



Workshop in Lanai Island

“Soil Health”

Rosemary Gutierrez-Coarite

Department of Tropical Plant and Soil Science

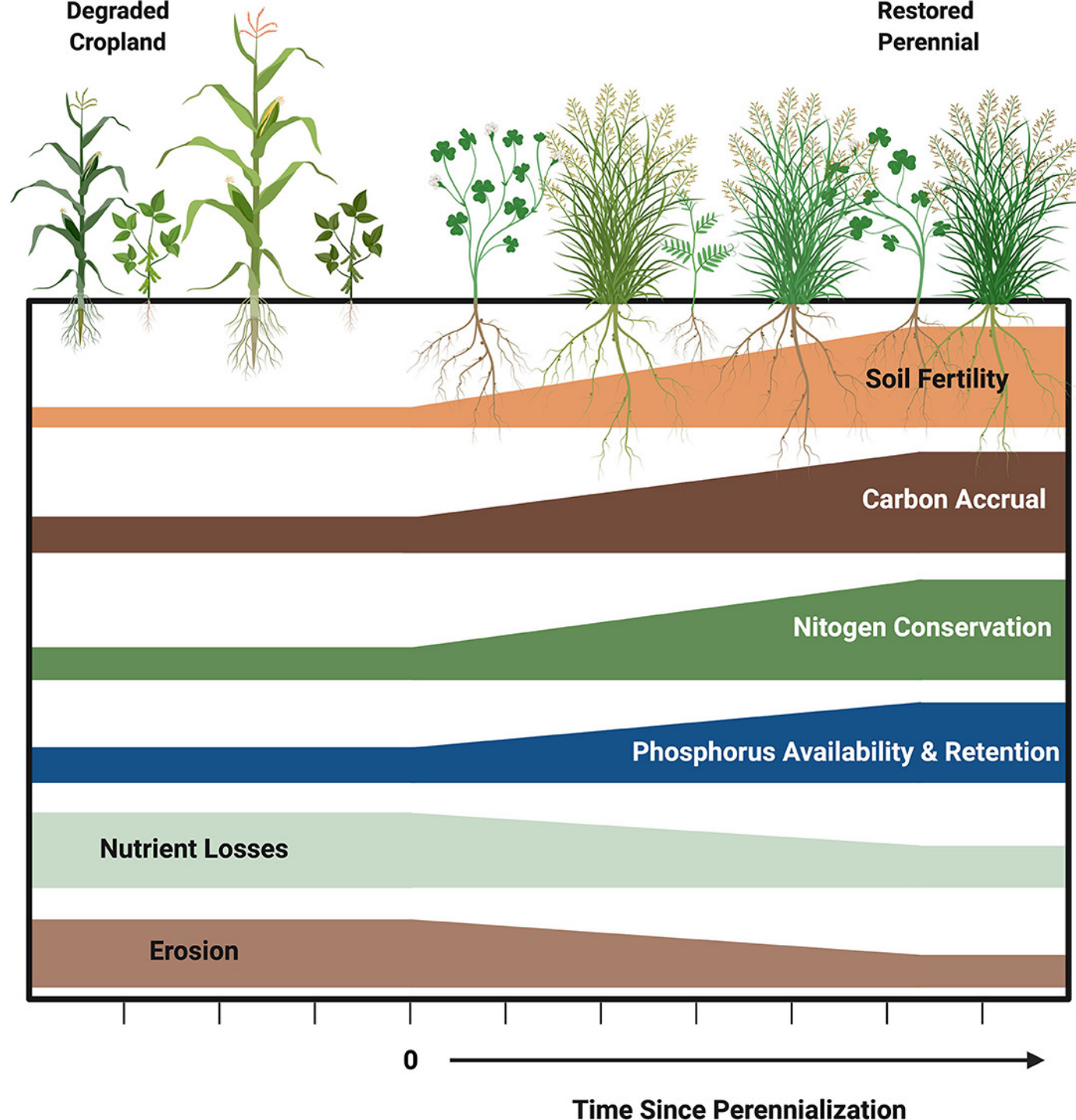
University of Hawaii at Manoa

Soil Health

- Soil health is the foundation of productive farming practices. Fertile soil provides essential nutrients to plants.
- Important physical characteristics of soil structure and aggregation allow water and air to infiltrate, and roots to explore.

Soil Fertility

- Soil fertility is the ability of a soil to provide the nutrients needed by crop plants to grow.
- The primary nutrients plants take up from soils include nitrogen, phosphorus, potassium, calcium and magnesium. Frequently, we need to supplement soil nutrients by adding fertilizer, manure or compost, for good crop growth.
- Plants take up many other nutrients from soils, but there is usually enough of these secondary nutrients in the soil, so there is no need to add more.



Soil pH

- Soil pH is another important aspect of soil fertility. pH is not a plant nutrient, but rather is a measure of the acidity of the soil. Most crops grow best when the soil pH falls between 6.2 and 6.8. This is the range in which plant roots can best absorb most nutrients from the soil.

