Arborist Report

Prepared at the request of:

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Ohlone College, Newark
Report on the Condition of Landscape Trees
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Prepared by:

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Assignment

SBCA Tree Consulting was asked investigate the condition of the different tree specimens on the Ohlone College Newark campus and provide commentary and analysis of the possible reasons why most trees have failed to thrive.

Introduction

Arborists inspected the trees on October 22, 2013. Trees were inspected and photographed and a soil auger was utilized to investigate the soil conditions and collect samples for laboratory analysis.

This report provides our observations and analysis of the problems and limitations identified during the investigation that contribute to the poor performance of the trees in the landscape. This report also provides recommendations for possible treatment for some of the most serious problems.

Summary of the Most Serious Problems Identified

There are a number of limitations in the above and below ground environments which affect the ability of the trees to thrive. These include:

1. Limited Rootable Soil – The sandy loam top soil is limited to a depth of no more than 12 inches in the areas investigated. The sub-soil is currently not suitable for root development. Trees located in raised areas where more soil is available were doing much better.
2. Soil Compaction – Soil compaction was found to be extremely high just outside tree planting excavations. Even though surface soil in most areas appears to be a sandy import, it was found to be highly compacted. The sub-soil is clay loam that is also highly compacted.
3. Weed Competition – It has been shown that trees that do not compete with weeds exhibit twice the growth rate[1]. Weeds compete for water and nutrients.
4. Wind – Trees that are exposed to ongoing windy conditions require greater moisture uptake. This in turn requires a more expansive root system.
5. Tree Species Selections – Evergreen trees have generally been found to do better when growing under coastal windy conditions. All of the tree species on the Newark campus are deciduous.
6. Trees that have Settled to Below Grade – Trees that have settled to below grade after planting are exposed to excess moisture and resulting oxygen deprivation in the root ball. Trees growing under such conditions seldom thrive.
7. Irrigation – Soil moisture conditions varied significantly throughout the landscape, from saturation to extremely dry. Bubblers are notorious for irregular application and were found to be placed directly adjacent to tree bases. Soil saturation was found at the bottom of many of the planting sites. The combination of bubblers and high soil compaction (both to the side and below the planting sites) confines irrigation to limited areas.

[1] Svihra, Pavel. "Weeds and Trees-How They Interact In The Landscape." Growing Points. UC Cooperative Extension, June 1992. Print.

Photo shows the base of a London Plane tree that is not thriving. Problems observed include: soil compaction, weed competition and improper irrigation water application.

Surface soil is a sandy loam with acceptable qualities but appears to be less than 12 inches deep and is highly compacted.

Laboratory analysis of sub-soil revealed significant limitations from boron, salts, pH and chloride. The clay loam sub-soil is not suitable for root development without being amended.

Discussion of Tree Species Represented

Nine tree species were identified in the landscape. All species are deciduous trees that are generally less adapted to windy conditions. Arborist comments are provided for each of the species. In general, trees planted on mounded areas were larger and in better health, most likely due to a greater soil volume available for root development and positive drainage away from base of the trees.

Acer rubrum 'Bowhall' **Fastigate Bowhall Maple**

The Bowhall Maple is the species used most extensively. It is planted in rows, some in open parkways and some in circular planting areas surrounded by pavement. It appears that the maples most protected from the wind are doing the best. Some of the maples were removed earlier for unknown reasons.

Celtis sinensis **Chinese Hackberry**

None of the Chinese Hackberry trees are faring well, not even those located in mounded areas. All display burnt leaf tips and stunted growth. The hackberries are best replaced.

Crataegus phaenopyrum **Washington Thorne**

A few Washington Thorne trees appear to be recently planted on the south side of campus. The trees are still quite small but appear moderately healthy.

Fraxinus americana **American Ash, 'Autumn Purple'**

Of all the trees, this species is doing the best. However, there is a significant variation in size and health based upon the conditions at the planting location. Most are planted in raised areas. Those planted under the parking lot with solar panels that have been topped are best removed.

Platanus x hispanica 'Yarwood' **Yarwood London Plane**

The London Plane tree is generally considered one of the toughest trees. The majority of the plane trees are faring poorly. Two are dead. Compacted, dry soil was prevalent.

