Preparing soils for a hot, dry year

Overview of seminar

- Garden and landscape soil basics
  - Comparative plant-soil systems
  - Soil testing and interpreting results
  - Interference with soil function
- Pitfalls of amending soils
- Mulch types
- Mulch problems
- Garden management using coarse arborist wood chips

Plant-soil systems, goals, and appropriate management

<table>
<thead>
<tr>
<th>Comparative criteria</th>
<th>Intensive annual agriculture</th>
<th>Home vegetable garden</th>
<th>Ornamental landscape</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plant life cycle</td>
<td>Annuals</td>
<td>Annuals/perennials</td>
<td>Woody plants/perennials</td>
</tr>
<tr>
<td>Planting scheme</td>
<td>Monoculture</td>
<td>Polyculture</td>
<td>Permanent landscape</td>
</tr>
<tr>
<td>Biomass removal</td>
<td>High</td>
<td>Moderate</td>
<td>Low</td>
</tr>
<tr>
<td>Soil disturbance</td>
<td>High</td>
<td>Moderate</td>
<td>Low</td>
</tr>
<tr>
<td>Nutrient inputs</td>
<td>High</td>
<td>Moderate</td>
<td>Low</td>
</tr>
<tr>
<td>Disease pressure</td>
<td>High</td>
<td>Moderate</td>
<td>Low</td>
</tr>
<tr>
<td>Pest pressure</td>
<td>High</td>
<td>Moderate</td>
<td>Low</td>
</tr>
<tr>
<td>Biodiversity</td>
<td>Low</td>
<td>Moderate</td>
<td>High</td>
</tr>
<tr>
<td>System goal</td>
<td>Maximize yield</td>
<td>Crops for personal use</td>
<td>Sustainability</td>
</tr>
</tbody>
</table>

Soil testing and interpretation

- Lab tests – only use a government or university lab that has expertise with garden and landscape soils
- Texture (https://youtu.be/0tRQUPDRiDU)
  - Sandy soils – little nutrient retention, high oxygen levels and rapid drainage
  - Silty soils – little nutrient retention, lower oxygen levels and slower drainage
  - Clay soils – high nutrient retention, lowest oxygen levels and slowest drainage

Interpreting lab results – compare natural vs. managed landscape

- Lab information that requires action
  - Excessive levels of nutrients can be toxic – identify source(s)
  - Soil OM – highly variable, important to understand and correlate with nutrient levels
Lab information that requires no action

- **pH** – it is what it is; do NOT attempt to change it except in limited volume areas
- Low to optimal levels of nutrients (verify any actions with ground truthing [below])
- Generic fertilizer recommendations – these are not made with sustainability as a goal

Factors that interfere with normal soil function and restrict air and water movement

- Layered soils (e.g., landscape fill used as “topsoil”) – creates perched water table
- Amended soils – creates textural barriers
- Drainage “improvements” (e.g., French drains) – creates perched water table
- Compaction – eliminates pore space
- Use of any sheet mulch (newspaper, cardboard, landscape fabric, plastic)

Amending soils

- Difference between amendment and mulching
- Incorrect system goal – annual crop production

Results of amendment

- Soil textural discontinuity
- Hydrology disruption

Water enters fine-textured soil; vertical and horizontal movement both occur

Water contacts soil interface; vertical movement stops

Water enters coarse-textured soil only when gravitational pressure overcomes barrier

- Soil subsidence
- Nutrient overload
### Mulches

**Impacts of landscape mulches compared to bare urban soils**

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Living</th>
<th>Synthetic</th>
<th>Inorganic</th>
<th>Organic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conserve soil moisture?</td>
<td>+/0/-</td>
<td>-</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Reduce soil compaction and erosion?</td>
<td>+</td>
<td>+/0</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Moderate soil temperature?</td>
<td>+</td>
<td>+/0/-</td>
<td>+/0/-</td>
<td>+</td>
</tr>
<tr>
<td>Provide nutrients?</td>
<td>+/-</td>
<td>-</td>
<td>0</td>
<td>+/-</td>
</tr>
<tr>
<td>Enhance plant growth?</td>
<td>+/0/-</td>
<td>0/-</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Enhance beneficial soil organisms?</td>
<td>+</td>
<td>-</td>
<td>+/-</td>
<td>+</td>
</tr>
<tr>
<td>Control weeds?</td>
<td>+</td>
<td>-</td>
<td>+/-</td>
<td>+</td>
</tr>
<tr>
<td>Control insect pests?</td>
<td>+/0</td>
<td>0/-</td>
<td>+/0</td>
<td>+/0</td>
</tr>
<tr>
<td>Control disease?</td>
<td>+/0</td>
<td>0/-</td>
<td>+/0</td>
<td>+/0</td>
</tr>
<tr>
<td>Reduce pesticide use?</td>
<td>+</td>
<td>-</td>
<td>+/-</td>
<td>+</td>
</tr>
<tr>
<td>Relative cost?</td>
<td>$</td>
<td>$$ to $$$</td>
<td>$ to $$$</td>
<td>Free to $$</td>
</tr>
<tr>
<td>Availability?</td>
<td>N/LC</td>
<td>N/LC, HI</td>
<td>N/LC, HI</td>
<td>N/LC, HI, A/U/TS</td>
</tr>
<tr>
<td>Ease of replacement?</td>
<td>Moderate</td>
<td>Difficult</td>
<td>Easy</td>
<td>Easy</td>
</tr>
</tbody>
</table>

