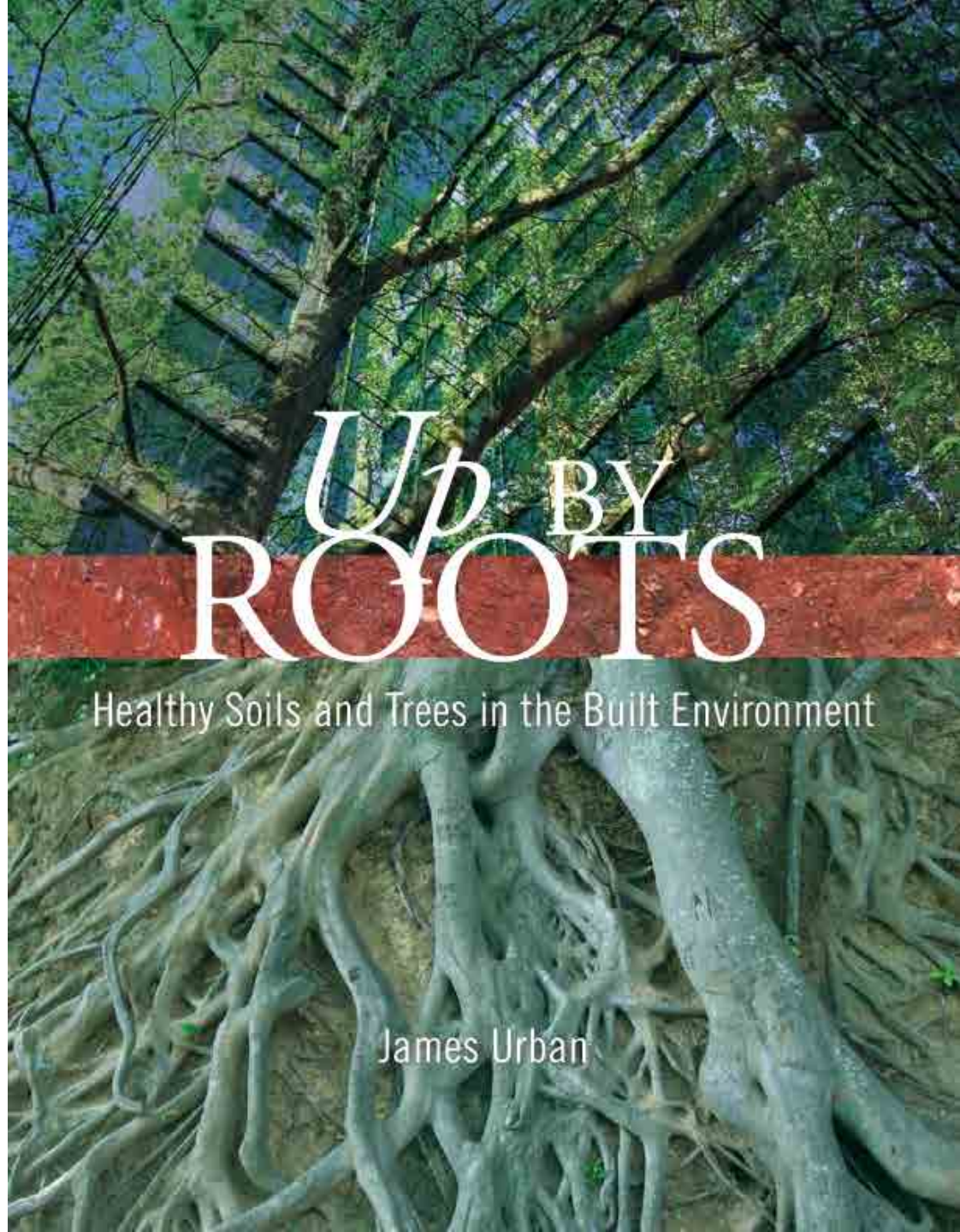


Arboricultural Association
Amenity Arboriculture Conference

Solving Difficult Soil Problems

James Urban, FASLA, ISA
Urban Tree + Soils
Annapolis, Maryland



Tree Requirements

5 Room for canopy growth

2

Water in

1

Sufficient soil volume

Water out

3

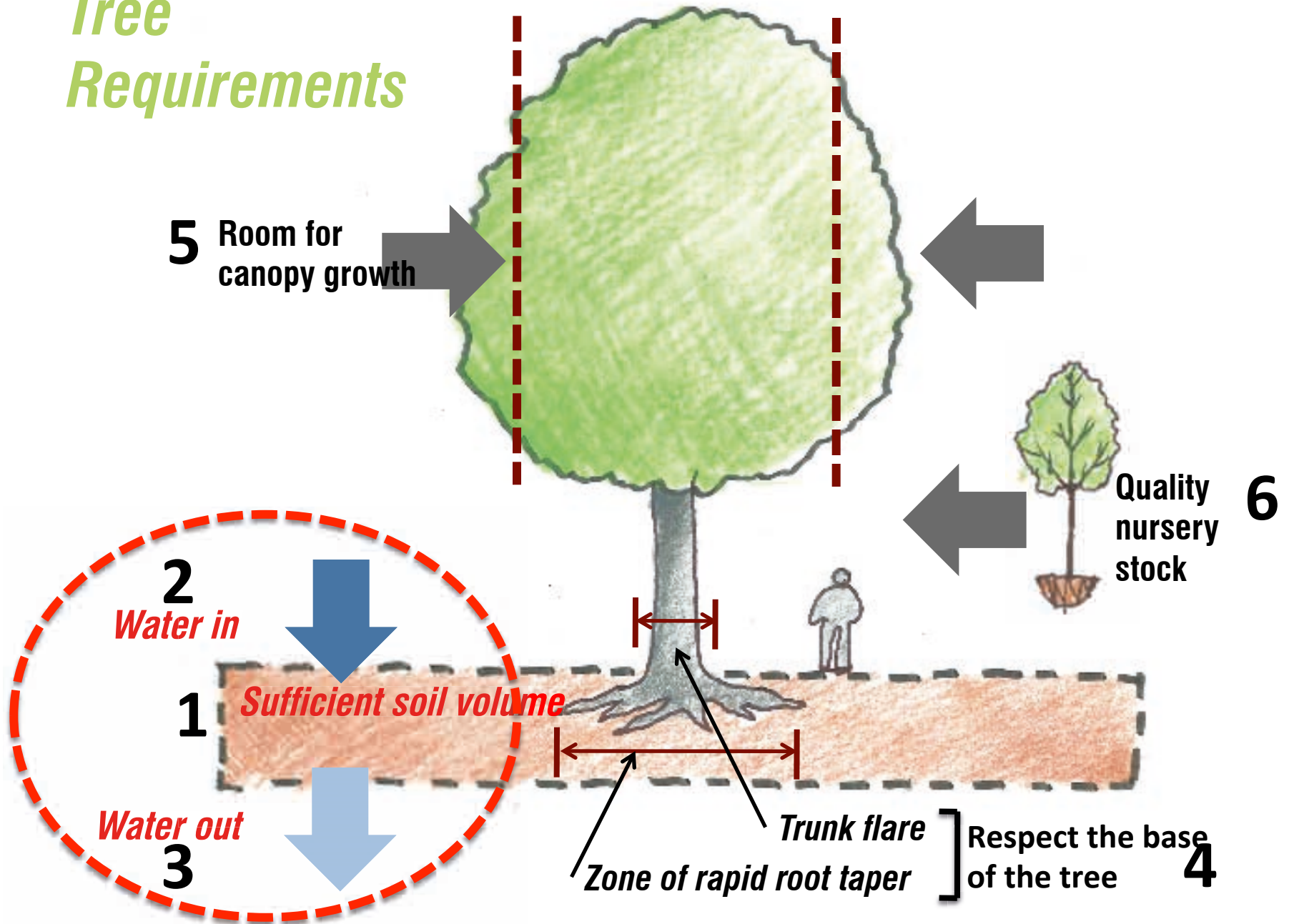
Quality nursery stock

6

Trunk flare
Zone of rapid root taper

Respect the base of the tree

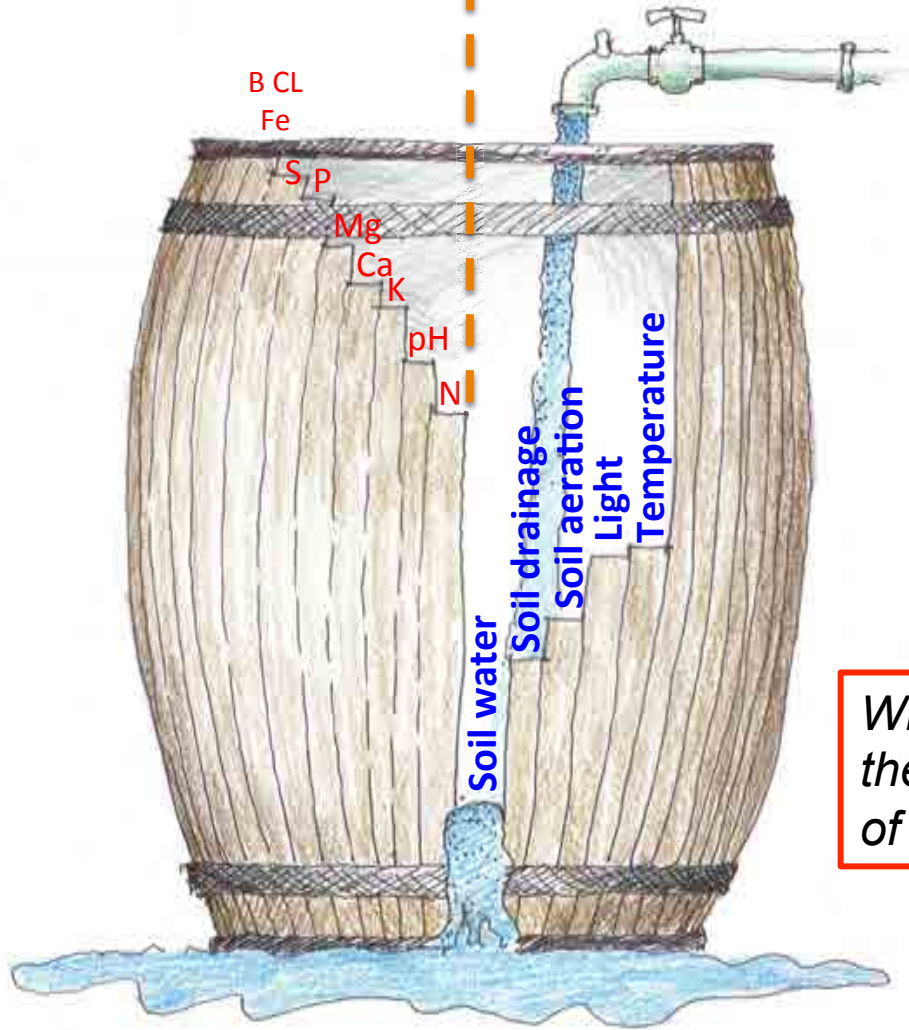
4



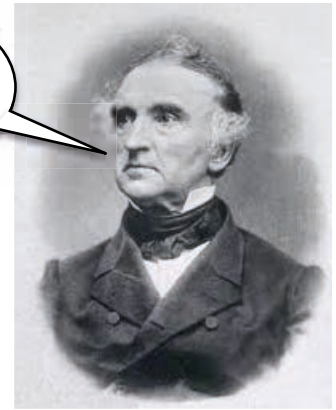
Soil Chemistry

Physical

above and
below the ground



?



Justus von Liebig
My hero!

Liebig's barrel
"Law of the limited"
applied to landscape plants

*What is more important in