Quercus lobata **Valley Oak**

Only one Valley Oak was found. It appears that another was likely removed earlier. This tree is located in a turf area, is in very poor health, and is a candidate for removal and replacement. Replacement species must be tolerant of turf conditions.

Quercus rubra **Red Oak**

Though most red oak trees are in poor health, there are a few that appear to be doing ok. The trees doing better are all located in raised areas where soil is mounded. This tree species is not well suited to high wind conditions. The majority of the red oak trees not located in mounds are best replaced with a tree species that has greater tolerances for the site limitations.

Ulmus parvifolia **Chinese Elm**

The Chinese Elm trees are planted in a grouping in the courtyard. The trees appear in poor health. Because they are surrounded by heavy metal grates and pavement, it was not possible to determine the soil conditions. Further investigation into soil conditions needs to be conducted to understand the reasons for the poor performance. This will require that the grates be removed and a water audit conducted.

Tilia cordata **Little Leaf Linden**

The condition of the linden trees was found to be from poor to dead. Even trees planted in the mounded area have small, wind burned leaves. Improvement in the root environment and irrigation management may offer a chance to help these trees. Most lindens should be replaced.

Discussion of Limitations to Healthy Tree Growth

Competition from Weeds – It is clear that weed competition is a serious problem. Experiments have shown that weed free trees (resulting from either herbicide, mulch or removal) grow more than twice as fast as trees that must compete with weeds: "Responses of ornamental cherry to weed control achieved by an herbicide, mowing, mulching and black tar plastic clearly show how important weed control is around young, just transplanted trees" (Svihra, Pavel).

Soil Compaction – High compaction was found in most areas, both in the topsoil and the subsoil. "Soil compaction destroys the soil's natural porosity by eliminating the air spaces within the soil. Compacted soil contains little air, holds little available water, and is harder, less penetrable and more resistant to water penetration. Consequently, root growth and tree health suffers. Soil compaction is best managed by preventing it."[2] The mounded areas where trees are planted exhibited deeper soil that is less compacted.

[2] Hagen, Bruce. "Frequently Asked Questions (FAQ's) About Oaks." Web.

Wind – The windy conditions of the site is a significant factor in the poor appearance of the trees. Windy conditions increase the demand of trees for moisture and cause leaf burn when the moisture is not available. Trees located in windy areas require additional soil volume for root development to increase moisture uptake.

Soil Volumes – As used in this situation, soil volumes refer to the cubic foot volume of soil that can support healthy root growth[3]. "It is imperative that available soil volumes for proposed tree planting be known for tree establishment but also to allow for their envisioned design size. Adequate soil volumes allow for better tree growth in the urban setting. Lindsey and Bassuk found that for much of the United States, a soil volume of 2 cubic feet for every square foot of canopy crown projection is a good place to start"[4]

In general, a large stature tree such as the red oak would require from 1,500 to 2,000 cubic feet of rootable soil. A medium stature tree such as the Bowhall Maple would require from 1,200 to 1,500 cubic feet.[5] Differences in soil textural qualities and supplemental irrigation can affect the soil volume requirements. Windy conditions increase transpirational water demands and trees require more soil volume to support a more extensive root system with greater water uptake ability.

An optimum soil volume is considered sufficient to sustain a tree to a normal mature size and life expectancy. What is most common however, is the question: "what can be termed a minimally acceptable soil volume?" Trees planted under less than optimum soil volumes will require greater care and are likely to be smaller in mature size, have a shorter life expectancy, and have more problems with pest and pathogen infections. Such trees can have a fairly long serviceable life if cared for properly. It is sometimes difficult to analyze the effects of soil volume when improper irrigation along with re-compaction of soil, wind and solar exposure play a part in tree health and vigor.

Soil Investigation – Soil auger investigation found that the site soil is of two primary strata: a 6"-12" thick surface layer of sandy loam topsoil; and the native clay loam subsoil below that. Both the topsoil and subsoil are highly compacted in most areas. Soil moisture varied widely from very dry to saturation.

