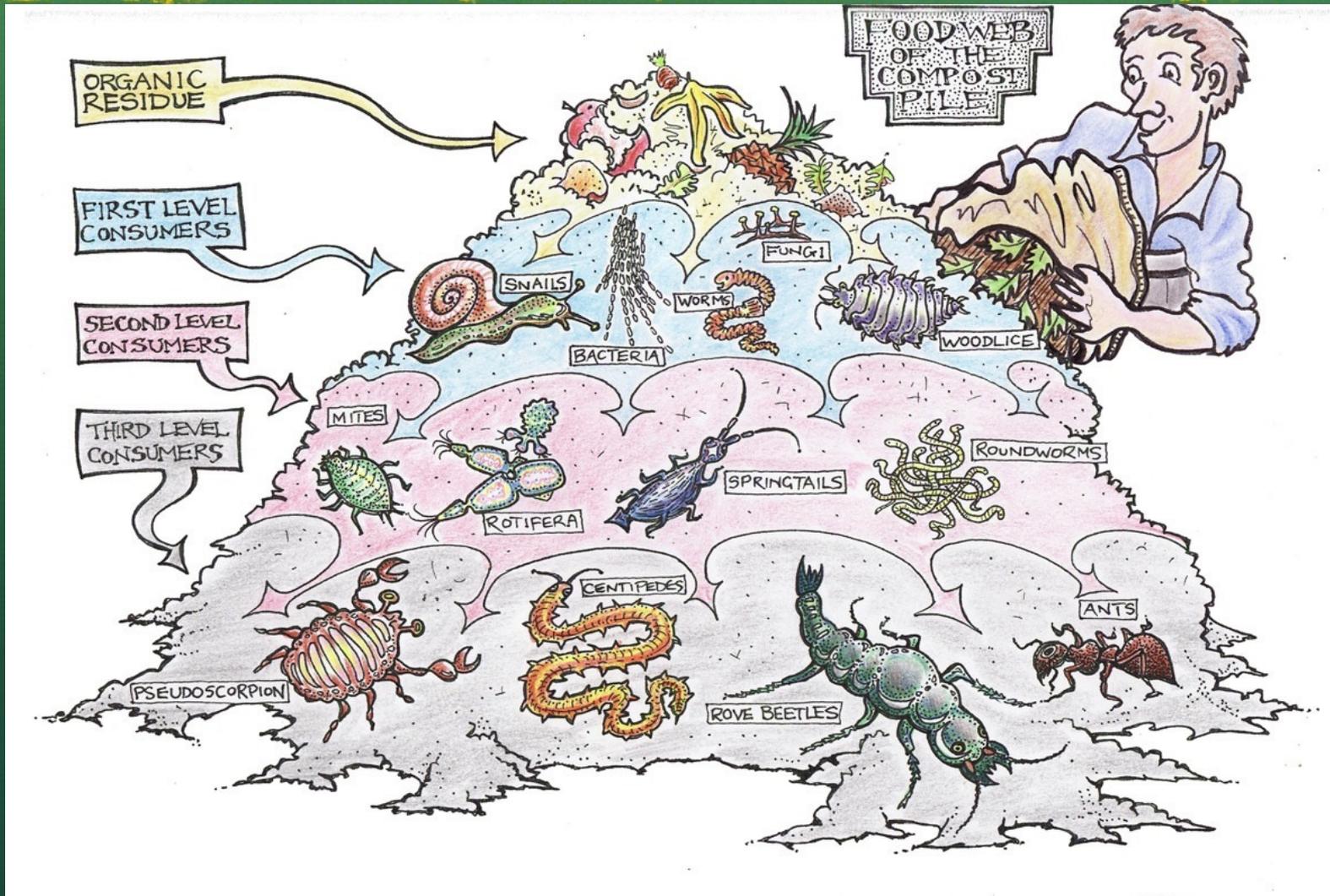


# Water Conservation

- 4 inch layer of mulch can save 130,000 gallons of water/acre in vineyards
- Water holding capacity increased by 40%
- 49% greater water Marin Carbon Project 1/2 inch compost one time 2600 gallons/acre



# Diversity of Soil Microorganisms



# Diversity of Soil Microorganisms

- A Tool in IPM
  - Turns on plant's natural disease fighting mechanism
  - Increased Competition for nutrients and energy
  - Predation
  - Site Occupation
  - Nutrient Management
  - Fungal Presence for Aggregation

