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UCLA's Campus Forest: A Community Resource

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Cover Photo:
Oblique aerial view of the UCLA campus, from the southeast, 2003 (T. Longcore).

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The Urban Wildlands Group is dedicated to the conservation of species, habitats, and ecological processes in urban and urbanizing areas.

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Authors' Note

The authors surveyed the campus during 2003, providing the basis for this report. All observations, opinions, and recommendations regarding tree health and tree care practices are those of Registered Consulting Arborist Jan C. Scow (ASCA #382) and Certified Arborist Cynthia Cohen (ISA #WE-6334A). Common names of trees are highly variable. We use the *Sunset Western Garden Book* (Brenzel 1995) where possible. Latin names are provided at the first mention of each species.

UCLA's Campus Forest: A Community Resource

1.0 Introduction

Institutions of higher education are looked to for leadership in almost every field of study. They provide expertise and training in medicine, law, the arts, all basic sciences, social sciences, and the humanities. Students at a great university should be exposed to a wide range of disciplines to receive a first-rate general education; history majors still have to learn something about science. The goal is to create well-rounded members of society. But far too often, universities fail to educate young people about how to observe and think about the natural world, even as programs are developed to teach about "sustainability." Students learn from books about the nature of faraway places, while educational benefits of local natural elements are overlooked.

In urban Los Angeles, a planted and well-maintained forest of trees and understory can provide both educational opportunities and environmental benefits. The University of California, defined as a "public trust" in the California Constitution (Article IX), manages one of the most significant urban forests in the Los Angeles region; the 419-acre UCLA campus, celebrated for its "park-like atmosphere," has a significant urban forest comprising approximately 15,000 trees (Webb 1997). UCLA's status and visibility make it a model for other large landholders in the academic community.

The UCLA urban forest is currently at a crossroads. Capital development has resulted in the removal of over 1,400 specimen trees since 1995, and more losses are expected in the next five years. The character and value of this urban forest could be lost if replacement plantings are not carefully chosen, or if especially important landscape features are not preserved.

This report assesses the current state of UCLA's landscape. During the 1960s and 1970s, UCLA developed a diverse, interesting, and thriving urban forest. Campus faculty and administrators took great pride in the landscape, evinced by publication of an informational booklet about the campus' trees and shrubs. The 1968 publication of *The University Garden* provided visitors with guided walking tours of the campus landscape.

Much has changed in the last 35 years — the needs of a growing campus have resulted in significant changes to the landscape. But even as these changes are undertaken, trees can and should play a vital role in campus sustainability, enhancing both the social and natural environment. The future of the campus forest will depend on the choice of trees to be removed, and the characteristics of replacement plantings. Maintenance practices such as pruning and watering must also be considered in charting the future.

This report is divided into three sections. We first present an assessment of the resources that make up the campus forest. We then discuss the challenges to the health and longevity of trees on the campus, from construction-related impacts and from landscape maintenance practices. The final section provides conclusions and recommendations to protect the existing campus forest and enhance it in the future, drawing upon comparisons with programs implemented at other major universities.

2.0 Resources Assessment

The Resources Assessment includes a survey of important tree resources, an illustration of the economic value of trees, using specimens on campus as examples, and a description of the trends in the status of these resources.