Soil Analysis – Four soil samples were collected from different depths (down to 24") and sent to Wallace Laboratories for analysis. The results of the analysis can be found in *Appendix 2*. In general, the surface soil was found to be acceptable but the clay loam subsoil was found to have some significant limitations to healthy tree growth and will require mitigation of compaction and amendment.

Irrigation –Soil moisture was found to be both too wet in some areas and too dry in others. Both conditions can have negative effects on tree health. Water application is primarily from bubblers that are placed at the base of the trees. Saturation was often found at the bottom of the planting holes and in turf areas. The high soil compaction reduces water infiltration.

[3] Rootable soil is a soil medium that is compacted less than 80% ASTM, has oxygen levels between 6-16% and has sufficient available moisture and nutrients with no toxic substances.
[4] Trowbridge, Peter and Nina Bassuk. Trees in the Urban Landscape: Site Assessment, Design and Installation. New Jersey: John Wiley and Sons, Inc., 2004. Print.
[5] http://www.sbcatree.com/id71.html

Trees Located in Turf – Few tree species are suitable for planting in turf. Trees planted in turf must be planted on mounded areas well above surrounding grade. This is to ensure that water drainage flows away from the base of the tree.

Species Tolerance for Coastal Conditions – In general, evergreen trees are more suitable for planting in windy coastal conditions. Evergreen leaves have a thicker leaf cuticle and therefore less subject to moisture loss resulting from windy conditions. The poor performance of the deciduous trees partially reflects the lack of tolerance for wind.

Recommendations for Maintenance and Mitigation

It should be recognized that, for trees that are salvageable, soil mitigation can be effective in allowing root systems to expand into the surrounding soil. Soil compaction should be the primary factor in determining when soil mitigation is required.

Soil Mitigation –Increasing the soil volume that is available for root development may allow many of the struggling trees to survive and eventually thrive. It is estimated that much of the soil surrounding the trees is compacted to greater than 90%. Root development outside of the immediate planting sites is mostly in the top 4-5 inches in the sandy loam imported soil.

The best method for mitigating the compaction is by simply excavating the compacted soil. The excavation is best undertaken when soil is driest and fractures better. Soil should never be worked when wet or saturated, as soil structure is destroyed. Soil amendments are incorporated during the excavation process. The procedure is as follows:

- Identify soil compaction areas (which most likely will be found throughout).
- When mitigating the soil surrounding existing trees, cut a circle around trees to sever roots growing in the sandy loam topsoil to prevent ripping the roots during the excavation. It is recommended that an application of a sugar solution be applied to freshly cut root ends to enhance root regeneration.[6]
- Trees planted too low must be elevated. Some sites will require additional soil. Interfaces between soils of different texture must be homogenized to facilitate water movement.
- Using a backhoe or excavator, excavate the soil to the desired depth (3 feet is recommended) while incorporating gypsum and compost at the designated rates.
- Incorporate compost 15% to 25% by loose volume. The target is to incorporate 5% on a dry weight basis.
- Leach the soil and salts freed by the addition of the gypsum.
- Soil re-compaction is best prevented through the use of organic mulch (arbor chips) placed over the soil and the restriction of foot traffic in the area.

[6] Percival, Glynn. "Sugar Feeding Enhances Root Vigor Of Young Trees Following Containerization". Journal of Arboriculture 30(6): November 2004. http://archive.treelink.org/joa/2004/nov/percival11-04.pdf Solution is made by mixing 30 gms. of sugar per liter of water to be used over each square meter of soil surface.

Maintain a Weed Free Area of Mulch Surrounding the Trees – By whatever means necessary, maintain a minimum of five feet radial distance of weed free, mulched soil area. The mulch will reduce future soil compaction, reduce weed competition, and prevent mowing equipment from coming in contact with the trees. Soil structure and soil fertility are also improved with the use of organic mulch. Salt buildup, as well as incidence of some diseases, are reduced. Mulches also moderate soil temperatures so that surface soil is cooler in summer and warmer in winter than it would be otherwise.[7]

Irrigation based upon Water Audit – Improper irrigation is a significant factor in the decline and death of many of the trees. Trees are irrigated by both bubblers and spray. The cause of tree decline was found to be from both excessive and insufficient supplemental irrigation. Application of water at the immediate base of the tree can be harmful after the first year. Supplemental irrigation for properly selected and planted trees should not be required after the first two years when soil conditions allow for satisfactory root development.

