Natural Landscaping at County Facilities Plan Amendment
Creating Natural Communities

Planning Commission Environment Committee

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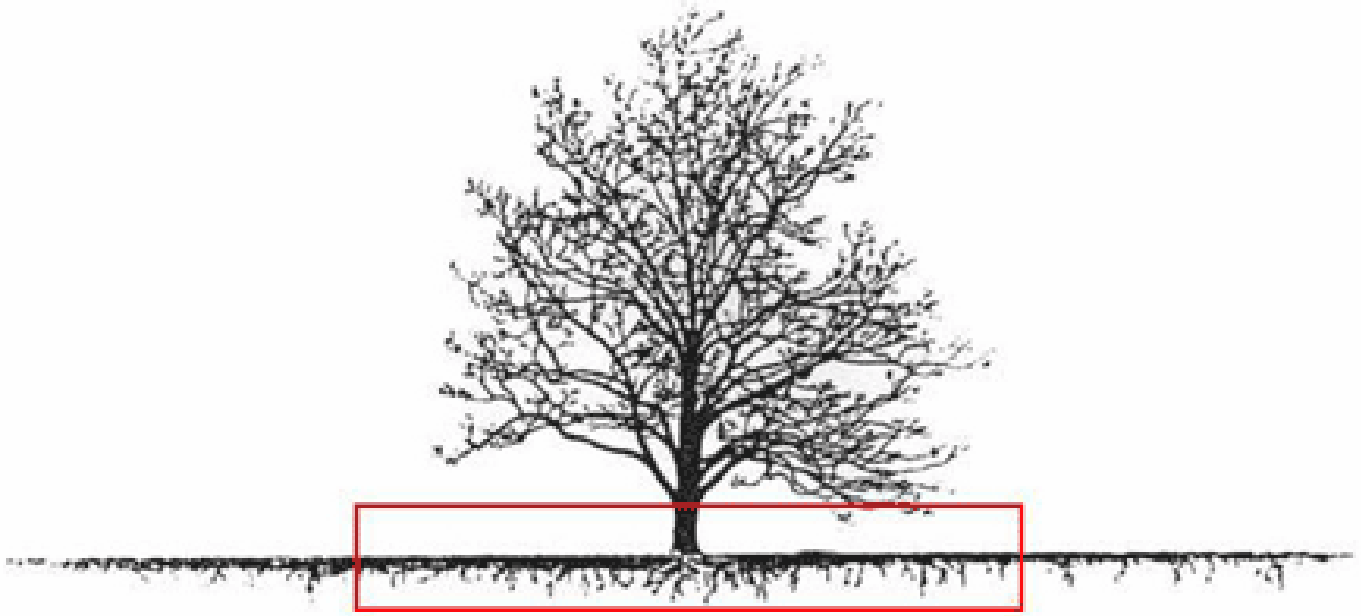
June 27, 2019

Tree Roots



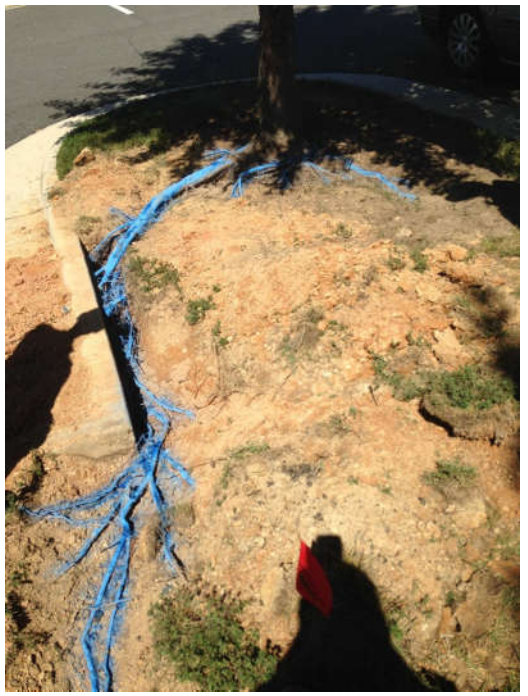
Critical Root Zone (CRZ)