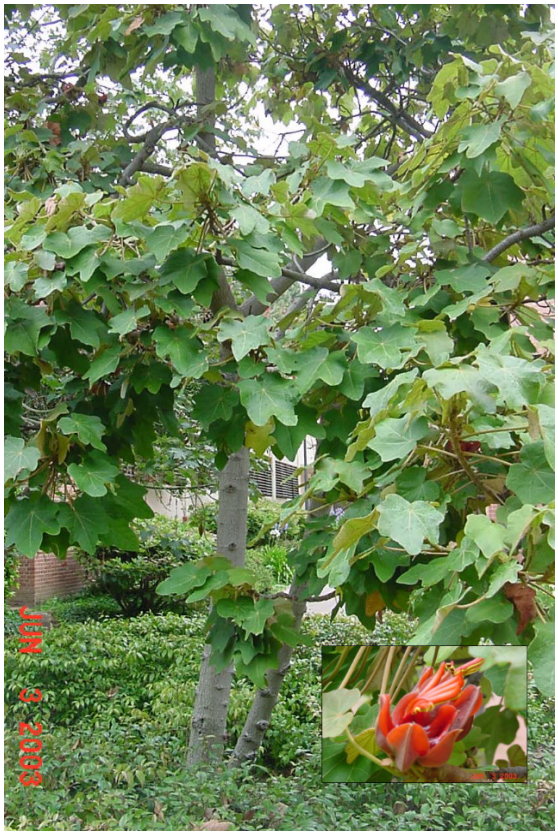
2.1 Important Tree Resources

We have divided this section into the following categories: extraordinary trees, special groups of trees, and high natural resource value trees. All photographs included in the text below were taken on UCLA by the authors.

2.1.1 Extraordinary Trees

Many trees on the UCLA campus are noteworthy and well known, even outside of the university. They also have been a source of pride for the campus (Pixley 1968-69). This section illustrates a small sample of the truly exceptional trees that make the UCLA urban forest a fascinating and valuable community resource.

The campus houses a wide array of trees and plants from all over the world, due in great part to the passionate and dedicated efforts of the late Dr. Mildred Mathias. Many of these trees are very rare in the California landscape. Other trees represent the finest known individuals of their species in southern California. Some trees planted more commonly in the Los Angeles area are represented by a particularly remarkable specimen on the UCLA campus, allowing local residents to imagine the potential of trees in their own home gardens. We (JCS, CC) identified and photographed nine extraordinary specimen trees for inclusion in this report. There are many others worthy of mention as well on the campus.



Monkey hand tree
(*Chiranthodendron pentadactylon*)
Extremely rare in the landscape, this tree has a large and unusual flower that resembles a red, sinister hand. The tree had religious significance in the Aztec culture of its native Mexico.
Location: West side of Schoenberg Hall

Bald cypress
(*Taxodium distichum*)
Native to swamps of the southeastern United States, this deciduous conifer is not commonly seen in the southern California landscape. This picturesque planting includes four trees, softening the sharp corners of Moore Hall.
Location: Southeast side of Moore Hall

Sausage tree (*Kigelia pinnata*)
Sausage trees are rare in the landscape, and the specimens on the UCLA campus appear to be in better condition than most of the other few known specimens in southern California. The tree has large fruits, resembling sausages or large russet potatoes, which hang from five-foot-long stems.
Location: South side of Moore Hall

Bottle trees ("Little Kurrajong") (*Brachychiton bidwillii*)
Although close relatives of this tree are commonly planted throughout southern California, this particular species is seldom seen. This planting, adjacent to ongoing construction, contains three trees. They are showing signs of crown dieback. This may be attributed to poor cultural practices, including grass planted against trunks, water from sprinklers hitting trunks, and soil compaction. The nearby construction activities will not help these trees to survive.
Location: East side of Boelter Hall

Coral trees
(*Erythrina* sp.*)*
These three coral trees in large planters are particularly lovely specimens. Erythrina, the official tree of Los Angeles, is well represented on the UCLA campus, contributing showy red flowers to the color palette of the landscape.
Location: West side of the Neuropsychiatric Institute

Italian stone pine
(*Pinus pinea*)
Although this tree is not rare in the landscape, this particular specimen is extraordinary. The tree is huge, gorgeous, and along with its partner on the south side of the stairs, defines the space atop Janss Steps in grand style.
Location: North side of the top of Janss Steps

Spiked cabbage tree
(*Cussonia spicata*)
This rare and unusual evergreen tree, native to South Africa, stands in the midst of ongoing construction.
Location: North of Life Sciences Building