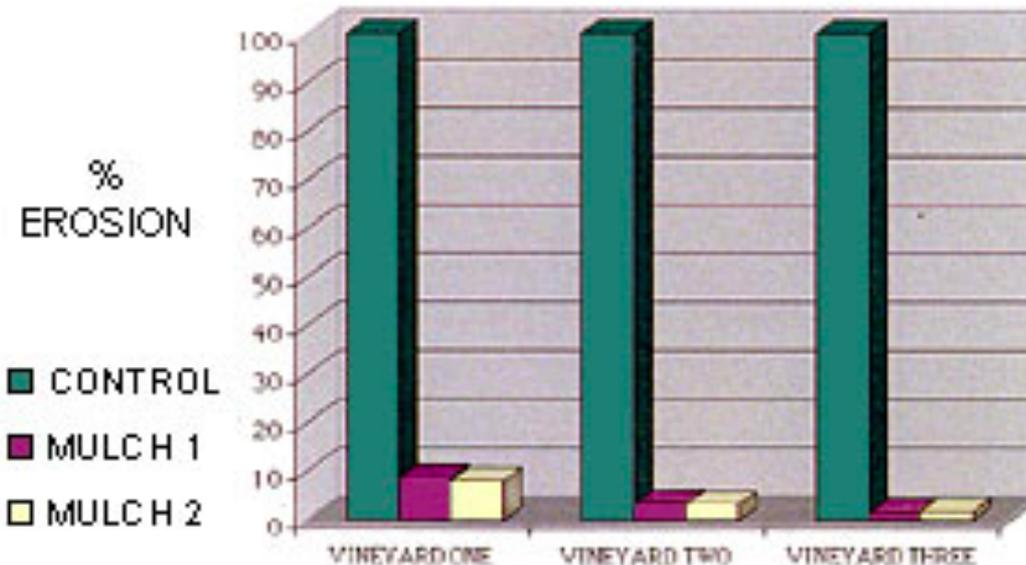
Diversity and abundance of microbes are indicators of soil health

# Compost vs. Mulch

- In/on top of the Soil
  - Supplies Nutrients
  - Improves Soil Structure
  - Affects Soil Water Management
  - Improves CEC
  - Some Erosion Control
- On Top of the Soil
  - Zero Nutrient Input
  - Slow Soil Structure Improvement
  - Conserves Water
  - No CEC Change
  - Reduced Erosion