the specification and review
of soil?*

Data Source: Kim Coder
Sketch Interpretation: James Urban
With apologies to Justus and Kim



Factors controlling soil performance

Consider how we harvest, handle and install soil.

Drainage is controlled by compaction and structure *as much as soil type!*

Water holding capacity

Organic matter can improve water holding capacity. You can have too much compost in the soil, particularly in deep soils.

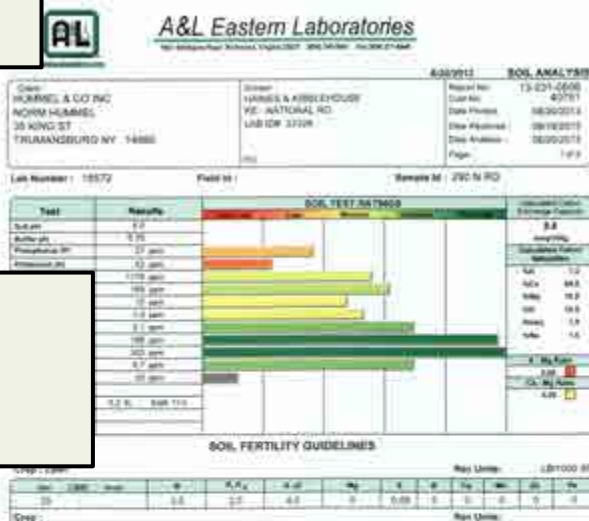


Compaction

Likely the most critical factor in soil health.

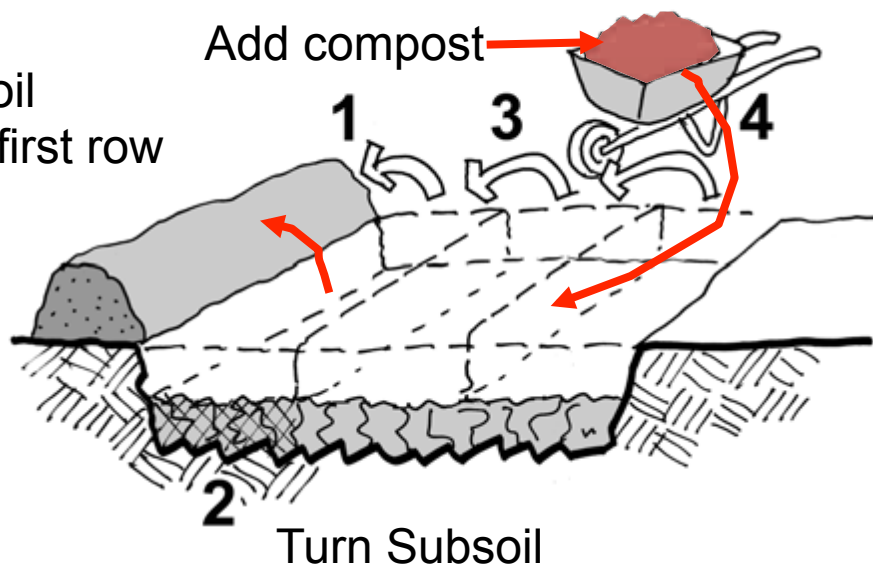
Soil chemistry

Minimum impact on plant performance in a reasonable range. Nutrient recommendations are for crop yields not plant health.