1.0 foot radius/1 inch of trunk diameter (measured 4.5 feet above grade)

(may be increased to 1.5 foot radius/1 inch of trunk diameter in some situations)

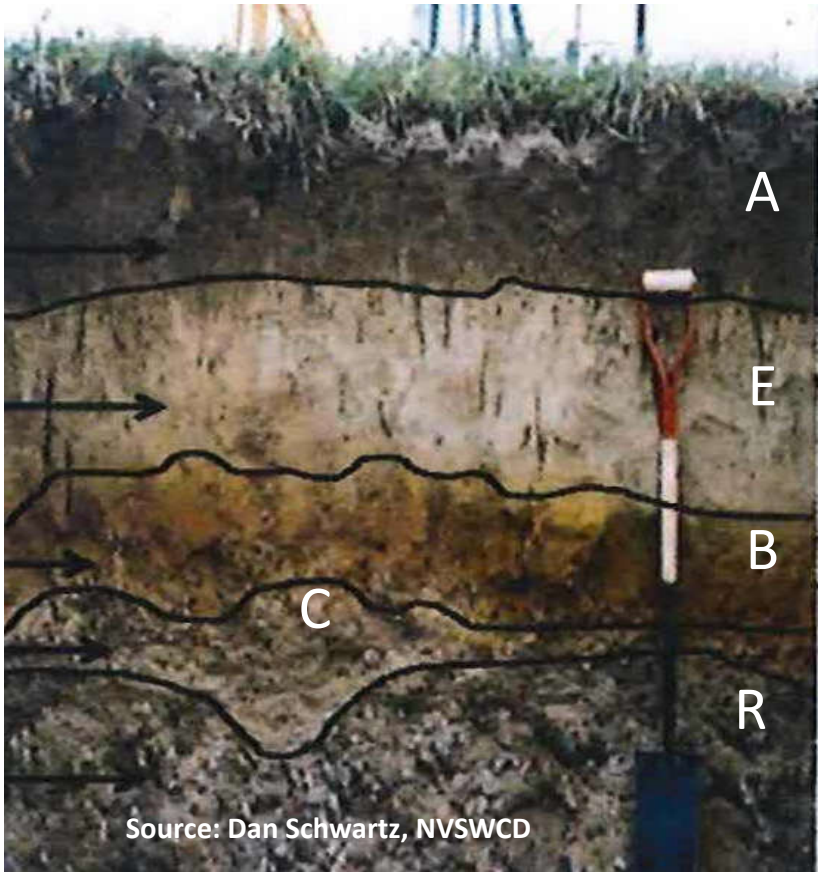
Trees (Dendrology) 101

- Roots
  - "Wine glass on a plate"
  - Roots (open field situation) can be 2-3 times as wide as the dripline (the outer edge of the canopy), and wider
  - 18-24 inches deep
  - Get thicker, (like the branches), and taper
    - Supporting – closest to trunk, bigger, heavier
    - Connecting
    - Absorbing – finest, further out
- Trunk and Branches
  - Outer bark
  - Cambium (two cells thick)
  - Phloem
    - Cell division and growth
    - Sugar transport down
  - Sapwood (xylem)
    - Structural support
    - Mineral and water transport up (sieve)
  - Heartwood (xylem)
    - Deposited chemicals



Soils 101

- Components
  - Mineral matter (sand, silt, and clay)
  - Organic matter (living and dead organisms)
  - Air
  - Water
- Solids – provide physical support
- Water & Air
  - Healthy roots & hydrated plants
  - Active microbe/fungal network
    - Are fed by plants
    - Break down organics
    - Release mineral nutrients
    - Defend trees from attack
  - Water dissolves nutrients (in solution) for root uptake
  - Native plants feed the soil organisms with root exudates, leaves, and woody debris & cycle continues
- Horizons (layers)
  - A: Surface, rich organics, fertile, biological activity
  - E: leached, pale, low fertility (rare in VA)
  - B: clayey, colorful, sticky
  - C: gritty, low fertility, water filter, groundwater recharge
  - R: bedrock



