

Trees and Compacted Soils

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Soils become compacted as a result of traffic. Compaction is common in urban areas and results from construction equipment and foot traffic. Soil is more likely to become compacted when the soil is wet than when it is excessively dry. Soil compaction is permanent, at least when viewed in reference to a human life span. Protecting the soil from becoming compacted is much easier than dealing with the negative impact of compaction on plant growth and health.

Why Soil Compaction Is Bad

Compacted soils do not allow water to enter or move through them as easily as uncompacted soils. They are unable to

hold as much water for plant use between rains or irrigation cycles. It is also more difficult for roots to extend outward from the plant. Trees with limited root systems are more likely to become uprooted during high winds. All of these stresses contribute to increased instances of disease and insect infestations.

Soil compaction is measured as bulk density (grams per cubic centimeter). A bulk density above 1.6 g/cc is an indication that the soil may not support appropriate plant growth. Solutions include:

- Replacing the soil—an expensive and time consuming task
- Incorporating organic matter into the soil to help break up the compacted

soil, thus allowing roots to provide better anchorage. (Do not incorporate more than 5 percent organic matter into the soil; exceeding this level can result in anaerobic breakdown of organic matter during excessively wet periods.)

- Selecting species that are more tolerant of compacted soils (Table 1). Even species that are tolerant of compacted soils and other poor growing conditions will grow better and live longer when they are planted on good soils.

Table 1. Kentucky trees that are tolerant of compacted soils.

Botanical name	Common name	Comments
<i>Acer campestre</i>	hedge maple	Medium-size tree; foliage like sugar maple
<i>Acer negundo</i>	boxelder	Large quantities of seeds; surface roots; prone to breakage in wind and ice storms; often develops extensive columns of decay
<i>Acer rubrum</i>	red maple	Surface roots; flat-headed apple tree borer common on stressed trees
<i>Acer saccharinum</i>	silver maple	Surface roots; prone to breakage; often develops extensive columns of decay; tolerant of wet sites; poor fall color
<i>Acer tataricum ginnala</i>	Amur maple	Small tree; interesting leaf shape; outstanding fall color; multiple trunks common
<i>Ailanthus altissima</i>	tree of heaven	Reluctantly listed because of extreme invasiveness; useful where nothing else will grow; useful in zoos for its exotic, tropical appearance; no other use in the urban environment. If used at all, plant male trees, confine roots; will form thickets
<i>Alnus</i> spp.	alders	<i>A. glutinosa</i> (European black alder) invasive; tolerant of flooded soils and low nitrogen; minimal fall color
<i>Aralia spinosa</i>	Hercules club, spiny aralia	Exotic, tropical appearance; tolerates hot, dry shade; excellent barrier plant (for people); use to prevent soil compaction under less tolerant species
<i>Betula nigra</i>	river birch	Tolerant of flooded soils; surface roots; intolerant of alkaline soils; aphids common on early spring growth
<i>Carpinus betulus</i>	European hornbeam	Columnar forms; densely branched; acceptable screen even when defoliated
<i>Carya illinoensis</i>	pecan	Leaf spots; honeydew (from aphids and scale) stains autos and other items; nuts attract squirrels and rats
<i>Celtis laevigata</i>	sugarberry, sugar hackberry	Rare in trade; aesthetically superior to <i>C. occidentalis</i>
<i>Celtis occidentalis</i>	common hackberry	Nipple gall on foliage; witch's broom; branch breakage
<i>Cercis canadensis</i>	eastern redbud	Small tree with multiple cultivars
<i>Crataegus crus-galli</i>	cockspur hawthorn	Thorns; rust diseases
<i>Diospyros virginiana</i>	persimmon	Interesting bark; messy fruit attracts animals; minimal fall color
<i>Fraxinus</i> spp.	ash	Not recommended because of emerald ash borer; existing ash should be preserved
<i>Ginkgo biloba</i>	ginkgo	Fruit is putrid; use grafted, male trees; outstanding fall color; slow growth
<i>Gleditsia triacanthos inermis</i>	honeylocust	Prone to borers and other insect pests; stem cankers on poor soils; produces thorns and fruit at an early age on compacted soils

continued on back.