# Erosion Control in Vineyards

## Relative Soil Movement

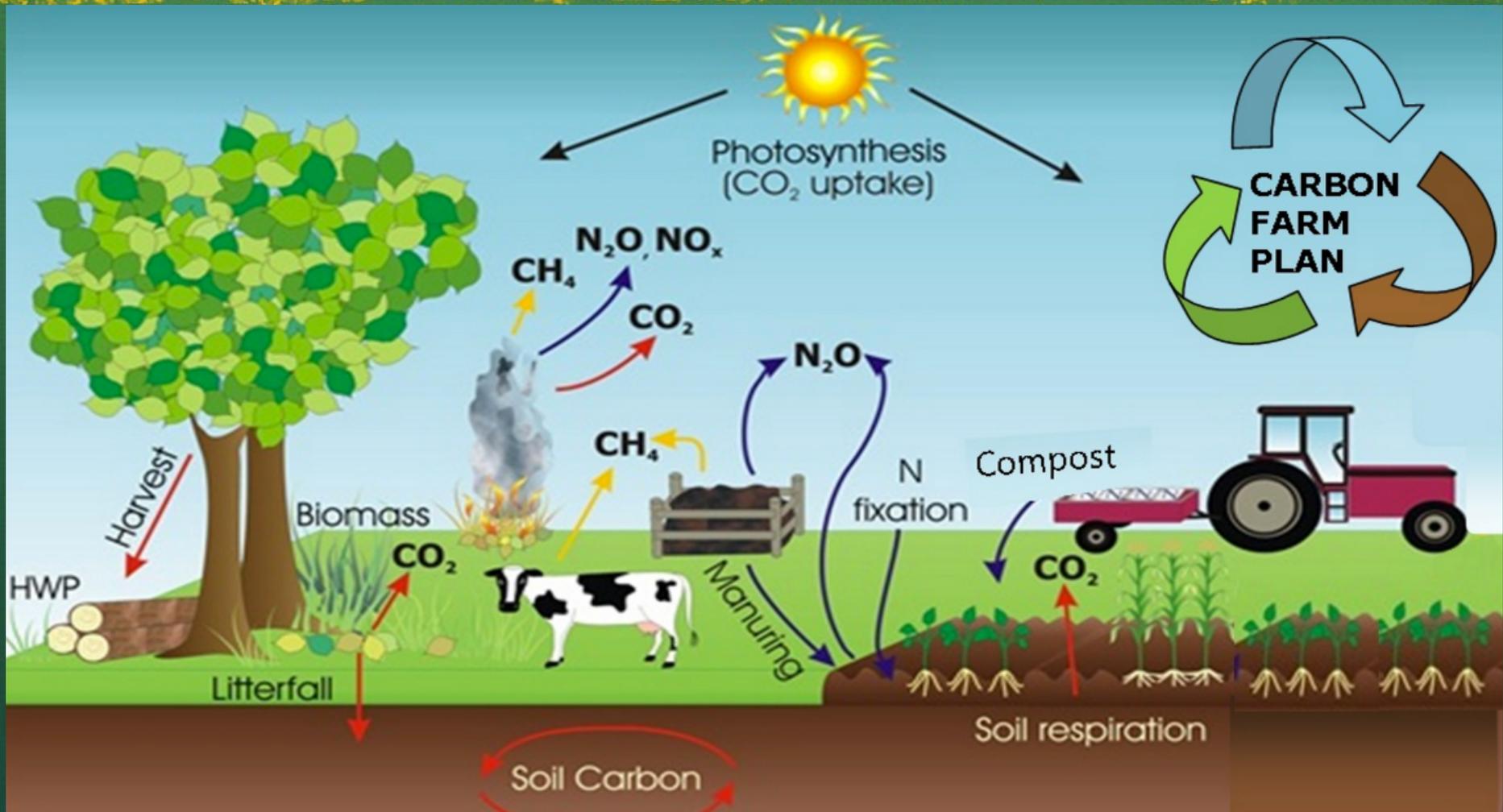


Soil erosion is expressed in percent of control. Control has no mulch applied. Mulch 1 and 2 had 3 inches of mulch applied in the fall of 1999. Mulch 2 has received an additional 1.5 inches of mulch in the fall of 2000.