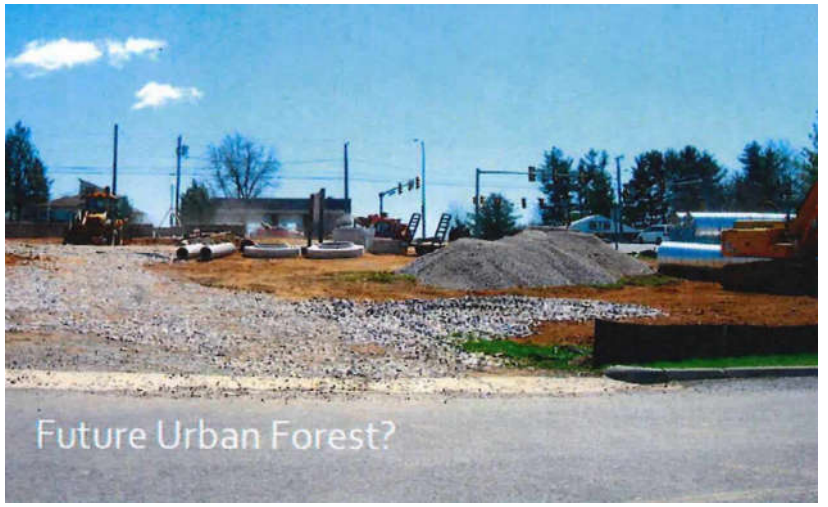
Typical Development Scenario

- The fertile topsoil is removed; possibly stockpiled
  - The fungal network is destroyed
  - Soil organisms die
- The land is graded
- The remaining subsoil is compacted
- Debris may be buried
- Stockpiled soil is spread on the subsoil
- Small planting areas are created
- An amended planting hole is dug for each plant

Development Impacts

- Compaction (generally to ~ 24 inches)
- Creation of Impervious Surfaces
  - Increased heat – water loss (evapotranspiration)
  - Sun reflectivity, from all angles – sunscald, increased water loss
  - High-velocity runoff
  - Reduced rooting area
- Changes in Drainage Patterns
- Root Loss
- Soil Mixing
  - Fertile topsoil dispersed throughout soil profile
  - Loss of microbes and fungal network
  - Structure is damaged or lost (round aggregates are flattened)
- pH Changes
- Salts
  - De-icers and fertilizers
  - Creates “drought” condition for plants
- Pollutants: heavy metals

