Leaflets News and Information for the Arborists of Michigan

Plant Health Care:
Tree Health & Urban Soils

By David L. Roberts, Ph.D, *Michigan State University*

Introduction:

People love their trees. New homes are often built on premium-priced wooded lots because existing, large trees contribute immensely to the beauty of landscapes. The same often applies to commercial developments. Urban environments usually subject trees to unfavorable conditions that often result in poor tree health, poor tree growth and decreased tree survival. Even though people love their trees, when development is performed, trees, like Rodney Dangerfield, "don't get no respect."

Even though people generally have good intentions, much of the problem with trees in an urban and suburban environment is due to the lack of human understanding. When people observe trees, they generally see a trunk, branches and foliage (Photos 1 & 3)), but not the roots. Roots comprise a surprisingly large and important component of a typical tree's anatomy. Because they are not visible to the eye, roots are usually the most violated portion of trees in urban sites.

Decline is a term often applied to trees whose health is decreasing due to a variety of factors. Decline is very complex, and understanding this issue may be difficult. Initial decline may be caused by adverse conditions caused by human activities. Among some of those conditions, alteration of the soil by grading (Photos 2), the addition or removal of soil (Photos 3 & 4), damage from construction and associated equipment (Photo 5 & 6) and the cultivation of turf in the immediate vicinity of trees (Photo 7) rank among the more common issues initiating tree decline. Invariably, diseases and insects become involved in the decline, making a reversal of the decline much more difficult. Decline may take years to manifest itself after adverse "urban" soil conditions have been created. Arborists are often expected to "fix" trees after the decline is well underway.

Natural vs. Urban Soils

Trees have evolved over millennia to grow in soils and environments that exhibit certain characteristics. For example, certain trees (red oak) prefer light, well drained soils; other trees (larch) are adapted to poorly drained or waterlogged soils. Some trees will grow in warm climates (zones) whereas others are well adapted to colder climates. Unfortunately, we as humans do not respect the natural environment of what trees need for optimum health and long-term survival. Following is a brief discussion of several common and important (but not exhaustive list) factors that affect tree health in urban soils.

Soil Texture: The three major components of soils that influence their textures are sand, silt and clay. When a site is naturally disturbed, either by glaciers, forest fires, volcanic activity or other

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Photo 3: Older, established trees are often the reason for site selection for new homes. Adding "fill dirt" is a common practice, but regrettably, many people do not understand the long term decline impact of such a practice on older trees. The tree well in this photo emphasizes many people's lack of understanding of the importance of roots in tree health.

Photo 4: There was no flare on this tree trunk, possibly indicating fill soil had been applied. A soil probe can help diagnose a variety of factors associated with tree decline. In this case, it was determined that approximately eight inches of "clay fill dirt" had been added to the original, rich, darker colored soil.

Photo 1: When people look at trees, they often only see foliage, branches and trunks. Roots are extremely important to support overall good health of trees. Roots are usually the most abused anatomical components of trees.

Photo 2: During construction or landscape modifications, grading may cause severe long-term damage to soil structure and roots. Visiting the site several years later may disclose declining trees, but the reason for the decline may not be evident.

Photo 5: Even though trees (left of center) are kept in construction zones for future use in the finished landscapes, trees often receive little respect during the construction project, as with this new home near Birmingham, Michigan.

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natural disasters, the soil components may be drastically altered, resulting in an inhospitable site for tree growth. Over centuries, ecosystems in these naturally disturbed sites evolve from grass-dominated areas to mature forests areas. Human activity in new development sites often mimics natural disasters. Top soil is often stripped off and removed from the site. Subsequently, "fill dirt" (often clay subsoil) is deposited and graded, leaving a highly compacted and nutritionally poor growing medium. These soils also tend to exhibit poor aeration and drainage.

Soil Organic Matter: Organic matter consists of actively decomposing plant/animal/microbe material as well as humus. Organic matter content in natural soils may comprise 5% or more of the soil component. Organic matter is important for soil pH, plant nutrition and for improving soil texture, which affects aeration and drainage. In disturbed sites, those altered by human activity, organic matter content is often below 1% of the soil makeup. This low organic matter content has a negative impact on tree health.

