

## Killing with kindness: how we enable trees to their ultimate demise

### Why do so many transplanted trees and shrubs fail?

- ✦ Misguided approaches to managing urban soils → improper site preparation
- ✦ Assembly-line plant production → poor quality roots
- ✦ Lack of awareness of how plants function → inadequate root preparation, improper installation and management
- ✦ Poor root establishment → increased mortality

### Seminar recommendations

- ✦ Apply to trees and shrubs (as the backbone of a permanent landscape)
- ✦ Are based on current, relevant plant and soil science for urban landscapes

### Today's topics

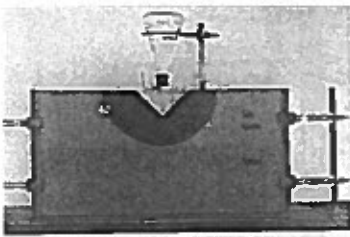
- ✦ Soil amendment
- ✦ Root preparation
- ✦ Pruning after transplanting
- ✦ Transplant fertilizers
- ✦ Mulching
- ✦ Staking

### Myth 1: Build a healthy soil by incorporating lots of organic matter

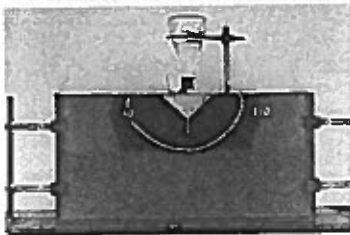
#### Problems caused by overamendment

- ✦ Result #1: Soil interface → perched water table
- ✦ Result #2: OM decomposition → subsidence
- ✦ Result #3 of excessive amendment: Nutrient overload

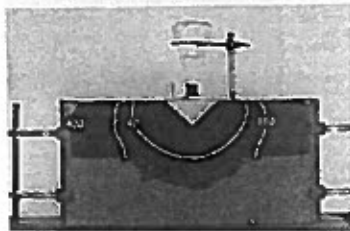
#### Perched water table



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

#### Subsidence

- ✦ When OM decomposition exceeds OM replacement → subsidence

#### Nutrient overload

- ✦ Nutrient overload → bad for tree, soil, and watershed health

## Soil test from an over-amended organic landscape:

DO NOT FERTILIZE this soil.

SOIL pH	5.9	NITROGEN: NO3-N =	110 ppm	NH4-N =	5 ppm
BUFFER pH	6.5	ORGANIC MATTER:	21.8 % (Desirable range 4-10%)		
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NUTRIENT LEVELS: PPM		Low	Medium	High	Very High
Phosphorus (P)	38	XX	XX	XX	XX
Potassium (K)	430	XX	XX	XX	XX
Calcium (Ca)	2463	XX	XX	XX	XX
Magnesium (Mg)	327	XX	XX	XX	XX

### Production vs. landscape horticulture

	Annual crop field	Permanent landscape
Vegetation is removed yearly	✓	Permanent vegetation
Soil is amended on an annual basis	✓	Can't amend soil after installation
System adapted to annual disturbance	✓	System not adapted to annual disturbance
Fertilized to maximize yield	✓	Fertilized to relieve deficiencies

#### Instead:

- ✓ Need for organic amendment can only be determined by soil tests
- ✓ In OM-poor soils, add only enough amendment to raise OM to natural, sustainable levels
- ✓ Add additional organic material as a mulch after plants are installed

#### Myth 2: Root balls must be left intact during transplanting

##### Facts:

- ✓ Container plants and balled-and-burlapped trees contain media that are different from landscape soil
- ✓ Burlap, twine, wire baskets, and other materials are all barriers to root growth
- ✓ Many balled-and-burlapped trees are bagged too deeply
- ✓ Deformed woody roots will not correct themselves

##### Instead:

- ✓ Removal of potting mix or clay from root balls will improve root establishment by eliminating barriers
- ✓ Correction of root flaws will stimulate new root growth and form a structurally sound system
- ✓ Installation at grade will ensure root crown is not buried

#### Myth 3: The crowns of transplanted trees must be pruned to compensate for root loss

Fact: Crown pruning redirects plant resources away from roots and towards new shoots

Instead: Realize that crown will remain dormant until roots can provide water for new leaves

#### Myth 4: Phosphate fertilizer stimulates root growth

##### Facts:

- ✗ Urban soils have enough phosphorus
- ✗ Phosphorus competes with iron and manganese
- ✗ Excess phosphorus inhibits mycorrhizae
- ✗ Excess phosphate pollutes aquatic systems