Source: Dr. Susan Day, VT



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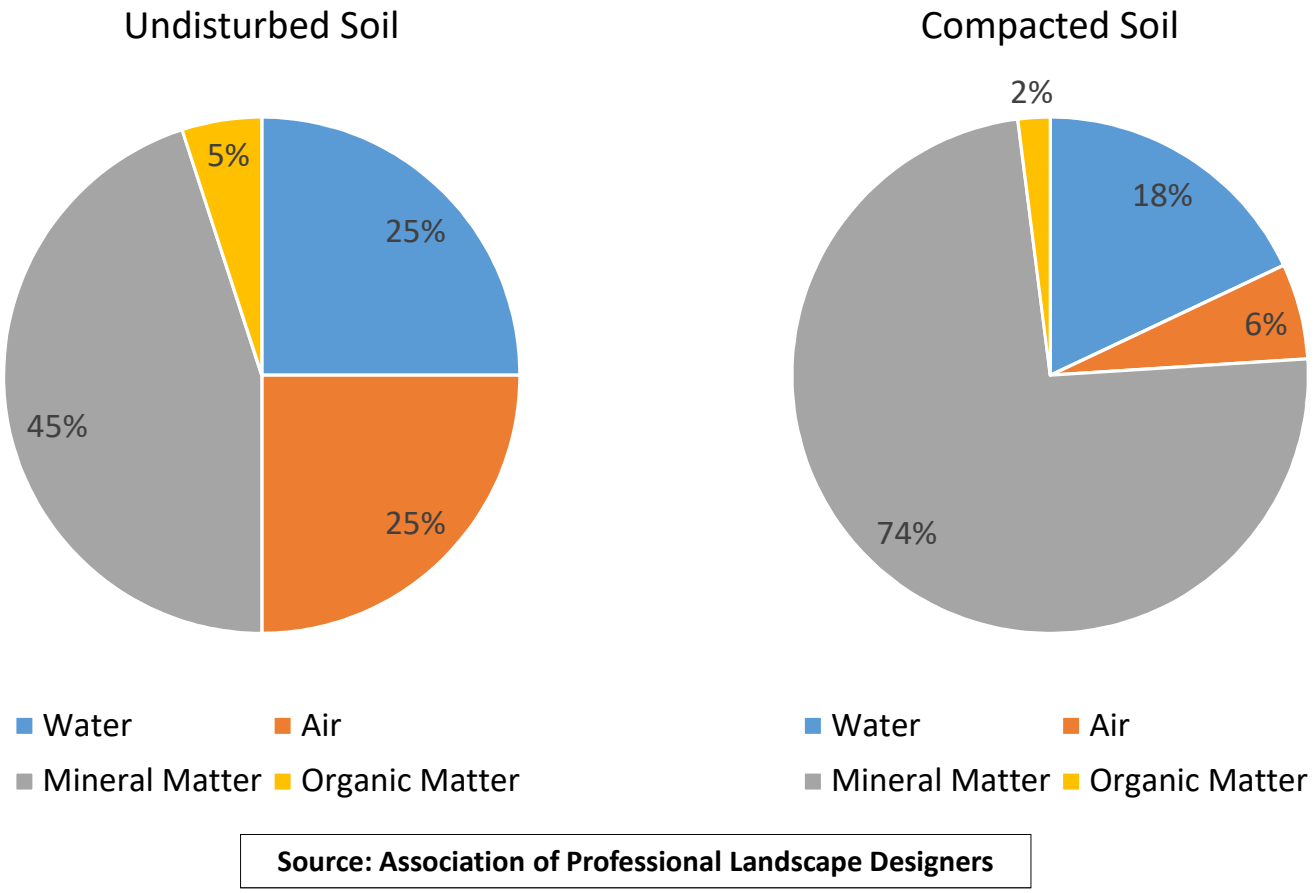
The Result

- Soils
  - Little organic matter; little life
  - (“Zombie” soil - it’s sort of alive, but not really)
  - Compaction
    - Limited pore spaces for air and water movement
    - Roots cannot penetrate
- Trees
  - Roots search for air and water
    - Surface roots - heaving sidewalks; roots grow b/w compacted soil & sod
    - Plunging or shortened roots
    - Little capillary water; urban heat island effect
  - Poor root anchorage
  - Stunted growth
  - Crown dieback
  - Slow decline
  - Lowered life expectancy
  - Premature death