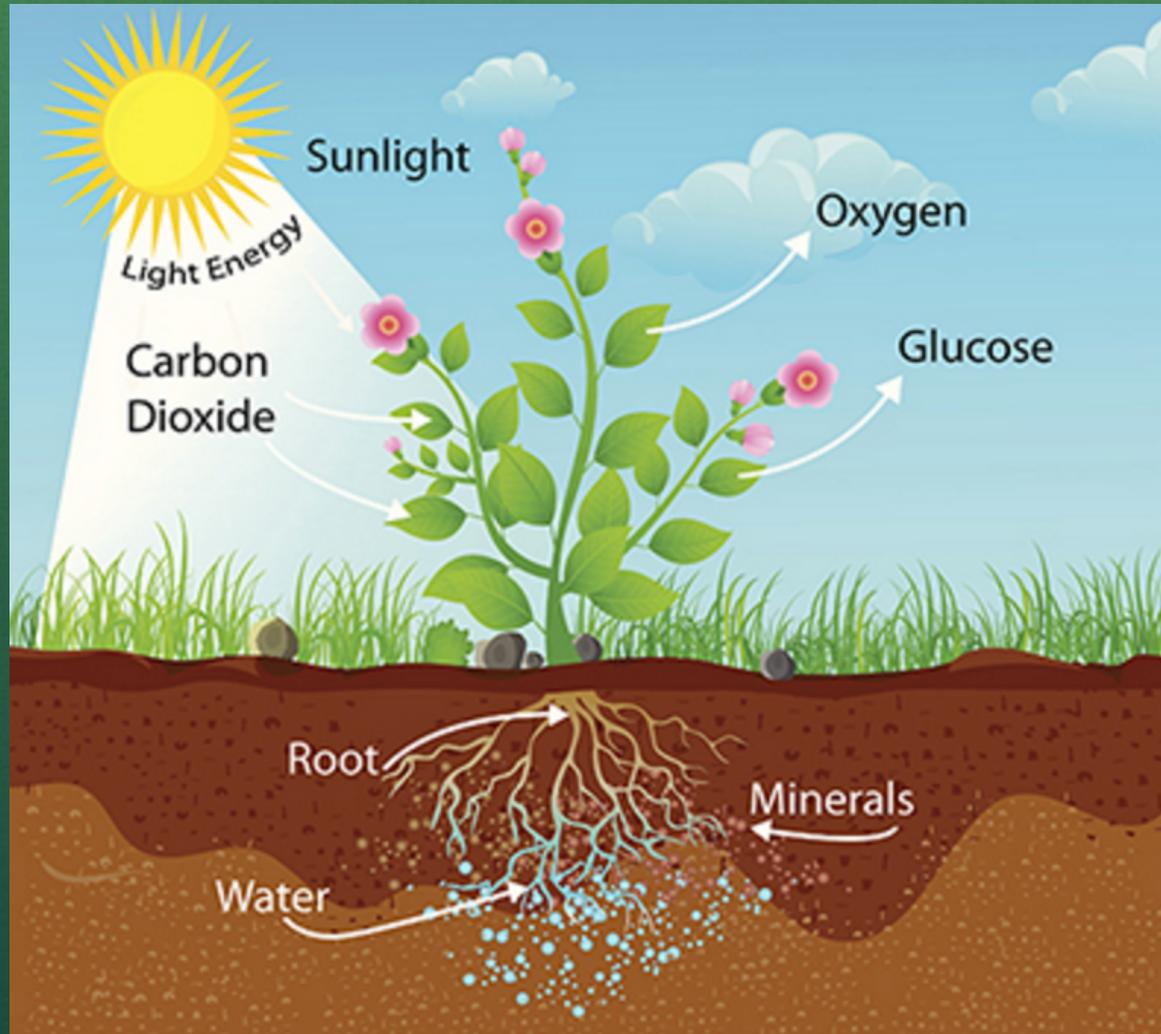
# Biochar in Compost

- Reduces emissions, conserves N
- Strips off available carbon
- Inoculates the biochar
- One application, rather than two
- Most effective in sandy or clay soils

# Carbon Farming



# Photosynthesis



Without

Compost

With



# Carbon Depletion/ Restoration

- It is estimated 150 – 200 billion tons of soil organic matter has been lost over the past century.
- In 2012 it was estimated that 9 billion tons of CO<sub>2</sub> are annually released in to the atmosphere from fossil fuel consumption.
- With the implementation of the appropriate management practices, soil organic matter content could be restored to pre-industrial agricultural levels within 50 years.

# Carbon Cycle Institute

Table 1. CO<sub>2</sub>e Reduction/Sequestration Potential, Cachuma Ranch (8000 acres),  
Santa Barbara County, CA

| Practice                  | Average Annual CO <sub>2</sub> e Sequestration | 20 yr CO <sub>2</sub> e Sequestration | CO <sub>2</sub> e Sequestration at Maturity |
|---------------------------|--|---------------------------------------|---|
| Rangeland Compost         | 638 Mg   | 98,847 Mg                             | 162,619 Mg (30 years)                       |
| Cropland Compost (590)    | 2,060 Mg                                       | 23,200 Mg                             | 43,374 Mg at 5% SOM                         |
| Shelterbelts (380)        | 98 Mg  | 1,960 Mg                              | 7,840-19,260 Mg at 80 years.                |
| Hedgerows (422)           | 6 Mg   | 120 Mg                                | 120 Mg                                      |
| Prescribed Grazing (528)  | 1,460 Mg                                       | 29,200 Mg                             | 29,200 Mg                                   |
| Riparian Restoration      | 410 to 1,535 Mg                                | 6,144-23,035 Mg at 15 years           | 18,431-69,106 Mg at 45 years.               |
| No Till (329)             | 39 Mg  | 780 Mg                                | 780 Mg                                      |
| Minimum-Tillage (345)     | 100 Mg   | 2,000 Mg                              | 2,000 Mg                                    |
| Silvopasture (381)        | 660 Mg   | 13,200 Mg                             | 214,000 Mg                                  |
| Nutrient Management (590) | 610 Mg   | 12,200 Mg                             | 48,800 Mg                                   |
| <b>Totals</b>             | <b>6,081- 7,206 Mg</b>                         | <b>187,651 - 204,542 Mg</b>           | <b>527,164 - 589,259 Mg</b>                 |

# Guidelines

- Make wisely use of compost and mulch
- Use mature compost
- Have a soil test done for baseline and amendments
- Monitor Soil Organic Matter (SOM) levels

# Quantity and Cost Calculator

Mulch/compost calculations. Only fill in the non-shaded, green areas

| Product        | Compost/Mulch depth (In.) | Number of acres you want to put mulch/compost on | Cost per Cubic Yard | Cubic yards per Acre | Cubic Yards for Total Farm | Cost per Acre | Total Cost of Mulch needed for Total Vineyard |
|----------------|---------------------------|--|---------------------|----------------------|----------------------------|---------------|---|
| Sonoma Compost | 0.2                       | 3  | \$20.00             | 26.9                 | 80.7                       | \$537.78      | \$1,613.33                                    |

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Mulch/Compost Calculations.

