

Shields Oak Grove Case Study, University of California, Davis

Introduction

The UC Davis Shields Oak Grove is the only large collection of mature oaks in the western United States. In order to ensure the long term preservation of these valuable trees, the University Arboretum asked Tree Associates to evaluate the condition and management of the Grove, which was established in the 1960's. The following items were of specific interest to the Arboretum staff:

- The current health of the trees
- The impact of large numbers of nesting herons on the health of the trees
- The structural integrity of the trees and associated risk to the public
- Current management of the grove (irrigation, pruning, fertilization, etc.)
- Treatments to improve tree condition for the long term

Methods

In order to address the Arboretum's concerns, our approach was first to evaluate the health and structural condition of each tree within the grove. This gave us information on the type, severity and location of health concerns as well as an understanding of structural defects and their impact on risk within the grove.

Because tree health is so intimately tied to soil conditions, a horticultural soil analysis was performed. We identified thirteen soil sampling locations, where we had pits dug by backhoe to approximately four feet deep (Figure 1). Data collected at these sites included tree rooting depth, size and condition; and soil texture, color, smell, bulk density (a measure of soil compaction), infiltration rate, percolation rate, and moisture levels (Figures 2 and 3). Soil samples for chemical analysis were collected at depths dependent upon the above analyses. In addition, the irrigation system was audited to determine recommendations for a modified irrigation schedule.

Certain trees with symptoms of root disease or decay (Figure 4) were identified for more detailed analysis which included an examination of their roots at the base of the trunk (a "root crown examination") and sampling diseased tissue for laboratory analysis.

Results

The following are selected results of our assessment:

- 73% of the trees in the grove were in "fair to good" (average) health or better
- Symptoms of root disease, micronutrient deficiency, damage by bird feces, twig and branch dieback, borers and spider mites were significant contributors to the health ratings (Figures 4-8).

- A relatively small percentage of the trees (14%) had a greater than moderate likelihood of failure (loss of trunk, limb or toppling) and the vast majority of the trees were given risk assessment ratings of less than 9 out of a maximum of 16 (Figures 9 and 10).
- Soil compaction was found to be significant at four of 39 locations, mostly in the upper 8 inches of soil (Figure 11).
- While only 50% and 43% of the infiltration and percolation rates met target values, the soil, roots and soil moisture sensors did not indicate poor drainage
- The soil within grass covered areas was not drying down to target moisture values between irrigations.
- Outside of grass covered areas the soil was becoming drier than target moisture levels between irrigations.
- In areas not influenced by bird droppings, soil chemistry was found to be within adequate horticultural levels
- Under the birds, pH was dramatically lowered while the total level of salts, nitrate, ammonium, sodium and chloride in the top six inches of soil were elevated in some sampling sites to levels which are toxic to roots
- All trees with roots sampled for disease tested positive for *Phytophthora* sp., a fungus which causes death of tree roots and trunk tissue
- The water audit noted several deficiencies within the irrigation system which needed to be addressed

From the above, the significant horticultural limitations found within the grove included:

- Excessive irrigation frequency in turf
- Root disease (*Phytophthora* sp.)
- Possible (soil pH related) micronutrient deficiency
- Impact of bird feces
- Tree structural defects
- Surface soil compaction and low surface infiltration rate
- Possible twig and branch disease

Recommendations

Considering the above, the following recommendations were provided to Arboretum staff to improve the performance of and reduce risks associated with oaks within the grove:

- Follow recommendations for tree work to improve structure, starting with trees with the highest risk rating.
- Repair irrigation system as recommended in audit
- Modify irrigation pattern to avoid frequently irrigating oaks within grass covered areas where possible
- Modify irrigation schedule to water no more than 2-3 times per week within grass covered areas

- Irrigate oaks outside of grass covered areas once every three to four weeks during the summer months
- Treat trees with iron chelate and/or soil sulfur as recommended in the report
- Utilize a deep penetrating core aerator within turf and non-turf areas to break up surface compaction
- Install and maintain 4" thick woodchip mulch over non grass covered areas of grove with priority in trafficked areas
- Manage vehicle traffic within the grove to avoid further compaction
- Remove birds from grove as soon as possible
- Treat trees with fungicide with activity against Phytophthora