English “double spading”

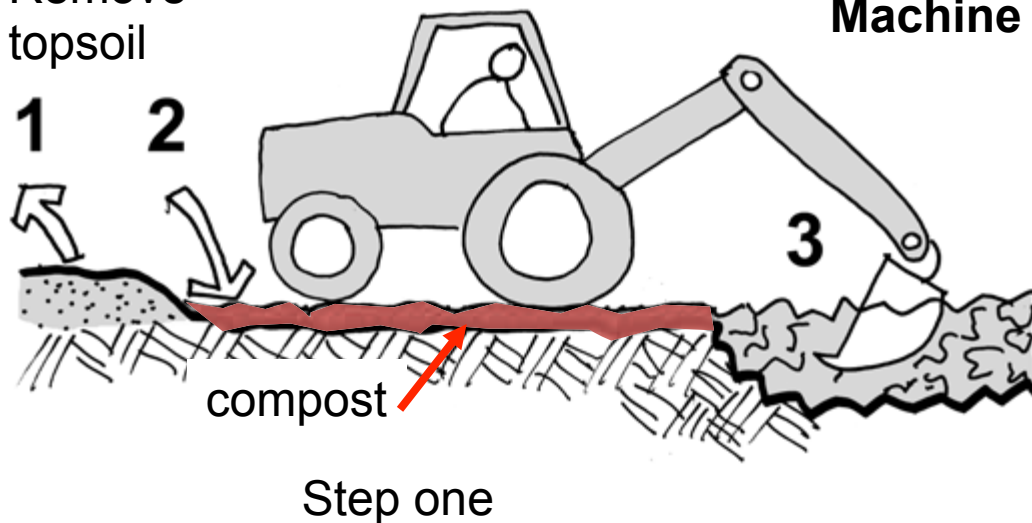
Topsoil
from first row



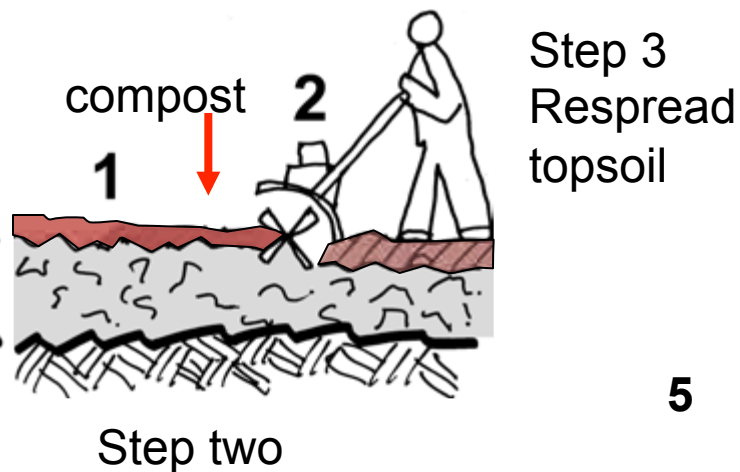
Soil Compaction Modification



Remove
topsoil



Machine “double spading”

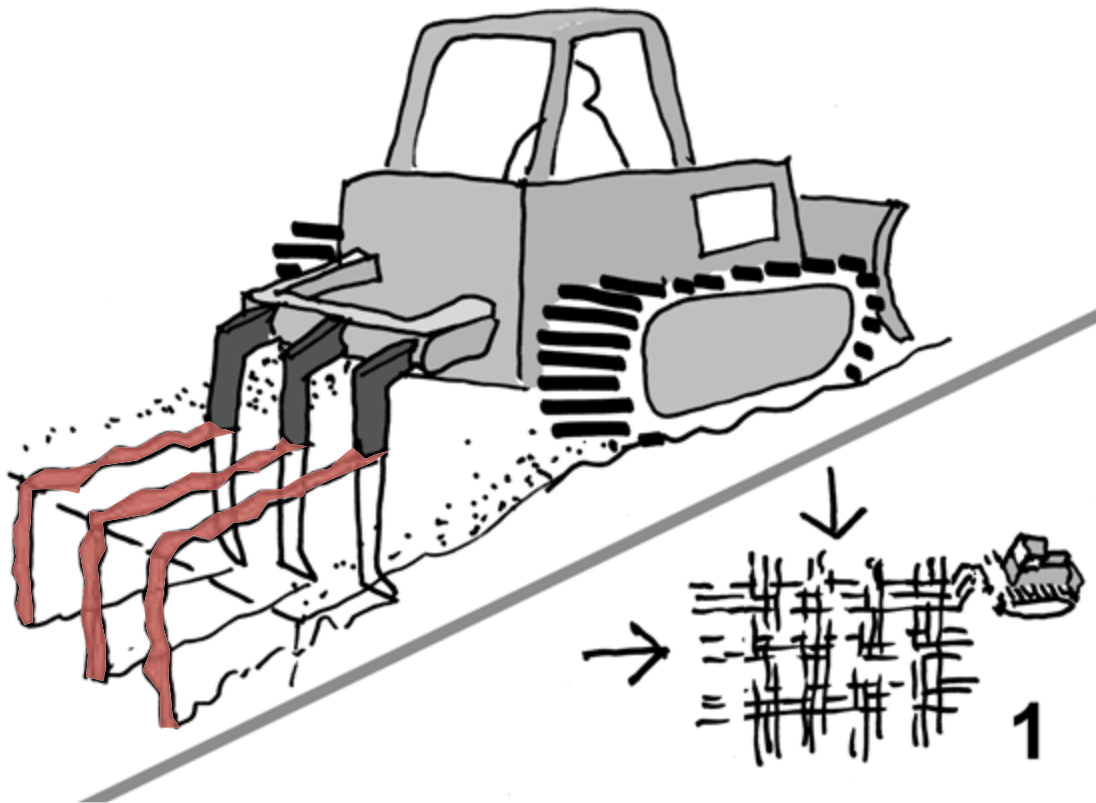




Compost!!!!

Get it into the soil, not just on top!

Organic matter does NOT get used up by the tree. **Tree ROOTS** (not the leaves) **are net contributors of organic matter** to the soil.



Subsoiling
large site



Trenches filled
with compost

Subsoiling
small site

SUBSOILING

Dealing with compaction: Cultivation (break it up!)



