



# Zilker Botanical Garden Activity Guide

## *Clay, Silt, & Sand: Determining Soil Texture in your Hand!*

**Ages:** 12+ and up

**Objective:** Folks will be able to define the three types of soil particles and determine texture by applying the soil ribbon test.

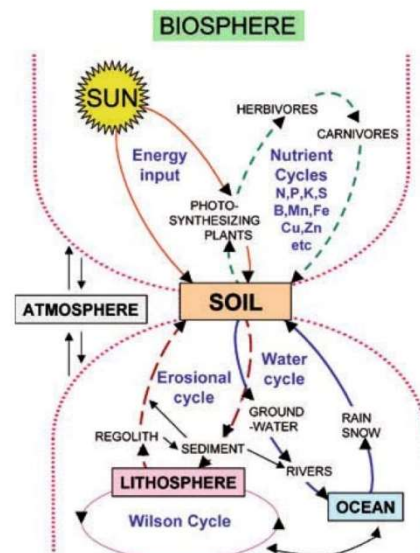
**What is Soil?** Soil is a mixture of solids, liquids, and gases that is:

- a medium for organismal growth
- a water & nutrient reservoir
- a modifier of the atmosphere
- weathered minerals from the earth's crust

Soil is a critical component in energy and nutrient cycling in our ecosystems as it interfaces with the biosphere, hydrosphere, atmosphere, and lithosphere.

**Soil is made up of particles.** Soil is comprised of organic and inorganic matter. Organic matter derives from living organisms, while inorganic matter derives from bedrock. When this rock material weathers and breaks down this is called mineral matter and can vary in size. We group these particles into three sizes based on their diameter.

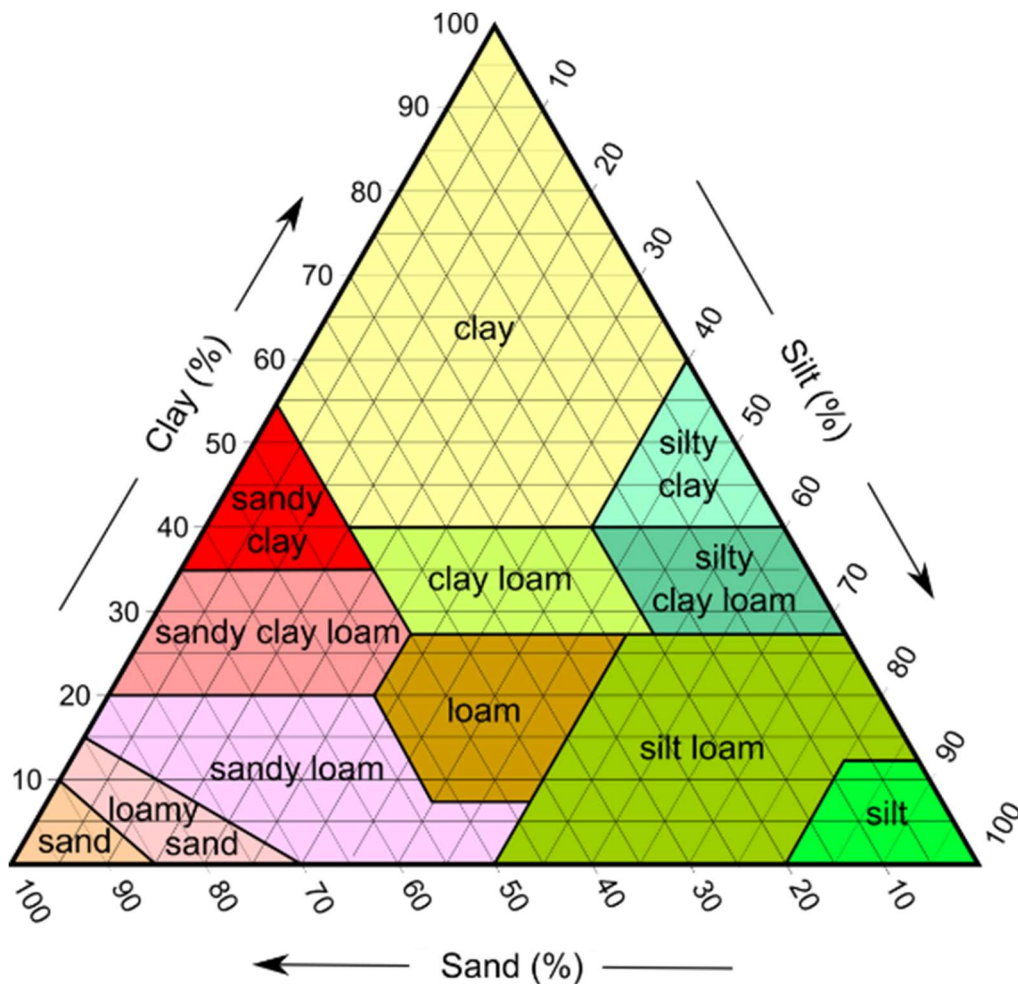
- **Sand** is the largest particle ranging from 0.02mm to 2mm in diameter
- **Silt** is the mid-sized particle ranging from 0.002mm-0.02mm in diameter
- **Clay** is the smallest particle being less than 0.002mm in diameter