Compaction



Source: Association of Professional Landscape Designers

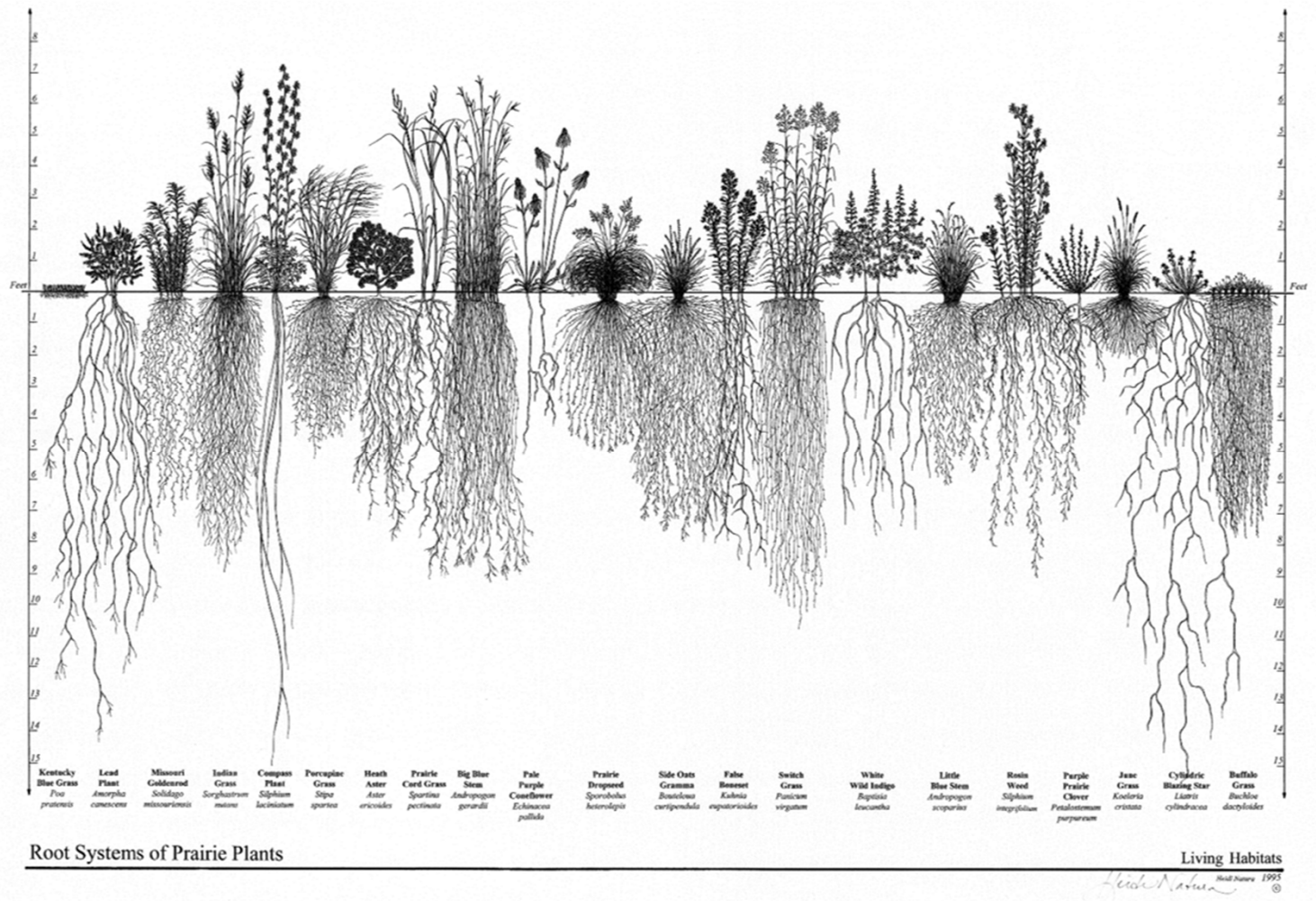
- 90% of compaction occurs within first few passes of heavy equipment.
- Compaction: easy to create (<u>especially</u> in wet soils); hard to correct.

Species Sensitivity to Disturbance

Higher Tolerance	Moderate Tolerance	Low Tolerance
Hackberry	Horsechestnut	Yellowwood
Persimmon	Dogwood	American Beech
Pines (most)	Eastern Redcedar	Black Walnut
White Oak	Southern Magnolia	Deciduous Magnolias
Willow Oak	Eastern White Pine	Sourwood
Black Locust	Chestnut Oak	Linden
Red Maple		Tulip Poplar
American Elm		Cherries
Sycamore		Hickories