Backhoe



Auger

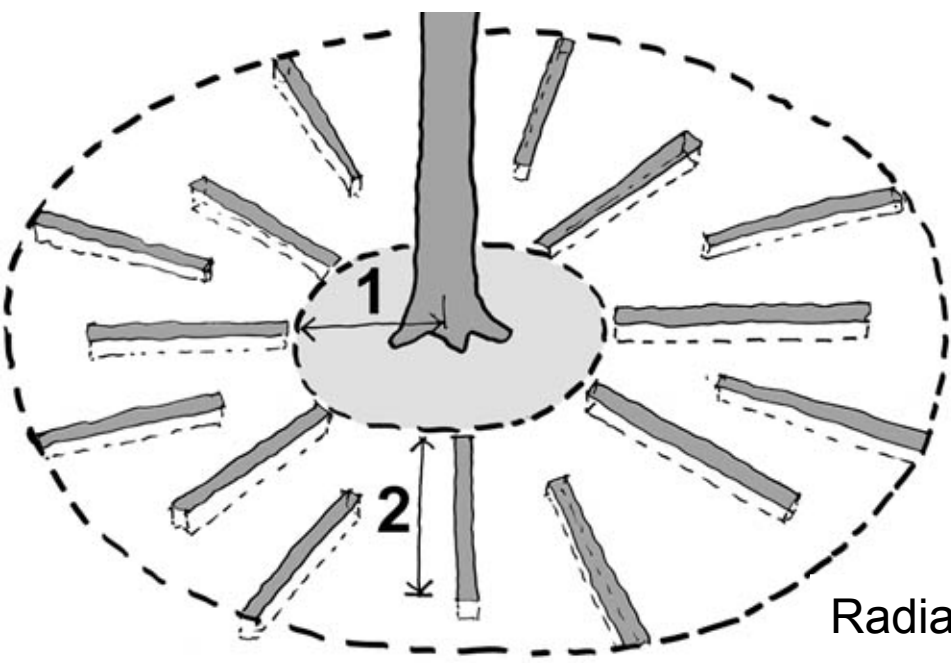


Chisels and rippers



Vertical mulching

3. Compaction reduction in the root zone of mature trees



Radial trenching



Air Spade / compost soil mixing

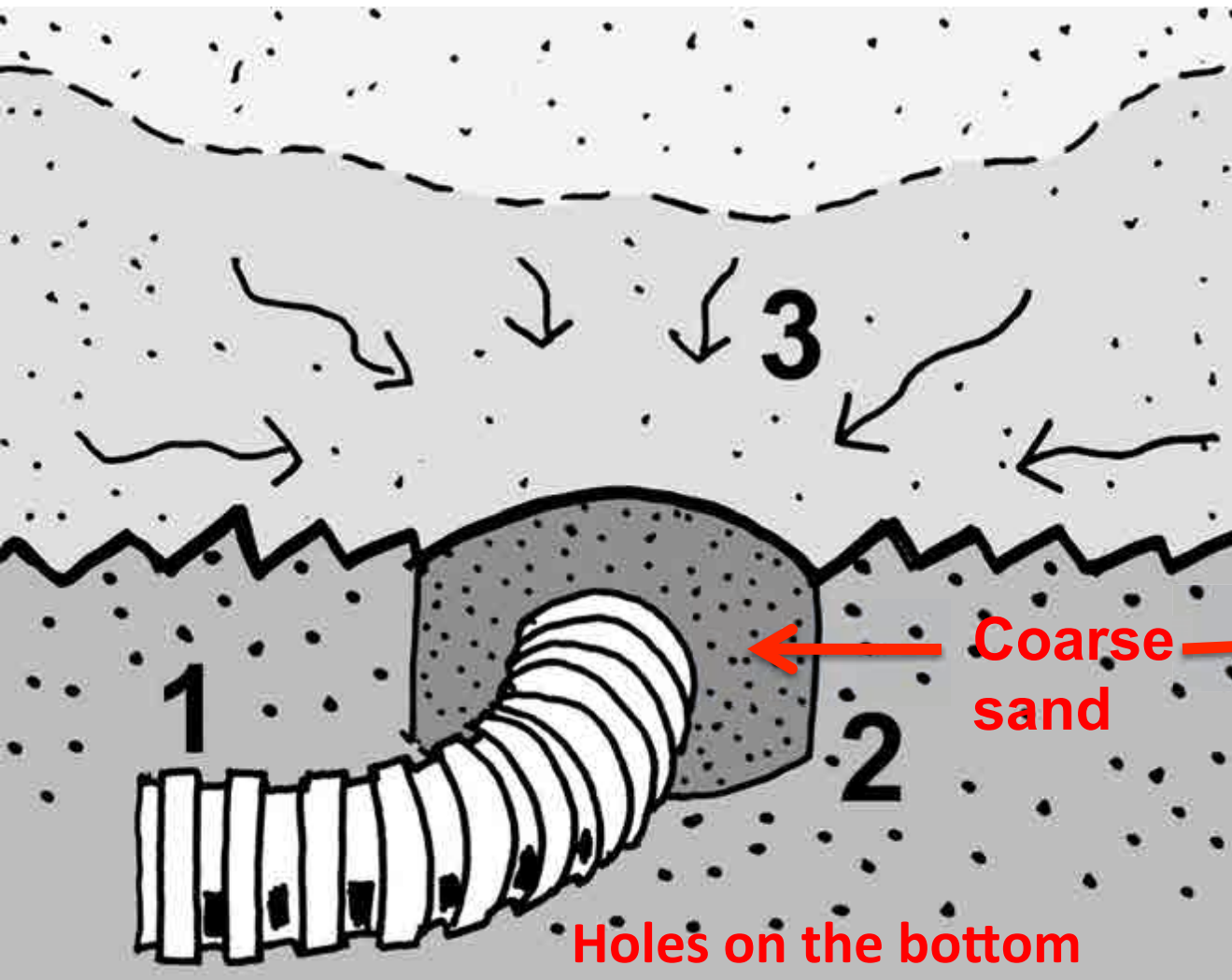


Drainage Modification

1. Drain lines
2. Topography modification
3. Soil bulk density modification
4. Soil texture modification

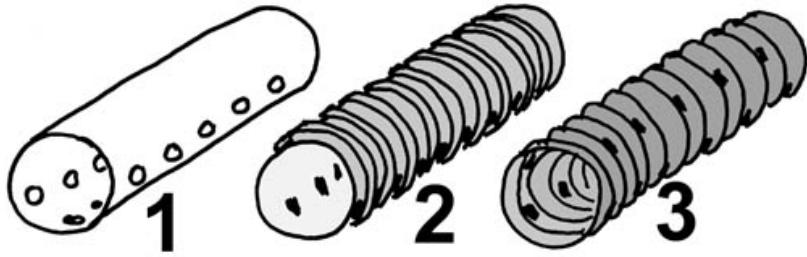


Drain lines

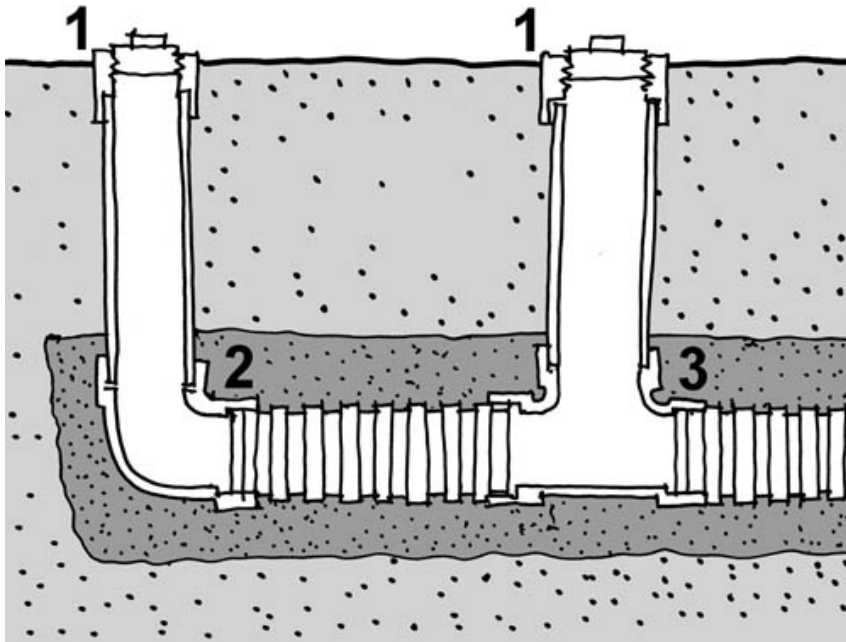


Forget the sock!

