Transplanting Oaks Does Not "Save" Them

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OVER THE PAST 15-20 YEARS, many oaks in the Los Angeles area were moved from one place to another to accommodate development. Developers loved the idea of being able to "save" the trees and incorporate them into their new and improved landscapes. The tree moving companies became expert at the extremely difficult technique of actually moving a boxed tree weighing many tons. New homeowners in the developments loved the idea of having a mature tree in their yard, and paid as much as 30 percent more for the privilege. The decision-makers felt that they had required adequate mitigation for the loss of native oak woodland. No one looked to see what the trees were saying.

In 1992, the City of Calabasas required that any transplanted oak trees be monitored for 5 years to see how they fared. Four sites in the City had a total of 87 mature Coast Live Oaks, which were moved. We began our observations as the trees were boxed and have followed them quarterly ever since. The following discussion is a brief overview of what we have learned.

First came the boxing. For 25 trees, the canopy was reduced by more than 70 percent before root pruning. The canopy of the other 62 trees was left intact. Only dead branches or those damaged during boxing were removed. Then a backhoe dug a 6-foot deep trench around the tree from 4-15 feet away from the trunk. More than 90 percent of the root system was lost during this process. The sides of the box were built and the trees then sat for 3-6 months. Then the bottom was dug out and boxing completed. Huge cranes carried the trees to either their new home or a storage site. No soil samples were taken to determine compatibility with the original site. Only in a few cases were the trees replanted in their original orientation. Except for one site where irrigation was installed, the trees were irrigated weekly or more often via watering trucks.

Our monitoring was both qualitative and quantitative. Each tree was given a vigor rating using the International Society of Arboriculture standard condition evaluation for landscape trees, which is based on canopy, foliage, trunk and root condition. Trees were categorized as healthy (5) stable/improving (4) stable (3) declining (2) and dead (1). We also measured the shoot length, number of shoots and leaves per shoot. Soil probes were used to determine root distribution and density. Leaf nutrient levels and soil foodweb composition were also evaluated.

In addition, we used a technique to measure the water stress inside the conducting vessels. Called stem xylem potential, a twig is inserted into a pressure chamber at midday when the tree is in full sun and then another sample is taken in the middle of the night. The amount of pressure it takes to force water out of the stem is the same needed by the tree to draw it in. By comparing the amount of pressure it takes to force water out of the stem at night when the tree is in equilibrium with its environment, with the pressure when in full sun, it is possible to see how well the tree is able to access water in the soil, and the extent of transpirational recovery.

The control trees (native trees left in their original locations) all remained healthy during the 10 year study, and measurements of their stem potential indicated that even when severely drought stressed, they had enough reserves to rebuild lost conducting tissue. Even during the hottest months, the canopies remained vibrant and the trunks showed active radial growth.

The transplanted trees were another story. Although the stem potential was useful primarily for monitoring irrigation, extremely high pressures were recorded, indicating continuing decline of conductance. Because the transplants had lost so much canopy and/or root mass, they did not had sufficient energy reserves to recover. Since replacing roots takes priority over replacing conducting vessels, the trees are in a state of cumulative decline.

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Tree being prepared for moving.

A quick note about oak tree biology. There is a complicated feedback loop between the new shoots and the roots, which regulate their growth. Auxins in the terminal buds stimulate root growth in the late summer and fall. The roots grow and produce hormones that stimulate new shoot growth in the spring. When the trees lost both large amounts of canopy and roots, this system was completely disrupted. Regeneration of root mass is related to tree diameter. It seems that it takes between 10 and 12 months per inch diameter to regenerate lost roots under ideal conditions. The transplanted trees varied in size, but using this guideline, it would take more than 10 years for the smallest trees to redevelop lost roots. Due to the loss of canopy, the trees have reduced ability to regenerate either roots or energy reserves.

Those trees whose canopies were left intact initially fared considerably better. They maintained a well-formed canopy that appeared to shrink back to a size manageable to the tree given the extent of root loss. These trees also were faster at regenerating fine root mass, and leaf analysis indicated that the non-pruned transplanted trees maintained higher levels of calcium in their leaves than did the pruned transplants. Calcium is a critical element in tree metabolism and the declining and extremely low levels found in the pruned trees illustrated yet another large disruption of physiologic function that the trees had to face.

The canopy configuration was also notably different. The non-pruned trees maintained a normal pattern of twig growth, similar although smaller than that of the control trees. After a few years though, most of them began to have more epicormic growth from the main branches and trunk, with less terminal twig growth. This was the pattern seen from the start with the heavily pruned trees. The trees were so stressed that the dormant cells in the trunk and scaffold branches were activated in a desperate attempt to gain more leaves. The pruned trees slowly replaced their canopy starting in the interior and moving out. After 10 years, many of the original large branches had died and were replaced by the poorly attached epicormic shoots.

Another interesting fact was that the interior leaves of the oaks continue to photosynthesize during the hot summer months when the outer shell of leaves shut down to reduce transpirational loss. This little extra bit of energy generated in the moist interior of the canopy allows the tree to exceed its baseline metabolic needs for the year and to store energy. When the canopy is pruned so heavily that the interior branches are exposed, the trees just barely survive. It takes several years for the tree to recover from a severe pruning when its roots are undisturbed, much longer when the roots are damaged. This is why it is important to only prune oaks only as needed. Transplanted trees are forced to use up their energy reserves day by day, just to stay alive.

By April 2002, only 5 of the 87 transplanted trees were established or self-sufficient. In the ten years of the study, 17 trees had died, 44 had declined and only 21 were stable. Thus, the long-term survival rate for the trees is at most 40 percent, with 10-20 percent being more realistic. Considering that it cost almost $1 million to move these 87 trees and approximately $60,000 per year to maintain and monitor them, transplanting oak trees does not appear to be a cost effective mitigation. Think of how many new oaks could have been planted for that sum. Think of how much existing oak woodland could have been purchased for public open space.

It appears that even the highest level of care is not sufficient to overcome the trauma of transplantation for most oaks. There are, however, a few exceptions to the rule. In the late 1930's seven coast live oaks were moved at Hearst Castle. The only one remaining alive by 1995 had been turned and moved just a few feet so that the branches faced the appropriate direction in relation to the main house. All the main branches have been pruned as they failed, leaving a mere skeleton of the once lovely tree surrounded by impatiens. The other trees failed one by one over the years. They required increasing levels of care and never became self-sufficient.

Declining relocated tree.

If the goal of mitigation is to replace lost resources, then transplanting oak trees should be recognized for what it is. There may be some cases when it is deemed necessary to move an individual tree, but we should acknowledge that the transplanted tree is no longer a self-reliant native, but rather a high care exotic. The true cost of taking care of the tree as it slowly declines over the years should be made clear from the start. Additional mitigations to replace the lost natural resource should also be required.

We have the technology to move the trees, but that doesn't mean that we are "saving" them. To save an oak, we need to leave it in place and work around it using the most sophisticated protection skills possible to reduce the impacts of construction. Imagine how beautiful it could be to have a development work with its oaks and topography, rather than reorganize them! Truly a goal worth striving for! Only then will we be truly saving the oaks.

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