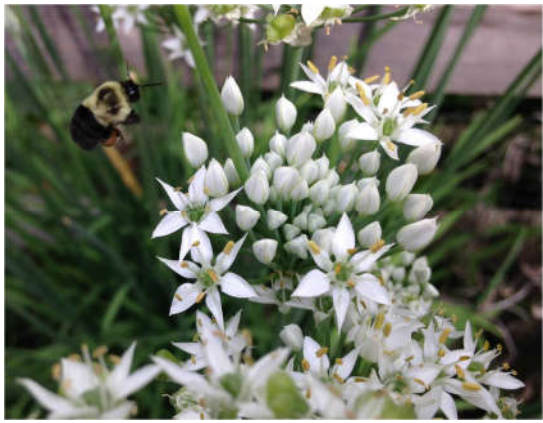
Notes:
- Tolerance somewhat dependent on type of disturbance
- Tolerance also dependent on tree health prior to disturbance

Herbaceous Roots



Why Native (Local) Plants?

- Coevolution – “native” plants are part of a community of organisms (microbes, fungi, insects, & vertebrates) that share an evolutionary history
  - Exotic – implies from another country
  - Non-native – not a local
  - Insects can detoxify the chemicals in the native plant leaves; insects become food for baby birds (no baby birds, no adult birds)
  - As a general rule, Exotic (and many non-natives) = Sterile (i.e., a “food desert”)
  - Timing (all seasons) – bird migrations, insects hatching, pollination (crops)
- Habitat – network of patches
- Plants pump sugars into the soil and store it in their leaves, feeding organisms above & below ground
- Native grasses build soils through constant root growth, adding large amounts of carbon
- However, …
  - All selected plants should be chosen based on their suitability to the site conditions (esp. urban effects), whether native or non-native
  - Choose a diverse plant palette
  - Habitat can be created with shrubs & perennials (cover the soil in layers)
- Note: Sometimes a plant outside of its native range can still perform most of its evolutionary role in a new ecosystem



Woody Plants

Common Name	Plant Genus	Butterfly/moth species supported
Oak	Quercus	534
Black cherry	Prunus	456
Willow	Salix	455
Birch	Betula	413
Poplar	Populus	368
Crabapple	Malus	311
Blueberry	Vaccinium	288
Maple	Acer	285
Elm	Ulmus	213
Pine	Pinus	203
Hickory	Carya	200
Hawthorn	Crataegus	159
Spruce	Picea	156
Alder	Alnus	156
Basswood	Tilia	150
Ash	Fraxinus	150
Rose	Rosa	139
Filbert	Corylus	131
Walnut	Juglans	130
Beech	Fagus	126
Chestnut	Castanea	125

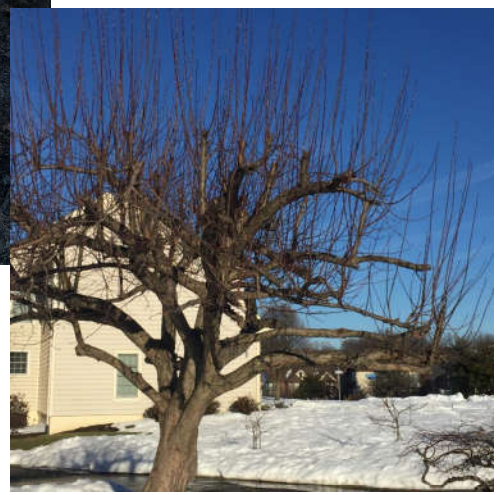
Herbaceous Plants

Common Name	Plant Genus	Butterfly/moth species supported
Goldenrod	Solidago	115
Asters	Aster	112
Sunflower	Helianthus	73
Joe pye, Boneset	Eupatorium	42
Morning glory	Ipomoea	39
Sedges	Carex	36
Honeysuckle	Lonicera	36
Lupine	Lupinus	33
Violets	Viola	29
Geraniums	Geranium	23
Black-eyed susan	Rudbeckia	17
Iris	Iris	17
Evening primrose	Oenothera	16
Milkweed	Asclepias	12
Verbena	Verbena	11
Beardtongue	Penstemon	8
Phlox	Phlox	8
Bee balm	Monarda	7
Veronica	Veronica	6
Little bluestem	Schizachyrium	6
Cardinal flower	Lobelia	4