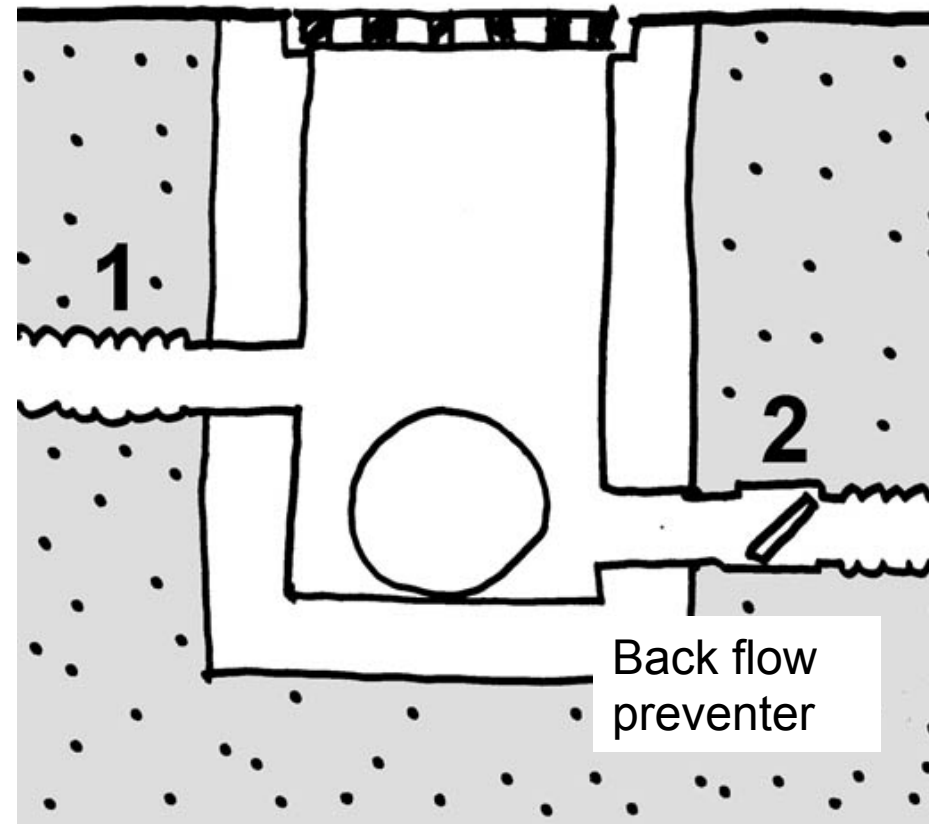


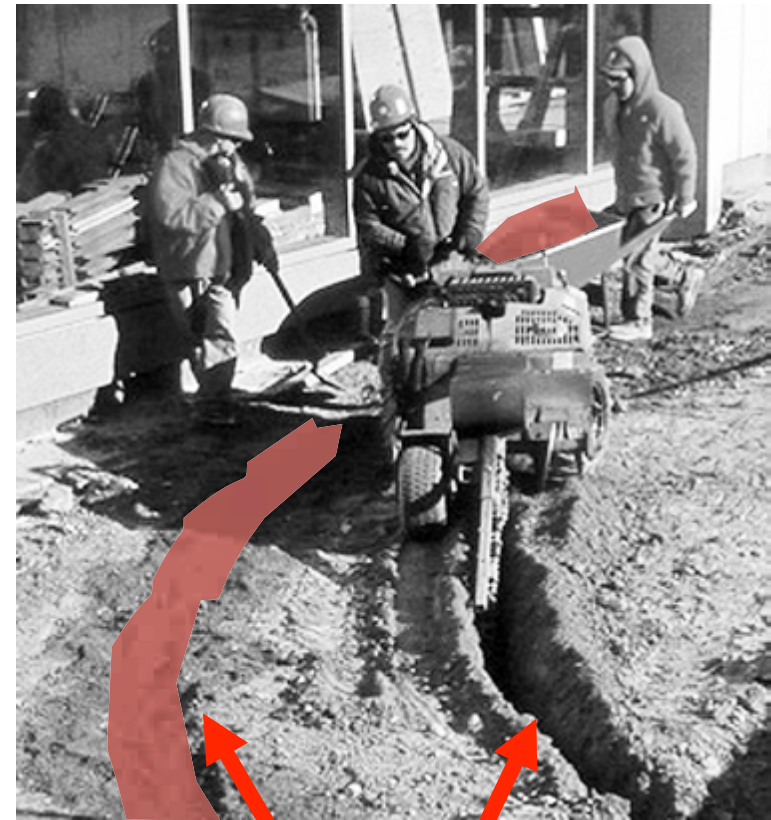
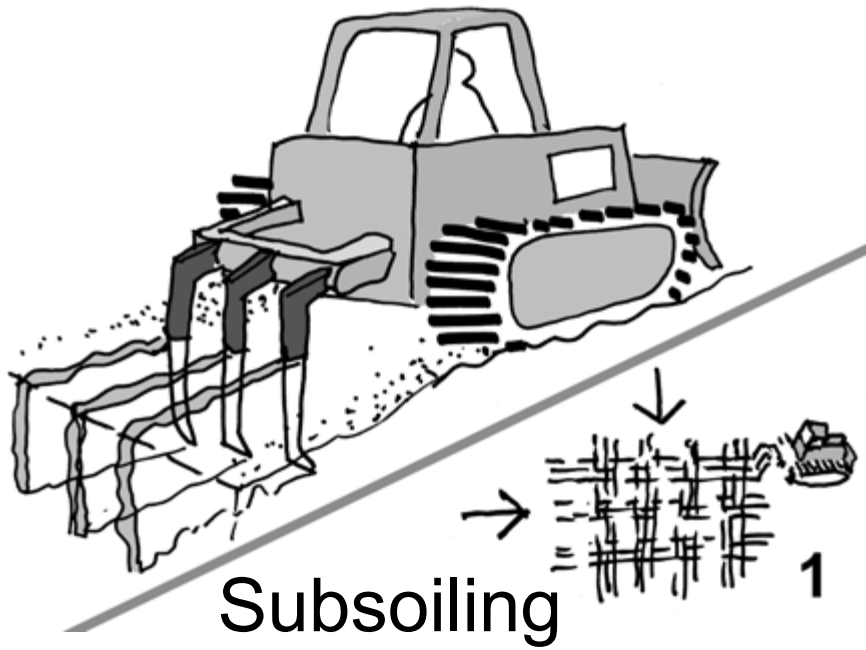


1. PVC pipe
2. Double walled pipe
3. Corrugated pipe



Cleanouts and inspection risers





Trenches filled
with compost

Reducing compaction improves drainage

Increasing soil water holding capacity

1. Soil texture and compaction modification
2. Topography modification
3. Soil amendments



Add Compost

BUT - Don't add too much compost to soils below the **top 150-300mm**.



Greater than **10-15% compost by moist volume** in the lower soil levels will result in excess soil shrinkage.

2.5-3% Soil Organic Matter by dry weight is a reasonable for trees!



Soil Reuse / Replacement

Soil removal and ped retention

Use big loaders and excavators

Remove soil in big scoops to preserve clumps. Do not screen. **Preserve peds!**



**What are
usable soils?**



Collected soils for resale



Undisturbed field soil



Construction on disturbed soils



Previous development sites

While some of these soils may look terrible they may be just fine with the addition of a little compost.