Rustyleaf fig
(Ficus rubiginosa)
Several impressive specimens of the rustyleaf fig occur elsewhere on campus, most notably along Dickson Court. The particular tree in the photo is a lovely and large specimen, which defines the entrance to the Math Sciences Building as a focal point and a meeting place.
Location: North of Math Sciences Building

Manna gum
(Eucalyptus viminalis)
Long ribbons of loose bark, characteristic of the species, hang from the trunks of this stately and beautiful specimen.
Location: Northwest corner of Murphy Hall

2.1.2 Significant Groups of Trees

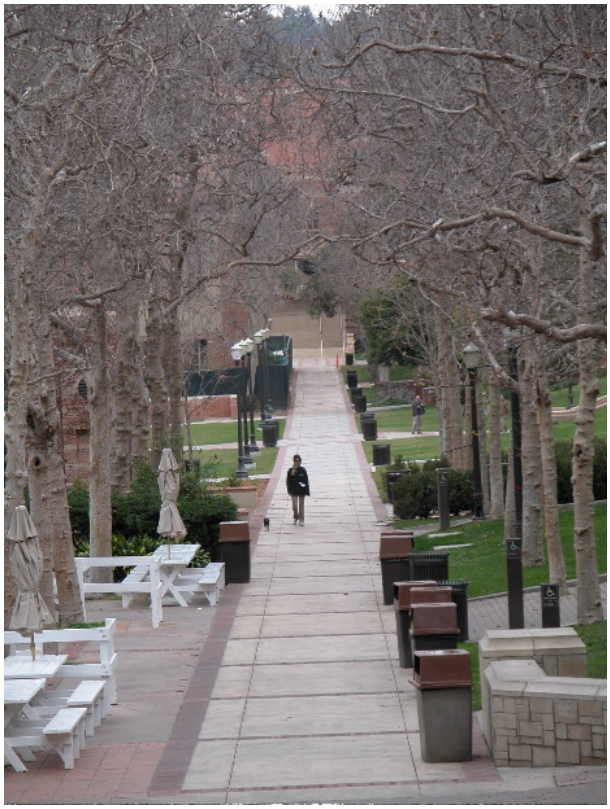
Groups of trees characterize distinct areas of campus and play important roles in the landscape. Trees lining thoroughfares and corridors guide pedestrians and vehicles while providing visual interest and shade. Groves planted in high-use common areas contribute to comfortable, beautiful, and easily identified meeting places. Informal plantings, sometimes resembling natural woodlands or containing remnants of native habitat, define peaceful spaces

separate from the bustle of campus. Many of these spaces reflect the landscape philosophy of Ralph Cornell, who in 1958 wrote:

> With open spaces within which to work it then would be possible to replace some of the trees that have fallen before the inevitable physical expansion of the plant. It would be possible to provide tree masses, shade and broken sunlight, the color of flowering plants, the living things that contribute so realistically to the 'refreshment of the spirit of man' (University of California, Los Angeles, Master Plan Landscape Philosophy, February 24, 1958).

We have attempted to identify those groups of trees that contribute to the special landscape at UCLA. These groups include formal plantings, informal plantings that contribute to a built environment suitable for reflection, study, or social gathering, and, informal sites that are or resemble natural areas (including native and historical remnants). Examples of campus areas that fall into these categories are illustrated below.