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Botanical name	Common name	Comments
<i>Gymnocladus dioicus</i>	Kentucky coffeetree	Interesting bark; tolerant of reflected light and heat; suitable for parking lots; fruit on female trees may be considered problematic
<i>Juglans nigra</i>	black walnut	Late to leaf out; early to defoliate; minimal fall color; fruit can be a tripping hazard, will damage automobiles, etc.
<i>Juniperus chinensis</i>	Chinese juniper	Numerous cultivars in species; tree form ("Keteleeri" and "Torulosa"), groundcover or shrubs
<i>Juniperus virginiana</i>	eastern redcedar	Tough on poor sites; cultivar "Canaertii" is small tree form that keeps juvenile foliage longer, has attractive fruit display; "Burkii" is a male (fruitless) form; all subject to cedar-apple rust
<i>Koelreuteria paniculata</i>	golden raintree	Rounded habit; deeply cut foliage; flowers can be messy; seeds drop; produces a thicket; an exotic invasive but rarely spreads beyond the immediate area
<i>Liquidambar styraciflua</i>	sweetgum	Surface roots on compacted soils; fruit can be a problem; foliage is interesting; outstanding fall color
<i>Maclura pomifera</i>	Osage orange	Only male varieties (female trees fruit that can be a problem); essentially disease and insect free; tolerant of reflected light and heat
<i>Magnolia grandiflora</i>	southern magnolia	Surface roots on compacted soils; fruit and leaves can be litter problem
<i>Magnolia virginiana</i>	sweetbay magnolia	Tolerant of compaction once established; attractive flower; subspecies australis "Henry Hicks" remains evergreen
<i>Nyssa sylvatica</i>	Tupelo/black gum	Tolerant of compaction once established; outstanding dark green foliage turning scarlet or reddish purple in fall.
<i>Ostrya virginiana</i>	hop hornbeam	Slow growing but tolerant of compaction; essentially disease and insect free
<i>Platanus x acerifolia</i>	London planetree	Fast growing; surface roots on compacted soils; one of the most urban tolerant trees (now listed as <i>P. hispanica</i>).
<i>Platanus occidentalis</i>	eastern sycamore, planetree	Fast growing; surface roots on compacted soils; one of the most urban tolerant trees; leaf anthracnose in cool, moist springs
<i>Populus deltoides</i>	eastern cottonwood	Surface roots on compacted and wet sites; tolerant of flooding; subject to storm damage; large wounds subject to developing into columns of decay; problematic near septic drain fields, damaged pipes
<i>Populus grandidentata</i>	bigtooth aspen	Fast growing with foliage that is smaller and better suited for landscapes than <i>P. deltoides</i> ; surface roots on compacted soils
<i>Quercus bicolor</i>	swamp white oak	Tolerates set sites; outstanding exfoliating bark
<i>Quercus falcata</i>	southern red oak	Deeply cut leaves; adapted to dry and compacted (clay) soils; established trees will not tolerate fill soil or sudden changes in soil environment
<i>Quercus imbricaria</i>	shingle oak	Adapted to dry and compacted (clay) soils; established trees will not tolerate fill soil or sudden changes in soil environment
<i>Quercus macrocarpa</i>	bur oak	
<i>Quercus rubra</i>	red oak	
<i>Quercus shumardii</i>	shumard oak	
<i>Quercus lyrata</i>	overcup oak	Adapted to wet or compacted (clay) soils; established trees will not tolerate fill soil or sudden changes in soil environment
<i>Quercus michauxii</i>	swamp chestnut oak	
<i>Quercus nigra</i>	water oak	
<i>Quercus pagodifolia</i> (Formerly listed as <i>Q. falcata pagodifolia</i> .)	cherrybark oak	
<i>Quercus palustris</i>	pin oak (Significantly over planted.)	
<i>Quercus phellos</i>	willow oak	
<i>Robinia pseudoacacia</i>	black locust	Tolerant of compacted soils; stressed trees produce thorns and numerous suckers
<i>Salix</i> spp.	willow	Surface roots on compacted soils
<i>Taxodium distichum</i>	baldcypress	Tolerant of wet and compacted soils; chlorotic on alkaline soils
<i>Ulmus</i> spp.	elm	Cultivars resistant to Dutch elm diseases