Field **mixing several soil layers** with compost (4:1) to make good quality planting soil



1



Pre-construction soil profile



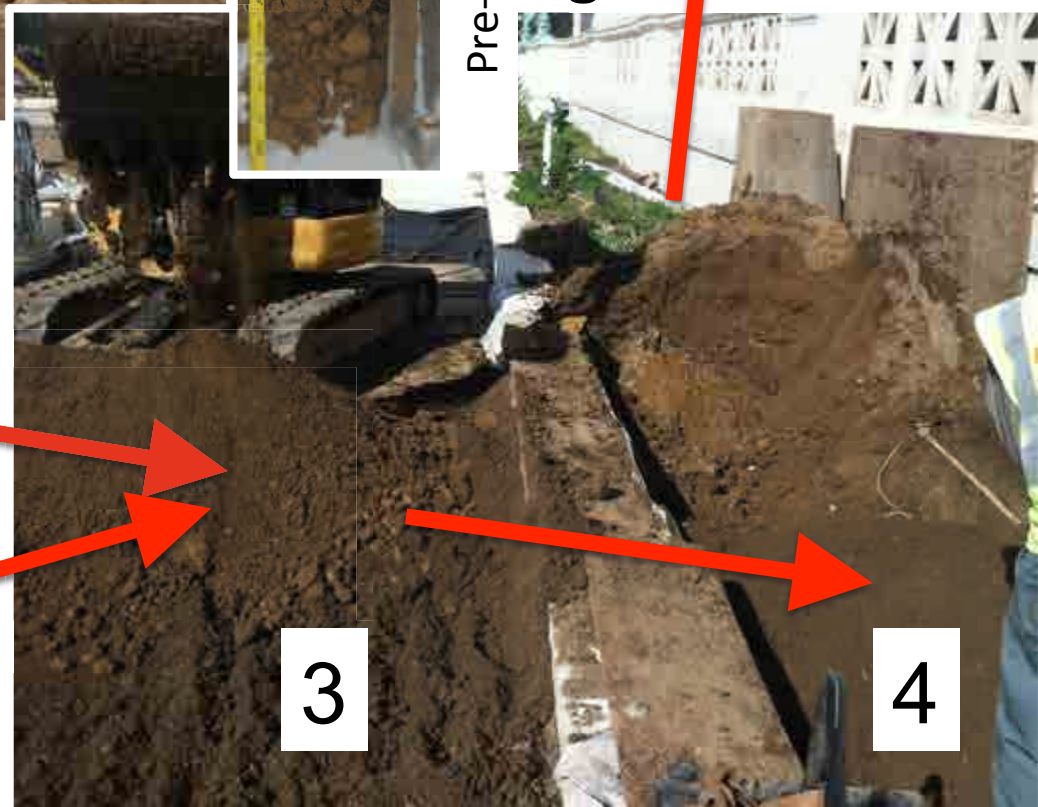
5



2

A

B



3

4



Planting Soil Compaction

Densimeter
accurate but expensive



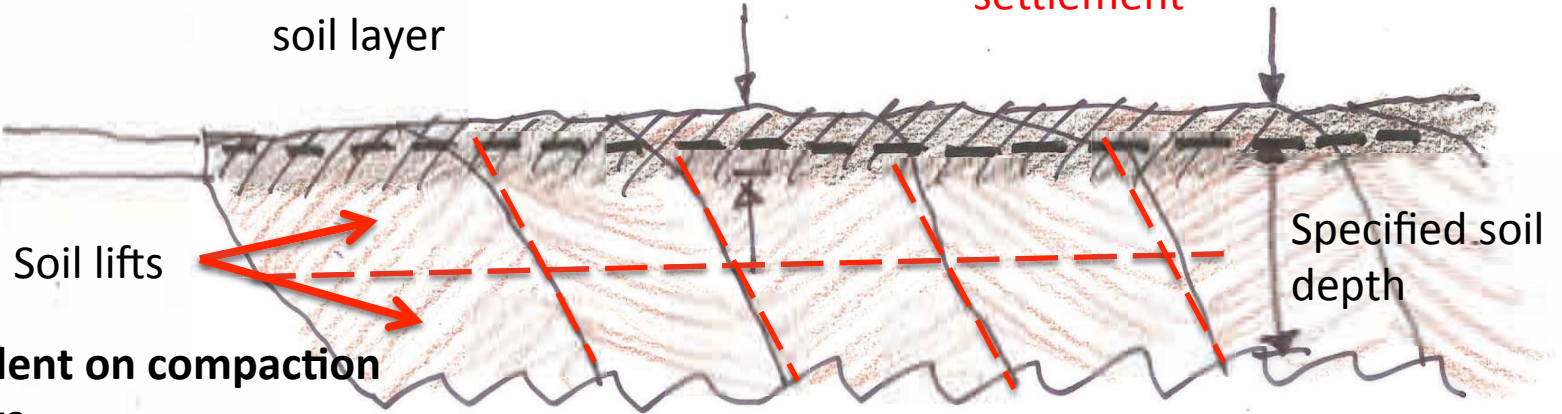
Penetrometer
inexpensive but
not accurate

Soil Installation

Anticipated settlement 10-15% of soil depth

A/O horizon with **added compost** tilled into upper soil layer

Added soil to **accommodate settlement**



BS 3882 is silent on compaction requirements



Avoid tracking over soil





Re-Thinking Manufactured Soil

**Are we putting too much
sand in our soils?**



Soil screening machines.....



.....produces soil with
few soil peds

Maintain macro pore space
with soil ped retention



Re-Thinking Soil Screening



Screened soil

Unscreened soil



Light screening through 50 to 100mm square mesh may be needed on soil with larger amounts of debris or heavier clay.

BUT where you can.....

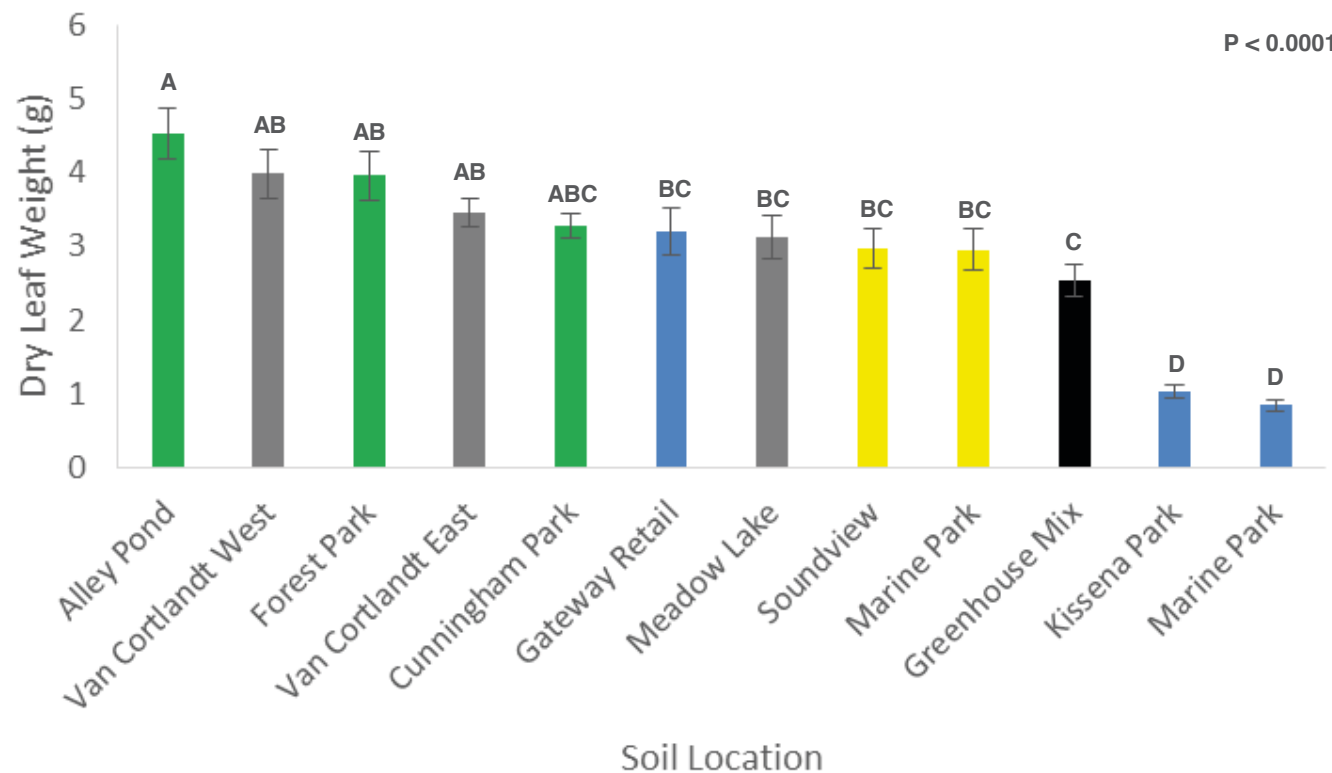
Control construction debris and trash by approval of soil source not by screening.