*Soil mediates the exchange of energy and matter between the lithosphere, hydrosphere, atmosphere, and biosphere (Chesworth, 2006)*

**Soil Texture** is the composition of the soil based on the percentages of clay, silt, and sand particles. It is important to understand soil texture as it influences several soil properties including water holding capacity, permeability, soil workability, fertility, and soil structure. Soils with high sand percentages feature good permeability and air space, but poor fertility and water holding capacity. On the opposite end of the spectrum is clay, which has high fertility and water holding capacity, but poor permeability and air space. Silt is fair on permeability, fertility, water holding capacity, and air space. The diagram below is the soil texture pyramid, and it identifies the names of the textures based on the percentages of clay, silt, and sand.

**Loam is the best soil texture for plants.** Being 40% sand, 40% silt, and 20% clay, loam features the best fertility, permeability, and water holding capacity. Additionally, loam forms clods and crumbs, which allows for greater drainage and air space.



**Activity: Determining Soil Texture by Feel** Soil texture describes the percentages of clay, silt, and sand, which influences its other properties. The pyramid at the bottom of page 2 shows the names for the textures dependent on the particle percentages. There are multiple methods to determining soil texture. The soil ribbon test is a relatively accurate method for determining soil texture based on the soil's ability to form a ribbon (or clump) in your hand. Follow the chart below to conduct your soil ribbon test.