Source: Doug Tallamy;
http://www.bringingnaturehome.net/

Tree Care Challenges

- Time to Establish – ~1 year/1 inch of caliper (diameter)
- Propagation issues
  - Unnatural environment for roots
  - Poor root system – plunging; girdling
  - May be planted too deep in pot
- Stock left in hot parking lot after delivery
- Water, Water, Water (before & after planting)
  - Daily for 2 weeks;
  - Every other day for 2 months;
  - Weekly until established (two+ seasons)
- Planting depth
  - Where are the root flare and the first lateral structural root?
  - Roots can handle prolonged moisture; the trunk cannot
- Mulch
  - 3/3/3 Method & donuts (yes)
  - Volcanoes (no)
- Topping (aka: tree-butchering/mutilation) (no)
- Staking
  - If planted well, don't need
  - Will ultimately choke a tree



Tree Care Challenges

- Prune
  - Wait at least a year
  - Cut dead and crossing/rubbing branches
- Remove grass from under/around trees
  - Grass hijacks the water and nutrients
  - 90% fewer roots under sod
- Mulch the leaves; top dress the lawn

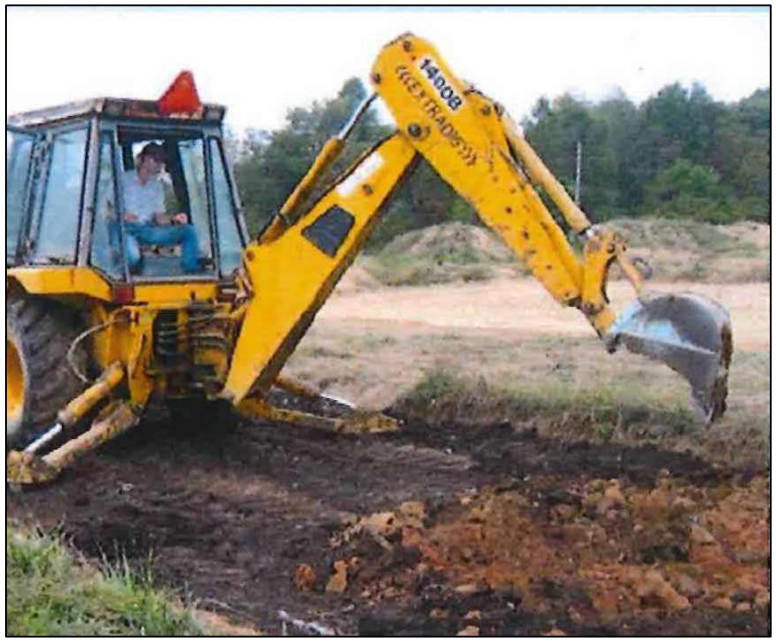
Tree Root Zone

No Tree Left Behind

- Protect the Soil & the CRZ
  - 1.5 feet radius/1 inch trunk diameter (general rule of thumb); limit disturbance
  - But, … tree survivability dependent on many factors
- Protect groups of trees & intact soils
  - The most mature trees are not always the best ones to preserve or plant
- Select appropriate species and assemblages
  - Mimic natural communities
  - Plant multiple layers – the below ground root layering reflects the above ground layers
  - Allow time for plants to grow in and complex soil network to develop
- Improve the soils
  - Amend the Area (not merely individual planting holes)
  - Aerate – rip; till; air excavation; radial trenching, to 18-24 inches deep
  - Mulch groups of plants (emulates natural forest ground cover)
    - Conserves moisture
    - Moderates soil temperature
    - Adds organic matter as it decays
    - Creates favorable environment for soil microorganisms that facilitate root functions
- Increase soil volume
  - Planting width
  - Connections to other pervious areas
  - Pervious pavement
  - Consider the location of utilities