2.1.2.1 Formal Plantings



A line of trees casually referred to as "Sycamore Alley" links the walkway between Kerckhoff Hall and the Anderson School. (We observed construction at the northern end of this area at the Glorya Kaufman Hall renovation, without adequate tree protection.)
Location: East side of Glorya Kaufman Hall, south to the Student Activities Center (formerly Men's Gym)

Eucalyptus trees on the walkway to Ackerman Union have been replaced with native coast live oak trees (*Quercus agrifolia*). As these trees mature they will form an entrance allée to Westwood Plaza.
Location: Between Ackerman Union and James E. West Alumni Center

Two parallel rows of rustyleaf fig trees line either side of this well-known entrance to the UCLA campus. (Several of these trees appear to be in poor condition.)
Location: Between Murphy Hall and the School of Law

This busy corridor at the northern edge of the Franklin D. Murphy Sculpture Garden is lined with three rows of picturesque coral trees.
Location: South of Macgowan Hall

2.1.2.2 Informal Plantings

The pathways and open spaces of the Franklin D. Murphy Sculpture Garden, dotted with jacaranda (*Jacaranda acutifolia*), sycamore (*Platanus racemosa*), and eucalyptus (*Eucalyptus* spp.), encourage pedestrians to meander and pause amid art and nature. Along the eastern edge of the garden, large pine trees shade seating areas outside the Public Policy Building.
Location: Franklin D. Murphy Sculpture Garden

The Mildred E. Mathias Botanical Garden is the last remnant of the arroyo that ran through the heart of campus prior to development, making this living laboratory an even greater resource to the campus and local communities. A wealth of rare and exotic plants can be seen along walking paths throughout the garden.
Location: Mildred E. Mathias Botanical Garden

2.1.2.3 Informal Sites That Are or Resemble Natural Areas

The oak woodland tucked into the hillside south of Sunset Boulevard represents an important vegetation type native to southern California. Trees in this grove predate the campus and are part of the natural vegetation of Stone Canyon.
Location: North and west of University Residence

Coast redwoods (*Sequoia sempervirens*), oaks, and sycamores create a streamside forest along Stone Canyon Creek.
Location: Around Corinne A. Seeds University Elementary School

The northwest corner of campus was described in a 1996 news article as "the last wild space in Westwood" (Gould 1996). This area supports an oak woodland and rare coastal sage scrub habitat (Scow 1995). This site is used regularly for teaching about native California ecosystems. Trees planted in the days of the UCLA Department of Ornamental Horticulture also survive in this area. Young oaks are recruiting naturally from acorns, increasing the extent of the oak woodland.
Location: Between Lot 11 and Veteran Avenue

This area, part of the campus' landscaped buffer, is heavily wooded with coast live oaks, Canary Island pines (*Pinus cananariensis*), and eucalyptus trees, and gives the impression of a forest.
Location: North of Easton Softball Stadium

Large eucalyptus trees were planted throughout the Ralph D. Cornell Grove, a memorial to the designer of much of the campus landscape from 1937 to 1972.
Location: South of University Residence

The UCLA Long Range Development Plan recognizes most of these significant groupings of trees and protects them from development by designating them as "preserves." One notable exception is the oak woodland and coastal sage scrub community west and north of Hitch

Residential Suites, between Lot 11 and Veteran Avenue. While no development is currently contemplated for the hillside, expansion of the nearby Child Care Center is planned.

2.1.3 High Wildlife Value Trees and Groupings

Trees in the landscape contribute to the support of wildlife. Wildlife values depend on the species of tree, its growth form, and the surrounding plantings. Studies of urban areas reveal a strong relationship between bird diversity and the number and diversity of trees, and the structural complexity of the habitats formed by trees, shrubs, and other plantings. Trees are more valuable to wildlife if they have a complex understory of shrubs, and if they are allowed to grow without excessive trimming. Larger groupings of trees with fewer disturbances from humans are more valuable as wildlife habitats than are single trees with no understory planted in high-traffic areas. Some trees and shrubs are valuable wildlife resources because they produce edible fruits or harbor insects that are preferred food sources.

