**Coffee and Urban Soils – 2/15/2022**

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Urban soils are different than those that we typically find in undisturbed soils.

Outline

1. Soil Conditions
   1. Physical
   2. Chemical
   3. Biological
2. Site Assessment
3. Soil Sampling
4. What do I do now?

Physical Conditions of Urban Soil

* No distinguishable horizons
* Subsoil fill above top soil
* Layers of rock or foundations
* Pavement
* Unknown debris – especially if there was a home that used to be on the vacant property

Subsoil fill and buried horizons. This creates challenges with the chemistry

Debris in the soil. Trash, rock, metal, etc. Makes it difficult for both the grower and the plant.

Compaction. This is present in our farm fields, but it may be less extreme than you notice in urban settings. Loose and airable soils are more ideal for plant growth.

Chemical Conditions of urban Soils

* Contamination concerns
  + Heavy metals
  + Asbestos – Homes are often collapsed in on themselves
  + Pesticides
  + Other contaminants
* Urban Soil Contamination Sources
  + Lead cleanup area
  + Smokestacks
  + Dry cleaning facility – how did they get rid of their chemicals
  + Tires, rusting metal
  + Oil drums for heating oil
* Nutrients
  + Low fertility levels
    - Possibly little organic matter to decompose back to the soil
    - No nutrients added based on use
  + pH
    - low or high
    - ideal range is 6.0-7.0 – most of the soils are above 7
  + Too little
    - Plants struggle to grow
    - Weeds outcompete
    - Reduced yield
    - Susceptible to disease/pests
  + Too much
    - Runoff/leaching cause pollution
    - Weeds can be an issue
    - Plant damage
    - Waste money

Biological Conditions of Urban Soils

* We have to work to bring soil biology back

Urban soil site assessment

* How do I know what problems may be present?
  + Find out the history of the site
    - Historical aerial photos (<https://www.acimap.us/>)
    - Property records
    - Talk to neighbors – neighbors may know more about the building
  + Sample the soil
    - Heavy metals
    - Nutrients
* Soil testing
  + Heavy metals
    - Who can take sample?
      * You (wear proper protection)
      * Hire a professional
    - What are you testing for?
      * Lead, arsenic, zinc, cadmium, chromium, mercury
      * PAHs and PCBs
    - Where do you send samples?
    - Determine if contaminants are likely and what areas to focus on
      * Test where house used to be, by road, where drip line used to be. Grassy areas might be lowest contamination.
    - Follow your labs procedures
  + Nutrients and pH
    - Sample to a depth of 4-8”
    - Collect 2 cups of soil per sample
    - Best if 1 sample represents less than 1 acre
    - Sample different parts of the site separately
      * Raised beds vs in-ground
      * Flowers vs vegetables
      * Perennials vs annuals
  + Taking a sample with a shovel
    - Take off the sides and only take the middle (about an inch wide). Get rid of grass
  + Do
    - Allow plenty of time for a lab
    - Keep timing and sample size similar from year to year
    - Samples should cover a max of 1 acre (lawn/garden) or 5 acres (farm)
    - Make a map of your sampling
  + Do NOT
    - Use a metal bucket
    - Sample immediately after fertilizer application
    - Under sample
    - Combine samples from areas which a drastically different or which have noticeable issues

How do I fix my soil?