Change specs to allow a combined rocks, roots, sticks, debris up to 5% or maybe even 10%. Eliminate ***“free of”*** from your spec.





Native Till

Coal Ash

Clean Fill

Urban Fill

New York City Urban Soil / Reforestation Study

Nancy Sonti

nancyfsonti@fs.fed.us



Old Cattle Market, Ipswich
Using existing soil in Silva Cells



Great peds

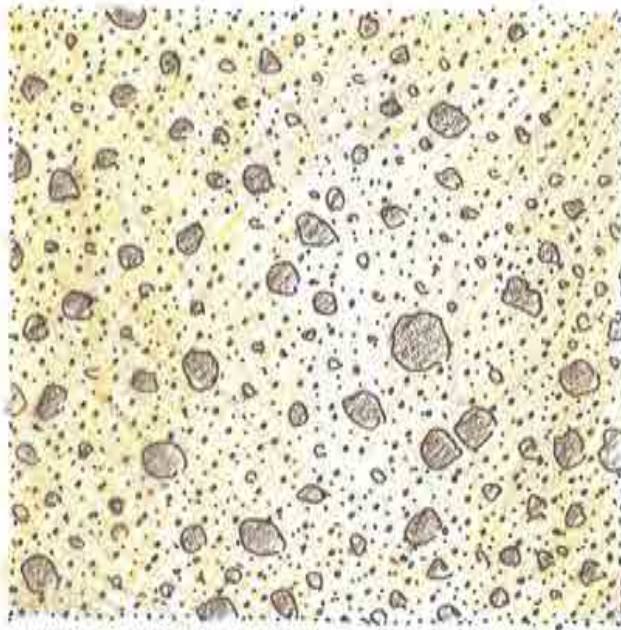
Brick

Beer can



Excellent tree growth

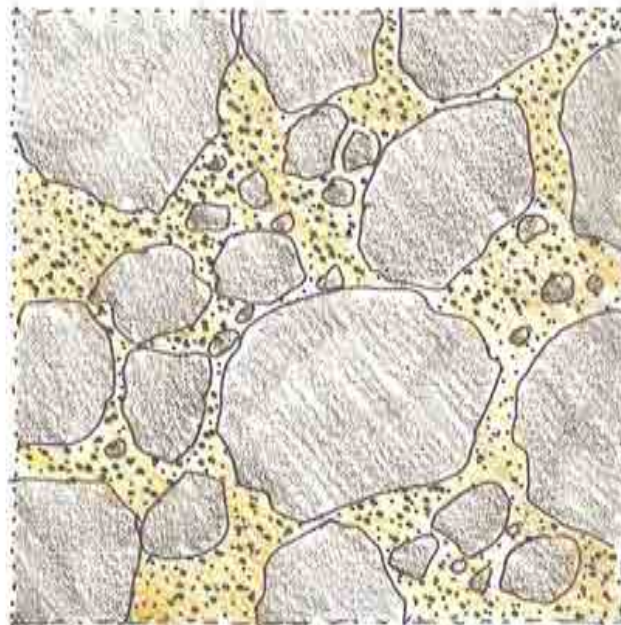




Blending soil and sand together
Greater proportion of **micropores**
Lower proportion of **macropores**
Internal structure of soil peds lost

Screened Mix

25% Topsoil
 60% Sand
 15% Compost



Soil peds segregated from sand
Greater proportion of **macropores**
Lower proportion of **micropores**
Internal structure of soil peds retained

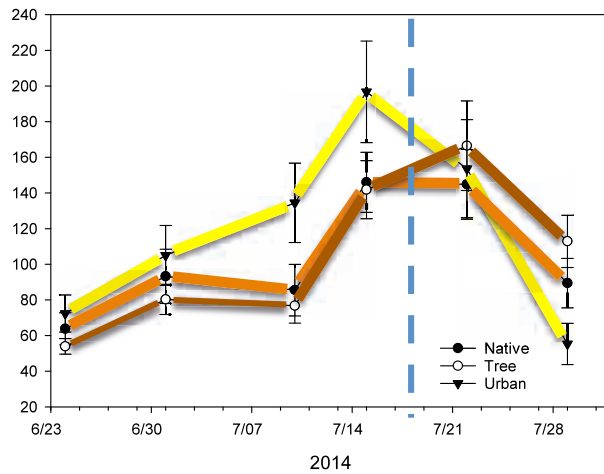
Unscreened Mix

60% Topsoil
 25% Sand
 15% Compost

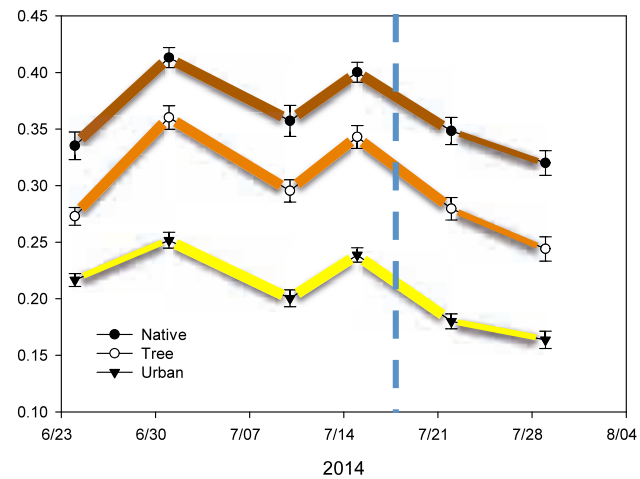
Morton Arboretum soil mix / soil screening test 2014/15