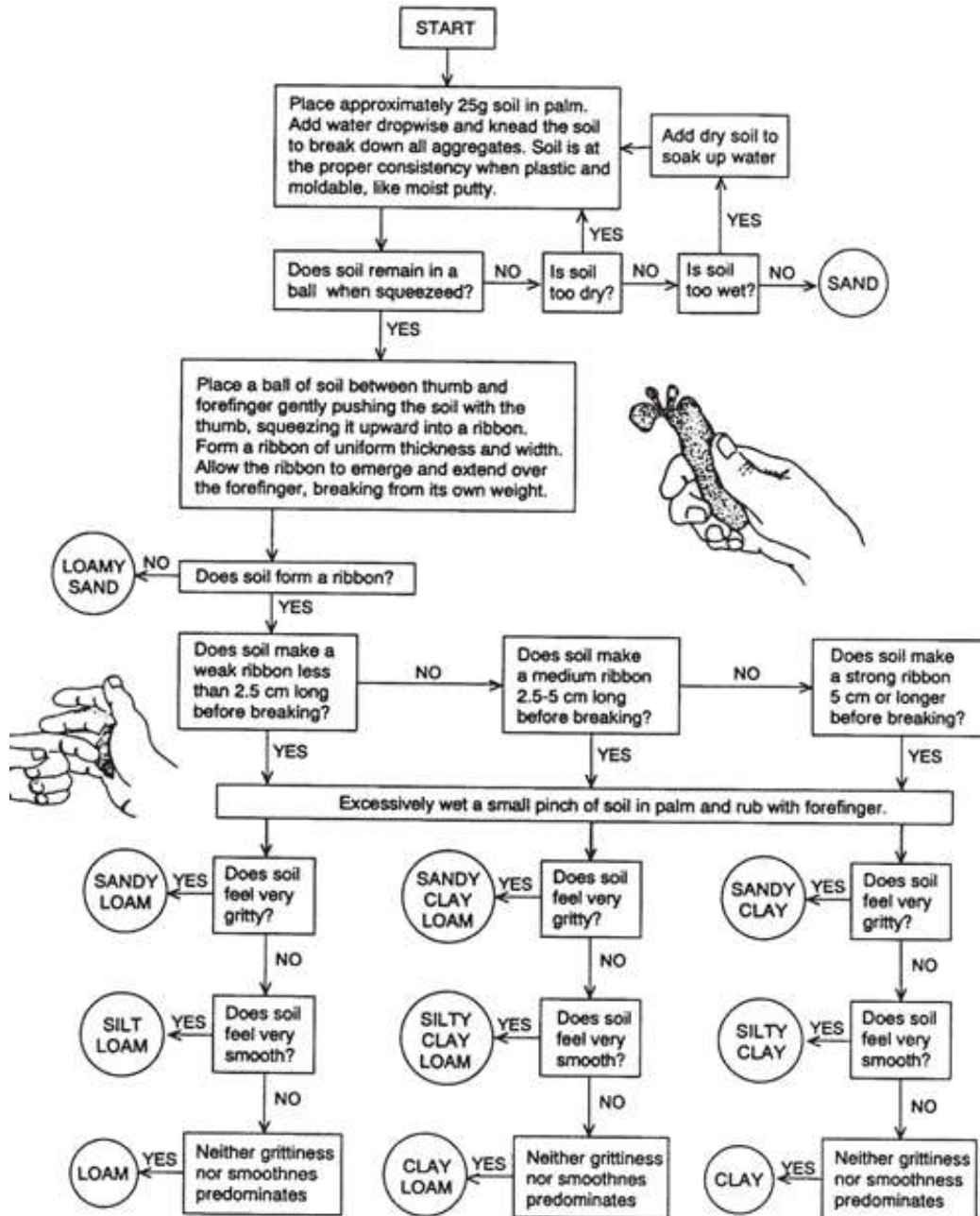


Diagram courtesy of New Mexico State University Cooperative Extension Service and Agricultural Experiment Station Publications.

The chart below describes many of the soil textures when dry and when wet. Can you determine which soil texture you have?

Soil Texture	When Dry	When Wet
Sand	Gritty, loose, and single grained	Easily forms into crumblable ball
Loamy Sand	Gritty & loose, but silt and clay are present	Easily forms into crumblable ball, but slightly stains fingers
Sandy Loam	Clods can be broken easily, sand is identifiable	Forms a gritty ball that can endure careful handling; stains fingers
Loam	Clods are somewhat hard to break, somewhat gritty	Forms a ball, not gritty but not smooth; stains fingers
Silt Loam	Clods are hard to break. Shows fingerprints and feels soft & floury	Balls are smooth, slick, and buttery; stains fingers
Clay Loam	Clods are very hard to break	Slightly gritty; stains fingers; ribbons well
Silty Clay Loam	Clods are very hard to break; feels smooth	Slightly gritty; stains fingers; ribbons well
Sandy Clay Loam	Clods are very hard to break; feels smooth	Slightly gritty; stains fingers; ribbons well
Clay	Clods cannot be broken without large amounts of force	Plasticky and sticky; stains fingers

**References and Further Reading:**

Chesworth, Ward. (2006). Encyclopedia of Soil Science. AAS/Division for Extreme Solar Systems Abstracts. 10.1007/978-1-4020-3995-9\_323.

Hanson, DeMouche, Lesikar, and Dreager. (2013) "Onsite Wastewater Management: A Manual for Tribes" New Mexico State University Cooperative Extension Service and Agricultural Experiment Station Publications. [https://pubs.nmsu.edu/\\_circulars/CR667/index.html](https://pubs.nmsu.edu/_circulars/CR667/index.html)