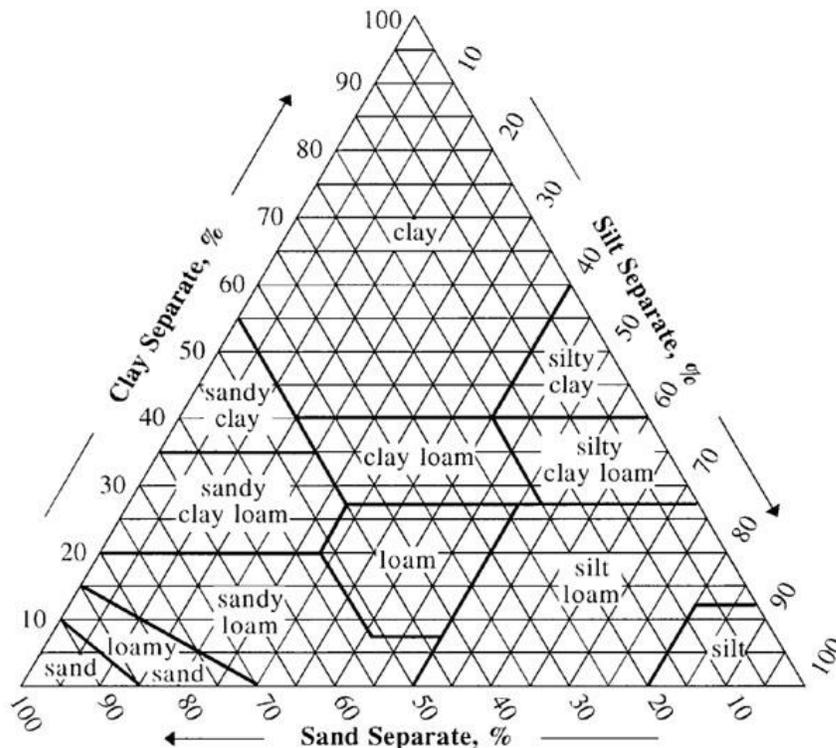


Urban Soils:

- “A soil material having a non-agricultural, man-made surface layer more than 50 cm thick, that has been produced by mixing, filling, or by contamination of land surfaces in urban and suburban areas”
- Characterized by:
 - Great vertical and spatial variability
 - Modified soil structure = compaction (reduced pore space + increased BD)
 - Restricted aeration and water draining → some locations more likely to be anaerobic
 - Low organic matter
 - Experience excessive inputs of heavy metals and synthetic chemical
 - Modified temperature and pH (high due to high loading of Ca in soils)
 - Surface crust formation → usually hydrophobic
 - Interrupted nutrient cycling + modified soil organism activity → fewer mycorrhizae associations (fungus that grows in association w/ roots)

Soil texture:

- Texture influences water holding capacity, water movement, nutrient availability, root penetration and soil structure.
 - Clay: fine soil particles that have more surface area, increasing water and nutrient holding capacities. Typically known for poor drainage, but not always the case (West Duwamish GB)
 - Sandy: coarse soil particles and large pores that increase aeration and water penetration, but often limit soils ability to hold water and nutrients. Interlaken park (sandy/sandy-loam) sees sloughing w/ limited disturbance suggesting it suffers from a lack of structure
 - Silt particles fall between sand and clay in size, nutrients, and moisture conditions. [SEP]
 - Loam: refers to a soil that has half as much clay as sand or silt, making for a well-structured soil with ideal pore space and surface area to hold water and nutrients. [SEP]
- Swell and shrink depending on water content, clay and organic matter influence the formation of aggregates and the maintenance of pore space, improving the structure of the soil



Common Drought Symptoms:

- Top of tree down, from the outside in
- Most native plants respond to water limited situations by dropping leaves...
 - For deciduous species: wilting, brown or curling leaves is typical
 - For conifer species: may drop all needles except the needles that grew this year and last year, or second-year needles may turn yellow or red prematurely
 - Sacrifice of older foliage enables the plant to use less water and protects the younger high food-producing foliage to ensure its long-term survival.
 - Cost to the tree is stunted growth—**we will see a much smaller “tree ring” for this season.**
- Drought stress: xylem tension can increase to the extent that a conduit breaks, allowing in air and effectively restricting water flow to the plant
- Avoidance methods reduce the degree of stress by adjusting physiological functions and morphological features to accommodate limited water availability. This can include adjusting stomata aperture to reduce water loss.
 - Plants cannot withstand lower water conditions/reduce photosynthesis
- Drought tolerant species, on the other hand, are able to endure restricted moisture conditions; often keeping stomata open longer, allowing for continued photosynthesis and growth.
 - Studies have shown greatest resistance in Grand fir, followed by Western Red Cedar, Douglas fir, with Western hemlock on the lower end

Steps to improve existing soil conditions:

- Compost – to improve soil drainage:
 - Compost is a mix of organic materials that are partially decomposed. Adding compost to clay soil improves drainage by breaking up the tightly packed clay particles.
 - Increases CEC = nutrient storage & availability
 - Reduce heavy metal mobility/toxicity + breakdown hydrocarbons/most pesticide residues
 - Too much compost too deep in soil promotes anaerobic conditions → add to upper 8"-12" of soil
 - **‘tie up’ heavy metals due to functional groups on humic matter**
 - When added to sandy soil, it increases the ability of the soil to hold water by acting like little bits of sponge. Compost returns nutrients that are removed by plants, provides habitat for the microorganisms that live in soil, and increases pore space.
 - Adding compost into soil or layering it on top of soil mimics how organic matter is recycled back into the soil in nature.
- Mulch – to protect soil:
 - Mulch is a generic term that refers to any protective covering put on the surface of soil. Mulch can be organic (compost, leaves, bark, cardboard, etc.) or inorganic (plastic, weed barrier, etc.) and is extremely beneficial because it helps retain moisture, control weeds, moderate temperatures, and prevent erosion.
 - Limits weed growth
 - Conserves water, moderates temperature and reduces erosion
 - Use mulch rings to reduce summer water stress and increase seedling survivorship at sites with limited summer soil moisture. ^[1]_[SEP]
 - Sometimes deeper mulching creates temperature conditions that significantly limited lateral root development and overall tree growth
 - A thick layer of mulch helps soil retain moisture and regulates soil temperature, and holds on to any water throughout the dry months. According to the [Forest Steward Field Guide](#) for Green Seattle volunteers, optimal mulch is two 5 gallon buckets of mulch/plant. Place mulch 4-6" deep and at least 4" away from the base of trees