Instead: Use a nitrogen fertilizer needed for root proteins and enzymes

#### Myth 5: Landscape fabric controls weeds permanently

Facts: Landscape fabric limits air and water, interferes with roots, and does not stop weeds

Instead: There are many alternatives...living, inorganic, and organic mulches

Impacts of landscape mulches compared to bare urban soils

	<u>Living</u>	<u>Synthetic</u>	<u>Inorganic</u>	<u>Organic</u>
Soil moisture?	+ / 0 / -	-	+	+
Reduce compaction?	+	+ / 0	+	+
Moderate temperature?	+	+ / 0 / -	+ / 0 / -	+
Provide nutrients?	+ / -	-	0	+ / 0
Enhance plant growth?	+ / 0 / -	0 / -	+	+
Enhance beneficials?	+	-	+	+
Control weeds?	+	-	+ / -	+
Control pest insects?	+ / 0	0 / -	+ / 0	+ / 0
Control disease?	+ / 0	0 / -	+ / 0	+ / 0
Reduce pesticide use?	+	-	+ / -	+

Cost?	\$	\$\$ to \$\$\$	\$ to \$\$\$	Free to \$\$
Availability?	N/LC	N/LC, HI	N/LC, HI	N/LC, HI, A/U/TS
Ease of replacement?	Moderate	Difficult	Easy	Easy

\$ = low  
 \$\$ = moderate  
 \$\$\$ = high

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

Effectiveness of inorganic and organic mulches

- ✦ Weed control improves with depth
- ✦ Permeability increases with mulch coarseness
- ✦ Greatest benefits with deep, coarse mulches

Organic mulches will

- ✦ Provide a slow release of macro- and micronutrients
- ✦ Improve soil structure by reducing compaction and allowing aggregates to form
- ✦ Enhance establishment of trees and shrubs in low-maintenance landscapes
- ✦ Enhance beneficial microbes, which can outcompete pathogens if soils are healthy
- ✦ Enhance soil macrofauna biodiversity

Arborist wood chips

- ✦ Concerns about high carbon:nitrogen ratio - will this cause a nitrogen deficiency?
- ✦ Will diseased wood transfer pathogens if it is used for chips?

Nitrogen availability

- ✦ Wood chip mulches have a high C:N ratio, leading to a localized nitrogen deficiency at the mulch-soil interface
- ✦ Wood chip mulches do not cause nitrogen deficiency in established plants
- ✦ High C:N ratio in wood chips probably prevents germination of some weed seeds

Fungal pathogens and wood chips

- ✦ *Armillaria*, *Cytospora*, *Thyronectria* and *Verticillium* can all survive on large wood segments for months
- ✦ Survival is enhanced if wood chips are incorporated into soil
- ✦ 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
- ✦ Under healthy (aerobic) soil conditions, beneficial and harmless fungi probably out-compete pathogenic fungi
- ✦ Healthy plants are not susceptible to opportunistic fungal pathogens such as *Armillaria* and *Phytophthora*

### Mulch strategies using coarse organic materials

- ✦ Let wood chips age before using them if there are concerns about disease
- ✦ Before installing wood chips, create a thin underlying layer of a more nutrient-rich mulch (like compost) if there are concerns about nutrient deficiencies
- ✦ Begin mulch application before annual weeds are established (spring or fall).
- ✦ Remove perennial weeds in early spring when root resources are lowest
- ✦ Prune or mow perennial weeds at root crown; pulling destroys soil structure
- ✦ Remove all noxious weed materials from site to prevent rerooting
- ✦ Thick layers (4-6" for ornamental sites, 8-12" for restoration sites and perennial weed control) of coarse materials are best for weed control and water conservation
- ✦ Keep mulch away from trunks of trees and shrubs
- ✦ Pull any resprouting plants; the mulch layer prevents erosion and facilitates pulling
- ✦ Replace mulch as needed to maintain appropriate depth

Myth 6: Trees shall be staked firmly at installation

#### Facts:

- ✦ Overstaking directs tree resources towards crown and away from trunk
- ✦ Trunks without taper will not support crowns once staking is removed
- ✦ Staking materials left on too long will girdle and kill the tree

#### Instead:

- ✦ If staking is necessary, keep it low, loose, and remove after one year
- ✦ Dig up and replant anything that can't support itself after one year

### Less Stress = Greater Survival

Proper site and root preparation + Proper aftercare =  
Successful establishment → ↓ Management \$\$\$

Visualize forests - not fields - when managing permanent landscapes

#### For more information

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