* Hard to “fix” but there are ways to improve
  + Improving the soil situation will take time
  + Improvement is dependent on 2 factors
    - What is wrong with the soil?
    - What are your production goals?
* Correcting nutrient issues
  + What does your soil report say and what are the recommendations?
    - Blindly adding nutrients is not always helpful
      * Imbalances can cause growth issues
      * Environmental issues if excess nutrients are applied
    - Organic matter is not a silver bullet
      * Consider the source
      * Have patience
      * What other issues exist in the soil report?
  + Nutrient concerns
    - Apply the correct amounts of NPK
    - Do you need micronutrients?
    - Consider the source
      * Organic vs inorganic
      * Differing levels of NPK
    - Know the nutrient levels of compost applied
* Improving soil
  + A soil analysis is not a full picture of soil health (like getting a health test is not a full measure of health)
    - Add tilth to the soil
    - Use cover crops
    - Keep living material in the soil year round
    - Consider other environmental factors
      * Flood plain?
* Correcting Contamination Issues
  + Consider the levels and your production goals
    - Are the levels significant?
    - Options to mitigate high levels
      * Remediation
      * Non-remediation
  + Remediation
    - EPA
      * Techniques most applicable for agriculture projects include physical (excavation, installing geo-textiles, soil washing, or soil vapor extraction) or biological (microbial, phytoremediation, or application of soil amendments.)
  + Non-remediation
    - EPA
      * Many non-remedial options exist…by planting above ground, including installing raised beds, growing in containers, green walls or rooftop growing, or aquaponics
    - It does NOT mean doing nothing
  + It does NOT mean doing nothing
    - Use some other growing method in the soil that’s there
  + Which to use?
    - EPA
      * Non-remediation is appropriate on “sites with low levels of contamination, or sites with contamination exposure risks which can be controlled by planting above ground.”
    - Non-remediation can also be used when the soil just prohibits in the ground growing –hardpan, backfill, asphalt, or too full debris
  + Think about more than just growing in the soil
    - Direct exposure to contamination (soil)
      * You can use grass as walkways
    - Inhalation of contamination
    - Uptake by plants and subsequent consumption
  + Non-remediation methods
    - Beds with frames – don’t use treated lumber. Cedar is most recommended wood.
    - Tips for beds with frames
      * If using wood, choose rot-resistant wood like cedar.
      * Remember that soil and water are heavy and will cause wood or toher materials to bow and shift over time. It’s best to have supports around the bed.
      * Find tons of DIY construction plans online or use kits (a little more expensive).
      * Make sure to mulch the ground around the beds to keep any soil contamination covered.
    - Large scale: woodchips
      * With topsoil/compost fill
      * Steps
        + Establish a base platform of woodchips to the necessary depth.
        + Measure desired plot size and create a woodchip “retaining wall”
        + Compress woodchip base by driving over. Or add cardboard to keep soil in place until woodchips settle.
        + Add compost/soil mix to desired depth
      * Remember that fresh woodchip mulch quickly decomposes, so use at least twice the depth you want.
      * Mulch will kill off most plants and grasses that it covers, but the most problematic weeds will grow through the mulch and thrive (thistle, bindweed, etc.). If time, try tarping the whole area before developing.
      * Mulch will spill off the edge of the garden onto sidewalks or parking lots. Keeping the edges tidy and mulch contained by using railroad ties around the perimeter.
    - Large scale: Mounded beds
      * Erosion control is important
        + Something needs to grow on the sides. Rain will wash away the soil
      * Plan ahead for width and depth
        + Size appropriately for your tools
        + Space well to allow for traveling in the row
    - Container growing
      * Allows to grow in a lot of situations, even on a roof.
      * Cloth bags, plastic bags and buckets.
      * Wood containers.

Questions

Where could we find the list of potential contaminants that were on slides 10 and 11?

* From USDA or other extension contaminations

Are there hotspot areas?

* The GE facility or others that were more industrial
* The USDA recommends don’t play in the soil if there are more 400 ppm, but extension takes extra precautions

I may have missed this, but is there a good cover crop that you suggest for soil amendments/development?

* Generally, you’re trying to get organic matter and break up the soil in urban settings. If you want nitrogen, legumes like clover are common. If you want to break up the soil, radish is common, and it winter kills.
* The SWCD has cover crop seed available

How long does it take to repair compacted soil if we have tilled for years and we’ve grown cover crops for the past couple of years? We are going towards a no till garden.

* It depends on the soil. You’ve been tilling to help with compaction, but tilling only goes so deep. You should probably see minimal compaction moving forward since you’re using cover crops.
* Digging a soil pit really helps to figure out where you are.
* Don’t confuse hard soils with compacted soil. Clay gets hard when it’s dry. Just because you can’t get a shovel in doesn’t mean it’s compacted. Add organic matter and use a cover