Subsoiling Technique

- Remove rubble
- Apply 4 inches of compost
- Use backhoe to dig to a depth of 24 inches; scoop; drop to break up clods. (Creates veins of compost deep in profile).
- Apply 4 inches of reserved topsoil
- Till to depth of 8 inches



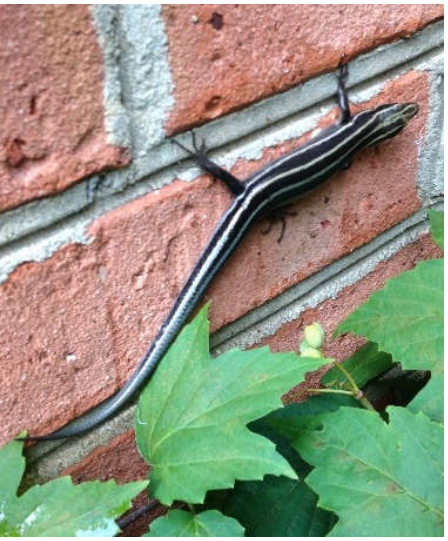
Source: Dr. Susan D. Day, Dept. of Forest Resources & Environmental Conservation, Virginia Tech

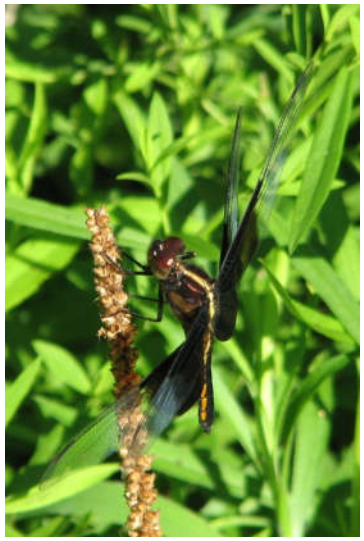
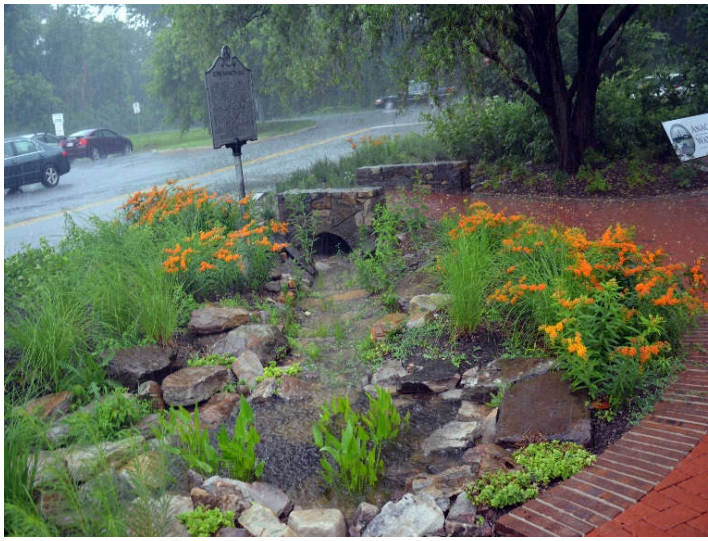
Site Considerations

- Reduce road/lane widths; reduce turning lane lengths; consider whether turning lanes needed
- Build on already degraded areas
- Conservation easements for stormwater credit - replant with seedlings
- Underground lattice structure (suspended pavements)
  - Porous pavers above
  - Un-compacted soil throughout underground lattice
- Plant Rescues
- Plants indigenous to Middle Atlantic, (but allow for consultation w/ UFMD)

Natural Communities Takeaways

- Native vegetation forms symbiotic communities above and below ground.
- Native plants coevolved with each other, insects, fungi, bacteria, & vertebrates; and most non-natives cannot support life or participate in those communities.
- Native systems with intact soils provide tremendous ecosystem services and should be protected and restored.



Questions?