Bryant Scharenbroch

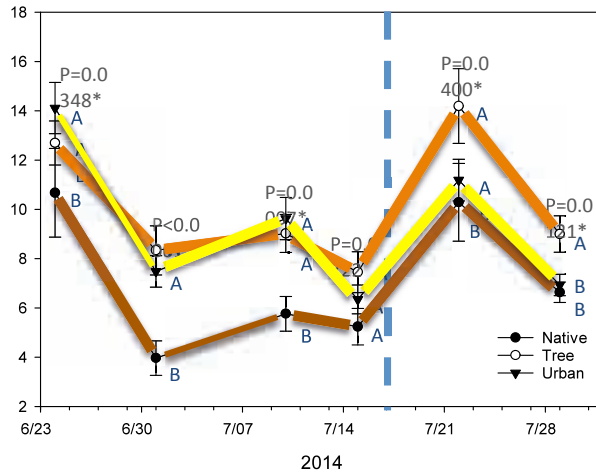
Stomatal conductance



Volumetric water content



Soil respiration



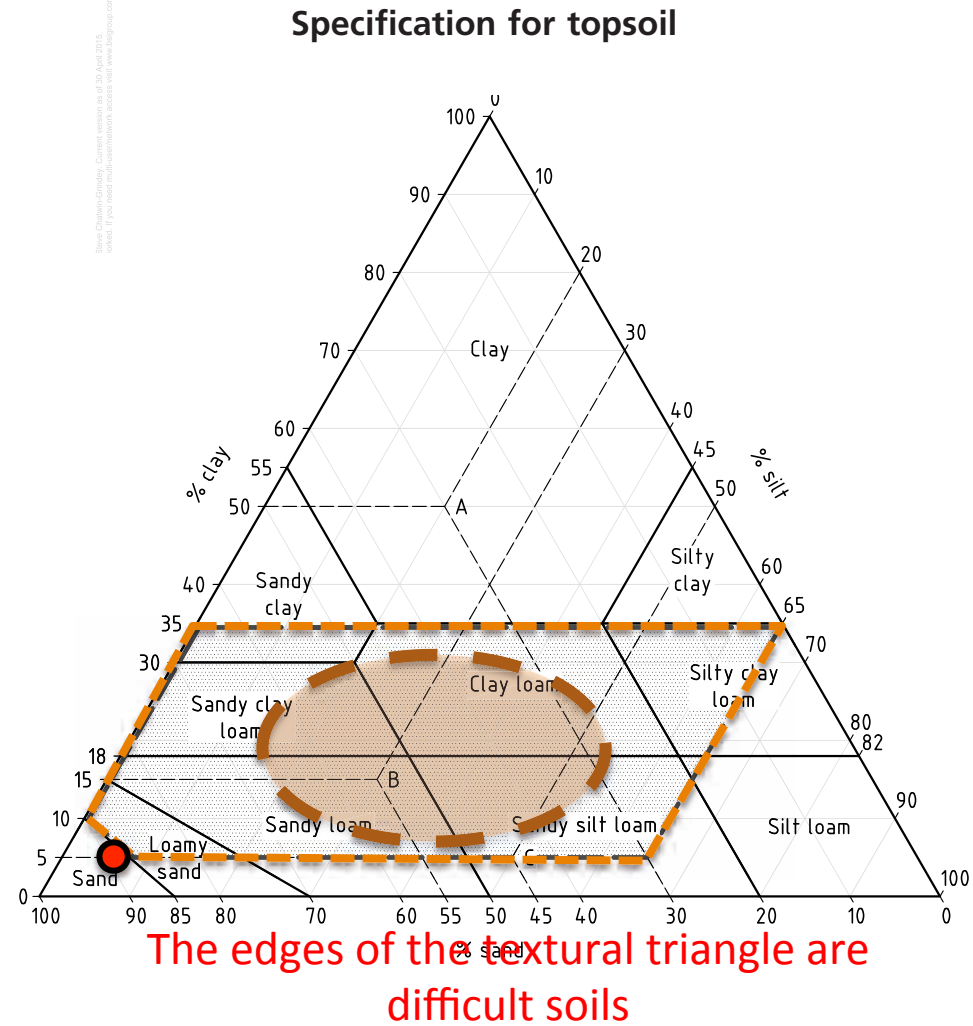
- Unscreened native soil
- Unscreened /25% sand
- Screened /60% sand

BS 3882:2015



Need to rethink the 50mm restriction

Soil specifications including BS 3882, ignore soil structure



New MS Word **Specifications** and dwg **Details** for:

Planting Soil Irrigation Tree preservation

Urban Tree Foundation
700 East Murray
Visalia, CA 93292

559.713.0631

www.urbantree.org

SECTION 32 9100

PLANTING SOIL

PART 1 – GENERAL

1.1 SUMMARY

Note to specifier: Remove parts of this work description that do not apply.

- A. The scope of work includes all labor, materials, tools, supplies, equipment, facilities, transportation and services necessary for, and incidental to performing all operations in connection with furnishing, delivery, and installation of Planting Soil and /or the modification of existing site soil for use as Planting Soil, complete as shown on the drawings and as specified herein.
- B. The scope of work in this section includes, but is not limited to, the following:
 1. Locate, purchase, deliver and install Imported Planting Soil and soil amendments.
 2. Harvest and stockpile existing site soils suitable for Planting Soil.
 3. Modify existing stockpiled site soil.
 - a. Modify existing site soil in place for use as Planting Soil.
 - b. Install existing or modified existing soil for use as Planting Soil.
 4. Locate, purchase, deliver and install subsurface Drain Lines.
 5. Fine grade Planting Soil.
 6. Install Compost into Planting Soil.
 7. Clean up and disposal of all excess and surplus material.

1.2 CONTRACT DOCUMENTS

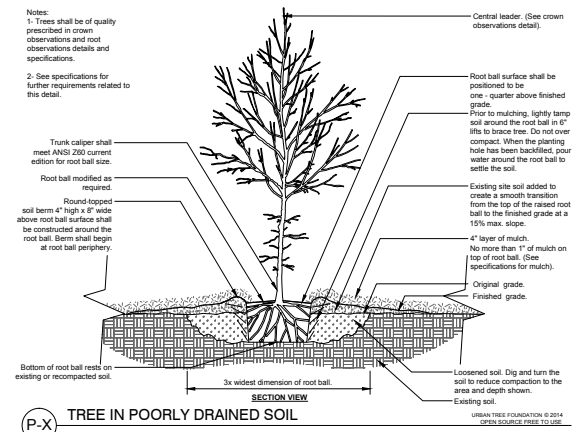
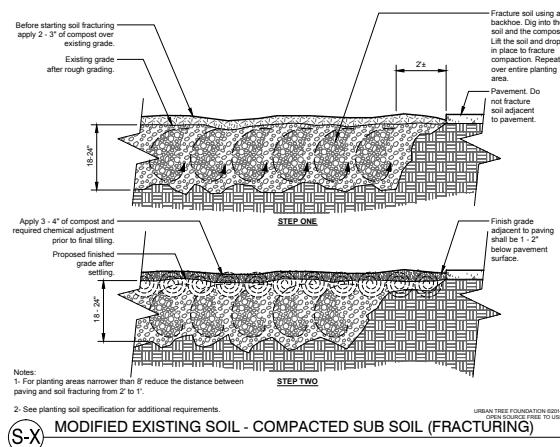
- A. Shall consist of specifications, general conditions, and the drawings. The intent of these documents is to include all labor, materials, and services necessary for the proper execution of the work. The documents are to be considered as one. Whatever is called for by any parts shall be as binding as if called for in all parts.

1.3 RELATED DOCUMENTS AND REFERENCES

- A. Related Documents:

Note to specifier: Coordinate this list with the other related specification sections. Add or delete sections as appropriate.

1. Drawings and general provisions of contract, including general and supplementary conditions and Division I specifications, apply to work of this section.
2. Related Specification Section
 - a. Section - Planting





Thank you!