Organic Matter

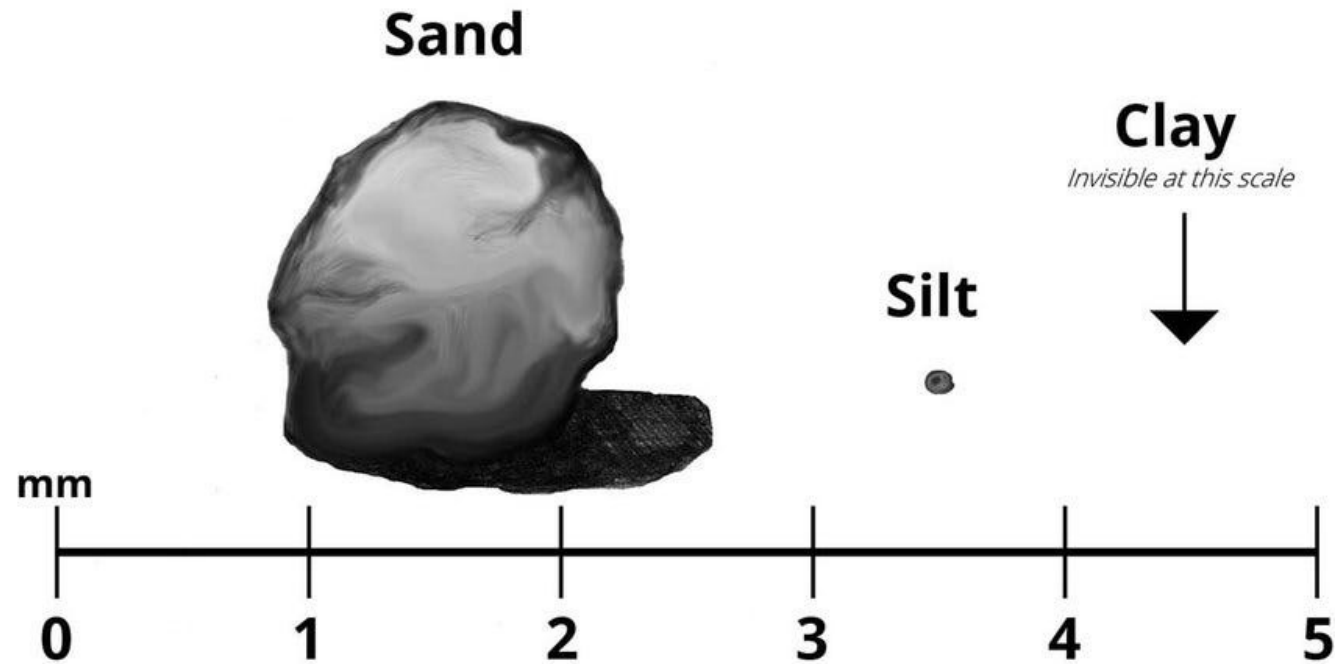
- Organic matter is composed of plant and animal residues, living and dead soil microorganisms, and substances produced through decomposition.
- Most agricultural soils contain only a small proportion of organic matter (usually less than 5%), but this small amount plays a very large role in soil quality.
- Soil organic matter tends to improve soil fertility, soil structure, and soil biological activity. Organic matter is added to soils through cover crops, manure, compost, and crop rotation.

Soil Texture

- Soil texture is an important soil characteristic that influences many aspects of soil quality. The textural class of a soil is determined by the percentage of sand, silt, and clay.
- Soils are usually made up of a mix of the three particle sizes. Sand particles are relatively large, clay particles are very tiny in comparison to sand, and silt particles are medium-sized.
- Clay and silt particles hold more water and plant nutrients along their surfaces than sand particles. Soil texture is an inherent property of a soil, and does not change under different management practices. Soils can be classified as one of four major textural classes: (1) sands; (2) silts; (3) loams; and (4) clays. These are based on the proportion of particle sizes found in each soil.

- For example, a clay soil will hold more nutrients and more water compared to a sandy soil, but will be more susceptible to compaction from plowing and cultivating.

