SOILS ASSESSMENTS FOR URBAN TREE PLANTINGS

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ABSTRACT. --Soil assessments are an important component of a successful urban tree program. The urban tree manager should follow procedures for mapping and describing the principal urban soils in his locality. An on-site investigation of the principal urban soils should be implemented to provide the necessary technical data for the urban tree program.

MANY OF THE DIFFICULTIES in the planting and management of urban trees are associated with the urban soil conditions. Often the existing soils available for street tree plantings are compacted and disturbed to such an extent that normal water and gas movement is severely limited (Patterson and Mader, 1982). The compacted conditions frequently create either excessively wet or excessively dry soils. Urban soils provide extreme and often severe conditions for urban tree growth. The ideal soil as commonly described in introductory soil textbooks is difficult, if not impossible, to locate in the urban environment. A majority of the urban soilscape contains these highly disturbed or man-made soils. Because of this fact, on-site soil investigations are crucial to effective urban tree planning and management.

Generally, little consideration is given to the soil conditions prior to tree planting, even though the root environment is vital to the survival and growth of the trees. This is partially because of the erroneous assumption that the urban soils will be similar to their rural soil counterparts (Kays, 1979). Typically, nothing could be further from the truth. Another reason why soils are given so little consideration lies in the difficulty of viewing and inspecting the soils, The urban tree manager can easily inspect the above ground environment.

County soil surveys are frequently of limited use in urban areas. Generally,such surveys reflect the soils prior to urban disturbance. Specialized on-site soil investigations are necessary to properly understand and plan an effective urban tree program (Kays, 1982).

The competent urban tree manager needs to become one of the most informed individuals concerning the urban soils in his locality. The education of the urban tree manager will of necessity be a self-taught learning experience. In order to educate oneself about local soils the following points are suggested.

1. Study the geologic maps and records for your locality. Visit the location of typical geological outcrops noted in the geologic reports. Become familiar with the characteristics of the principal geologic units in your locality.

2. Study county soil survey reports for your locality. Visit the location of typical soil profiles noted in the soil survey. Learn the distinquishing features and characteristics of the principal soil series in your locality (Soil Survey Staff, 1951).

3. Study and learn the basic inter-relationships between geology, soils, and topographic conditions in your locality.

4. Examine various urban soil conditions in your locality through digging and observing soil profile pits in areas of interest. Obtain assistance from the Soil Survey staff of the Soil Conservation Service.

5. Learn to observe subsurface conditions at any opportunity. Construction sites frequently offer good opportunities.

6. Map, catalog, and learn the major types of urban soil in your locality. Maintain a field notebook and record on maps your observations.

7. Arrange with a testing laboratory to have soil test data prepared for the principal urban soil types in your area. Table #1 illustrates some of the types of soil test data you should consider.

a. Develop an understanding of how the different soil conditions influence plant growth through observation and testing for your urban tree program.

TABLE 1 - ON-SITE SOIL INVESTIGATIONS METHODOLOGY

Soil Characteristics	Level 1 - Preliminary Investigations: Identification of Potential Problems		Level 2 - Detailed Investigations: Recommended Testing if Moderate or Severe Problems Occur at Level 1
	Moderate [ii]	Severe [ii]	
Morphological			
Depth to rock	<4 feet	< 2 feet	**Numerous** borings; also determine effect upon water table
Depth **to seasonally high water table**	< 4 feet	< 2 feet	Numerous **borings; determine reason(s) for** shallow **water table; collect data for drainage design**
Depth **to apparent water table**	< 6 feet	< 4 feet	**Numerous borings; determine reason(s) for** shallow **water table; collect data for drainage design**
Depth to restrictive horizons	< 4 feet	< 2 feet	Numerous borings; determine nature and permeability of restrictive horizon; determine effect upon water table
Soil structure			
Massive	yes	yes	**Conduct infiltration** and subsoil permeability tests
Platy	yes	yes	Conduct infiltration and subsoil permeability tests
Physical			
Soil texture			
Sand	>75%	**790%**	Laboratory soil texture; determine drainage rates for irrigation design
Clay, **Kaolinitic**	750%	**7 65%**	**Laboratory soil texture; check structure and bulk density**
Clay, Expandable	any	> 10%	**Laboratory soil texture; infiltration and** permeability **tests**
Clay and Silt	> 50%	> **75%**	**Laboratory** soil texture; infiltration and drainage rates
Soil permability	< **0.25** in/hr	< **0.05** in/hr	Determine permability of important horizons; collect data for drainage design
Bulk density - clay	**dense (71.4** g/cm^3)	**dense** (>1.5 g/cm^3)	Determine soil porosity, infiltration and subsoil permeability
-loam	**dense** (>1.6 g/cm^3)	**dense** (>1.8 g/cm^3)	Determine soil porosity, infiltration and subsoil permeability
Chemical			
pH	i	i	**Check** pH in rooting zone; select plants accordingly
Fertility	1	1	Check phosphorous and potassium levels in rooting zone
Lime requirement	pH <6	pH < 5	Laboratory analysis for lima requirement
Salinity	pH >8	pH >9	Laboratory analysis for salinity

1 Can be checked with field soil testing kit, however it is recommended to also send samples to laboratory for testing.
ii Approximate determination of moderate and severe; good judgment is required.

Examples of the assessment of urban soils can be found in Craul and Klein, 1980 and Patterson, 1981.

This proposed self-taught urban soil education program for your local soils can obviously become a long-term effort. The rewards from such an educational program will be important early in the learning process, but will be amplified as your knowledge and understanding increase. Although the study of subsurface conditions takes a special effort, you will find that the benefits can be quite significant.

Numerous technical and budgetary decisions are necessary in planning soil investigations. Although you will want to obtain sufficient data for the principal soils in your locality, a system will be needed to determine priorites. Table #l provides an on-site soil investigation methodology. Level l-preliminary investigations should be used at a minimum rate for the assessment of all of the principal soils in your locality. This preliminary rating can be accomplished by a modest soil investigations program. Level Z-detailed investigations should be conducted at a minimum for each soil and soil characteristic that is rated as having a potentially severe problem as indicated on Table This procedure will allow the urban tree manager to direct the soil investigations to the more severe soil characteristics and to the particular soils that have a greater number of severe problems.

This type of soils assessment effort should be considered as an essential component for a professional urban tree program. Thorough soils investigations should provide the basis for considerable management benefits and economic savings to the urban tree program.

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