Soil pH & Nutrition: pH is defined as the negative logarithm (base ten) of the concentration of hydrogen ions (H^+). Hence, a soil with a lower pH, say 6, has 10X the number of hydrogen ions than a soil with a pH of 7. With more hydrogen ions, the soil is considered more acidic. With less hydrogen ions (more OH ions), the soil becomes more alkaline (sweet). The soil pH is important because certain elemental plant nutrients are more available or less available. At a higher pH, certain elements such as iron, manganese and copper become unavailable, causing poor plant health. At a lower pH, below pH 5, for example, the elements phosphorus and potassium usually become unavailable. Trees generally prefer a lower soil pH, in the 5-6 range (Photo 8). In many Michigan landscapes, the soil pH often measures above pH 7 or even pH 8.

Soil Flora and Fauna: A natural soil contains numerous and diverse populations of flora and fauna. A natural forest soil may contain one billion bacteria per teaspoon of soil. There may be 20,000 different species of bacteria in that teaspoon of soil. A teaspoon of forest soil may contain 40 miles of fungal hyphae (fungus body). There may be 10,000 or more arthropods per square foot of natural forest soil. All of these organisms and others are vital for the soil food web recycling of nutrients, which alternatively provides the optimum environment that favors tree health. Many urban soils lack this rich plethora of microbes and animals, which does not promote a healthy soil or a healthy tree.

Turf vs. Trees: Turf is a highly desirable component of most Michigan landscapes. However, turf is a tough competitor with trees, particularly when space, water and nutrients are considered. Usually, we expect turf to grow under trees, a relatively unnatural situation. Turf culture tends to shift the soil pH to the higher pHs (7-8) while tree (forest) culture tends to shift the soil pH lower toward the 5-6 range. This shift in pH usually results from soil biology changes; turf shifts the soil microbial populations to favor bacteria while forest soils tend to shift microbe populations toward more fungi. Hence, the fungal to bacterial ratio in grasslands is often 1:3, while it is 10-100:1 in natural forest soils. The soil biology component is important for determining whether soil is more optimal for turf or trees.

Remedying Urban Soil Issues

Obviously, the best practice is to avoid creating the adverse "urban" soil conditions that disfavor tree health. For existing trees on development sites, providing protection for the soil and roots of trees will help to minimize later decline issues. For development sites, often the cheapest fill dirt is utilized; it is far better over the long term to apply high quality soil to landscape sites before new plantings are installed. Arborists are often asked to make older, declining trees healthier after construction of new homes or businesses have been completed; correcting past issues that are leading to tree decline can be daunting. A variety of tests should aid in implementing the necessary remedial procedures. Soil tests should include pH, nutrition levels, soil texture and tilth, and compaction. Soil health can also be measured according to levels of flora and fauna.

Because trees are often expected to thrive in far less than ideal soil conditions, several methods can help to improve the soil and tree health. Various physical techniques to improve aeration and drainage are available. Vertical mulching and radial trenching are two methods commonly used to improve the soil conditions necessary for tree roots and ultimately improved tree health. The use of a backfill containing critical nutrition and soil/organic matter at the appropriate soil pH should assist with gradually improved tree health. Avoid using turf herbicides in the vicinity of tree roots. It is also best to mulch rather than cultivate turf under trees. Mulch rather than turf more approximates the natural forest conditions under which trees have evolved. Undoubtedly, proper mulching in the root zone of trees is probably one of the best techniques to improve tree health.

Photo 6: These trees are being severely abused at this new development in Northern Michigan.

Photo 7: Turf and trees are fierce competitors. The failure of this tree on a golf course could be due in part to a turf-oriented culture, where herbicides, fertilizer programs and irrigation procedures can promote adverse conditions for tree health.

Photo 8: For development of this home and garage near a lake front, the topsoil was stripped off, exposing sandy subsoil. Interestingly, the pH of the sand measured 7.8 while the original, natural forest top soil measured a more tree-friendly 5.6. Several inches of clay fill dirt will likely be added for the establishment of a lawn. Trees at this site will probably begin to decline within a few years.