| Field Name  | Vine Row Swath (Ft.) | Vine Row Spacing (Ft.) | Percent of one Vineyard Acre that mulch will be applied to | Number of Vineyard Acres that you want to put mulch on | Total number of "treated acres" that mulch will be applied to | Depth of mulch to be Applied (In.) | Cost per Cubic Yard Delivered | Cubic Yards/ Acre* | Total Cubic Yards Needed | Mulch Cost/ Acre | Total Mulch Cost for Vineyard |
|-------------|----------------------|------------------------|--|--|---|------------------------------------|-------------------------------|--------------------|--------------------------|------------------|-------------------------------|
| Your Winery | 2                    | 8                      | 25.00%   | 10   | 2.5   | 2                                  | \$25.00                       | 67.2               | 672.2                    | \$1,680.56       | \$16,805.56                   |

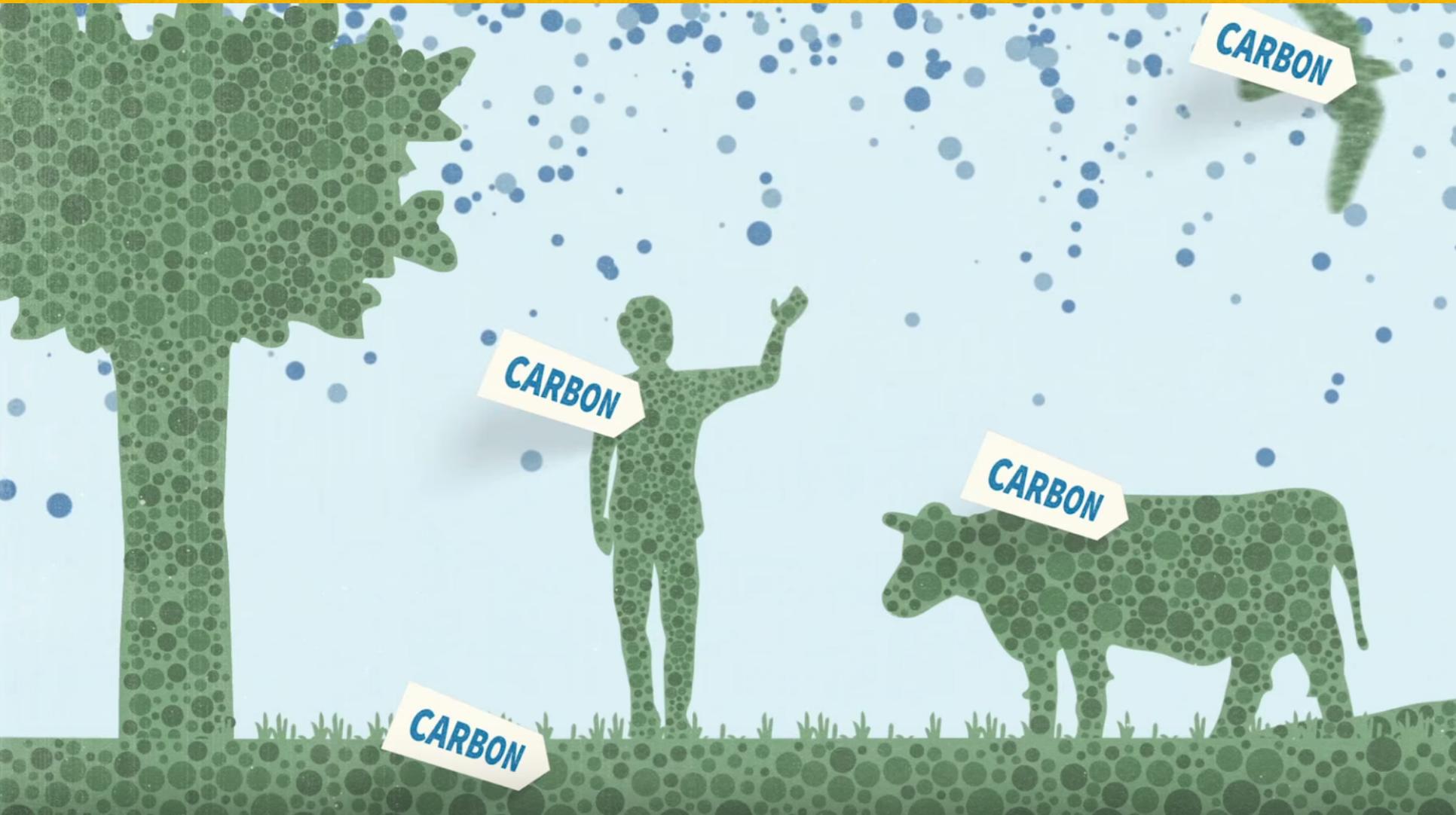
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# SPREADING THE GOODS



# The Compost Story



# Thank you Questions?



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