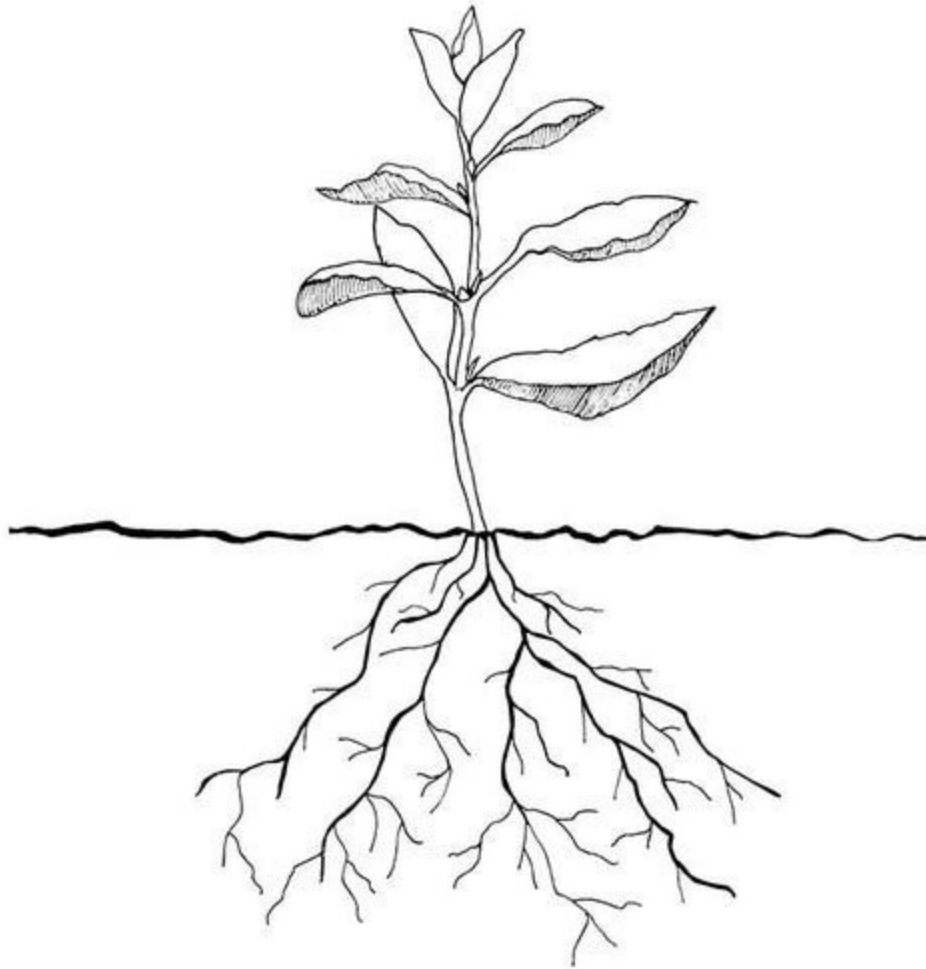
Relative Soil Particle Size



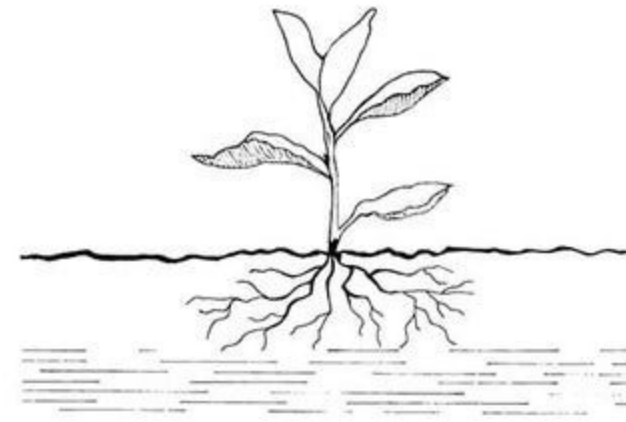
Soil Compaction

- Soil compaction occurs when soil aggregates are pushed closer together, and pore spaces shrink.
- This usually occurs when heavy tractors, trucks and other machines are driven over soil, particularly if soils are wet. Soils can become compacted at the surface, but also at the layer of soil just below the depth of tillage (subsoil compaction).
- Plants have difficulty growing in compacted soil because the soil aggregates are pressed together, leaving little pore space for air and water, which are essential for root growth.

Plant growth is limited in compacted soils



No Compaction



Compacted Soil

Soil Biological Activity

- Healthy soils are teeming with living organisms: bacteria, fungi, insects, earthworms, etc. As these living things go through their life cycles, they perform many functions that help improve the quality of soil.
- Soil organisms decompose fresh organic matter such as crop residues and animal manures.
- They also create humus, a form of organic matter that doesn't decompose further, that helps soils hold water and nutrients.
- Earthworms tunnel through soils, opening up pathways for air and water to move into the soil.



Soil Preparation

- **The ideal soil texture is “loamy”** and consists of equal parts of sand, silt, and clay. Loamy soil has that perfect balance
- It holds moisture but also drains well, allows oxygen to reach plants’ roots, and is rich in humus (organic matter).
- It’s fertile, easy to work, and contains plenty of organic matter.



Improve your soil

- The best way to make poor soil into perfect soil is to add nutrient-rich organic matter such as compost and/or manure.



Improve your soil

The benefits

- Loosens tight clay soil to improve drainage and aeration, and release minerals.
- Bulks up sandy soil to improve its water-holding capacity and nutrient retention.
- Makes soil easier to dig and work with.
- Moves soil pH towards a level ideal for most fruits and vegetables.
- Supplies food for beneficial soil organisms (earthworms, insects, fungi, and beneficial bacteria).