$ = low  
$$ = moderate  
$$$ = high  
N/LC = nursery/landscape center  
HI = home improvement store  
A/U/TS = arborist/utilities/tree service

#### Acceptable mulches

- **Living**: Cover crops, ground covers
- **Inorganic**: Brick, decomposed granite, lava rock, stone pavers, tumbled glass
- **Organic**: Bark, coir, compost, leaves, nutshells, pine needles, straw, wood chips

#### Unacceptable mulches

- **Synthetic mulches (geotextiles, plastic, rubber)**
  - Not a permanent solution to weed control
  - Can damage health of landscape system
  - Sheet mulches reduce water and gas transport
  - Rubber mulches are flammable and may leach harmful chemicals
- **Organic sheet mulches (cardboard, newspaper)**
  - Can induce anaerobic conditions if used on wet, poorly drained soils
  - Will become hydrophobic if allowed to dry out
  - Can become pest havens for termites and rodents

#### Effectiveness of inorganic and organic mulches – numerous studies

- Weed control improves with mulch depth
Permeability increases with mulch coarseness

Greatest benefits and fewest drawbacks with deep, coarse mulches

Organic mulches can...
- provide a slow release of macro- and micro-nutrients
- improve soil structure by reducing compaction
- enhance establishment of trees and shrubs in low-maintenance landscapes
- enhance beneficial microbes and soil macrofauna biodiversity

Problems with fine-textured mulches
- Includes sawdust and compost
- Deep applications will lead to anaerobic soil conditions
- Often become compacted into impervious layers

Using compost as a mulch
- Use only if soil tests indicate generally low levels of nutrients
- If needed, use a thin layer of compost covered with an arborist wood chip mulch to prevent erosion and weed establishment (the “mulch sandwich”)

Arborist wood chips – the best choice
- Generated through chipping trees or parts of trees; they are NOT bark mulches (a poor choice)
- Many benefits, including unique ones
  - Provide a sustainable level of nutrient availability and prevent nutrient leaching
  - Build soil organic matter slowly and sustainably
  - Improve water and oxygen movement in soil
  - Reduce evaporation
  - Prevent soil erosion and compaction
  - Enhance beneficial microbes, especially mycorrhizae
- Ideal for weed control
  - Decrease nitrogen levels at mulch-soil interface
  - Reduce light needed by photodormant seeds
  - Reduce light availability to buried leaves and root crowns of weeds
  - Mulch depth is critical – when depths are less than 3” then weeds increase

Myths about arborist wood chips (AWC)
- “Wood chips leach nitrogen from the soil”
  - Wood chip mulches only affect nitrogen at the mulch-soil interface
  - Wood chip mulches do not cause nitrogen deficiency in soil beneath interface
  - High C:N ratio in wood chips prevents germination of weed seeds on interface
  - “Wood chips made from diseased wood will infect plants”
**Fungal pathogens and wood chips**

- Armillaria, Cytospora, Thyronectria and Verticillium only survive on large pieces of wood
- There is a possibility of disease transfer if wood chips are incorporated into soil
- There is no evidence that pathogens in mulch can infect roots below the soil surface

**Fungal communities in wood chips**

- Fungal species in wood chips are generally decomposers, not pathogens
- In healthy (aerobic) soils, beneficial fungi out-compete pathogenic fungi
- Healthy plants are not susceptible to opportunistic pathogens

**Landscape and garden management advice for gardeners**

**Data-based landscape management**

- Have at least one soil test to determine baseline nutrient levels and %OM
- Select plants that will tolerate site soil type and conditions
- Roots need nutrients, water, and oxygen. Avoid anything that reduces availability of these factors

**Soil amendment**

- You cannot change the character of your soil with amendments but you will create problems
- Amendments create textural discontinuities that reduce water, oxygen, and root movement
- Layered soils will create perched water tables

**Mulching**

- Do NOT place cardboard underneath AWC. No sheet mulches should ever be used
- Begin AWC application before annual weeds are established (spring or fall)
- Prune or mow perennial weeds at root crown; pulling destroys soil structure
- Thick layers (6-8” for ornamental sites, 8-12” for restoration sites and aggressive weed control) of AWC are best for weed control and water conservation. Add more as needed to maintain 4” depth.

For more information:

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Facebook page: http://www.facebook.com/TheGardenProfessors
Facebook group: https://www.facebook.com/groups/GardenProfessors/
Publications: https://www.researchgate.net/profile/Linda_Chalker-Scott/publications. This houses articles on many mulches, including arborist wood chips.
Washington State University Extension publications: http://gardening.wsu.edu/(peer-reviewed fact sheets on many topics of interest)/