Any attempt to excavate soil surrounding the trees in order to mitigate soil compaction will likely damage the existing system. Much of the current irrigation can be abandoned and replaced by a simple system of lines laid just under the surface layer of mulch. With proper species selection and planting site preparation and planting, supplemental irrigation should be required for no more than two years.

It is recommended that 'spray bubblers' or Netafim be used to replace bubblers for trees planted in enclosed planting sites. A water audit is also needed to clearly understand the different irrigation areas and plant material requirements.

Trees that have Settled to Below Grade – Trees that have settled to below grade or were planted at the bottom of swales must be elevated or relocated. Because trees all are deciduous, this can be accomplished during winter months. This requires some root pruning as well as the application of a sugar solution to freshly cut root ends to enhance root regeneration. Additional soil may be needed to elevate the trees, more is better. Homogenize soils of differing textures.

Tree Pruning – Most trees are in need of what is known as Early Structural Pruning. The purpose of Structural Pruning is to: remove broken or damaged stems, select the lowest permanent branch, establish branch spacing, remove weakly attached stems and develop a strong single central leader for the trees. It is imperative that maintenance personnel be trained on the implementation of the ANSI A300 Best Management Practices. Training and Certification can be attained through the International Society of Arboriculture (ISA). Early structural pruning, if correctly done, is the most cost effective maintenance a tree will ever receive.

Replacement Planting –Many of the trees that are either dead or in severe decline should be considered for replacement. Though some deciduous trees have been suggested for replacement planting, it is recommended that evergreen trees be favored. Replacement planting is likely to have greater success if the planting sites are properly prepared. Site mitigation will be much easier when preparing for a new tree. Mound tree planting sites as much as is possible to provide a better root environment.

[7] Harris, 1983: Arboriculture

New Species Suggestions

Many of the tree species currently planted are having a difficult time surviving. Trees that perform better under coastal windy conditions are generally evergreen. Species suggestions include:

Evergreen Trees

1. Coast Live Oak (Quercus agrifolia)
2. Cork Oak (Quercus suber)
3. Camphor (Cinnamomun camphora
4. Red Flowering Gum *(Corymbia ficifolia)*
5. Japanese cryptomeria (*Cryptomeria japonica)*
6. Monterey Cypress *(Hesperocyparis macrocarpa)*
7. Brisbane Box *(Lophostemon confertus)*
8. Water Gum *(Tristaniopsis laurina)*
9. Broad-Leaved Paperbark *(Melaleuca quinquenervia)*
10. Flaxleaf Paperbark *(Melaleuca linariifolia)*
11. New Zealand Christmas Tree *(Metrosideros excelsa)*
12. Canary Island Pine *(Pinus canariensis)*
13. Japanese Black Pine *(Pinus thunbergii)*
14. Victorian Box *(Pittosporum undulatum)*
15. Eastern Arborvitae *(Thuja occidentalis)*
16. She-oak *(Casuarina equisetifolia)*
17. Swamp Mallet *(Eucalyptus spathulata)*

Deciduous Trees

1. Maidenhair Tree *(Ginkgo biloba)*
2. Chinese Pistache *(Pistacia chinensis)*
3. California Sycamore *(Platanus racemosa*)
4. Black Locust *(Robinia pseudoacacia)*
5. Japanese Zelkova *(Zelkova serrata)*

Concluding Remarks

Without mitigation, most of the trees on campus are not expected to ever thrive. If nothing is done, the trees are expected to continue to look bad and continue to decline in health. It will only be cost effective to retain trees that are not in too severe of decline. For trees in fair health, site mitigation to increase the amount of rootable soil is recommended.

Design modifications need to accommodate evergreen tree species that are better suited to the campus conditions. Many evergreen trees provide good screening from the wind; one species noteworthy is the Monterey Cypress. In this area with a likely high water table, it is critical that all tree planting sites be mounded and subsoil be amended.

End Report