The most valuable groups of trees and shrubs for wildlife include: the groves surrounding the University Residence, the riparian-associated trees of Stone Canyon around the Corinne A. Seeds University Elementary School, the Mildred E. Mathias Botanical Garden, the oak woodland and coastal sage scrub community between Lot 11 and Veteran Avenue, and the larger groupings of trees around the landscaped buffer of the campus, especially at the northwest corner. Each of these provides sufficient area to be utilized by a diversity of migratory birds and other wildlife. Many of these sites are surveyed as part of the annual Christmas Bird Count conducted by the Los Angeles Audubon Society.

The coastal sage scrub and oak woodland habitats in the northwest portion of campus have been used extensively for research and education over the life of the campus. This area is documented to support over 30 native bird species, including oak titmouse, bushtit, California quail, spotted towhee, California towhee, Cooper's hawk, red-tailed hawk, northern flicker, orange-crowned warbler, and others (Longcore 1997). Furthermore, it is regularly frequented by mule deer (Longcore, pers. obs.).

Some tree species provide significant wildlife resources, both within groupings and as individual landscape plantings. These include California sycamore (*Platanus racemosa*), coast live oak (*Quercus agrifolia*), other oaks (*Quercus* spp.), toyon (*Heteromeles arbutifolia*), and pines (*Pinus* spp.). Birds frequent these species to forage on fruits and insects in the foliage. Flocks of cedar waxwings and yellow-rumped warblers descend upon the campus during the late fall to exploit such resources. The ecological values of these tree species are enhanced if a complex shrub understory is planted with them.

2.2 Economic Value of Trees on Campus

There are many methods to establish the value of trees. Some of these are subjective evaluations of worth, while others are accepted as a means of establishing a dollar value for trees. The previous sections identified individual trees and groups of trees that are important resources on campus because of their beauty, rarity, effect on ambiance, or habitat value. Trees can also be assigned a specific monetary value. We illustrate economic valuation below, using two established techniques.

2.2.1 Specimen Value

One way to determine the value of a very large tree is to appraise it using the "trunk formula" method. This technique assigns a dollar value to a tree, based on the assumption that a tree the size of the appraised tree could not be replaced in kind with a readily available specimen of the same size. It relies on extrapolating data from a smaller and more available nursery tree and increasing that value proportionately for size, then *depreciating* the value for factors such as species, location, and condition of the tree.

To illustrate, we (JCS, CC) analyzed three fairly impressive trees on campus and applied the trunk formula method to appraise each tree, based on the 9th edition of the *Guide for Plant Appraisal* (Council of Tree and Landscape Appraisers 2000), and data from *Species Classification and Group Assignment* (Western Chapter International Society of Arboriculture 1992). The trees are a large manna gum near Murphy Hall, an Italian stone pine at the top of Janss Steps, and a rustyleaf fig near the Math Sciences Building. Each of these trees is a significant specimen and is pictured in Section 2.1.1. Their values are shown in Table 1.

Table 1. Specimen value of three extraordinary tree specimens.

Tree number	Species	Common name	Location	Value
1	*Eucalyptus viminalis*	Manna gum	Murphy Hall	$24,300
2	*Ficus rubiginosa*	Rustyleaf fig	Math Sciences Building	$25,800
3	*Pinus pinea*	Italian stone pine	Top of Janss Steps	$37,800

2.2.2 Ecosystem Services Value

Another method of determining the value of trees is to analyze the stream of environmental benefits that trees provide the public. These benefits, which are provided without cost, are known as "ecosystem services" or "nature's services." Trees provide many ecosystem services: removal of carbon dioxide from the air, production of oxygen, provision of shade for people and structures, amelioration of elevated urban temperatures, reduction of nitrogen oxides, sulfur oxides, ozone, carbon monoxide, and particulate matter (all of which have significant adverse health effects), reduction of stormwater, and the promotion of groundwater recharge. These environmental benefits, while "free," do have economic values. Urban forest researchers have measured ecosystem services from trees and calculated the cost of replacing the beneficial services that the trees provide. Thus, on a tree-by-tree basis, or in patches, we can calculate the dollar value of the environmental benefits that accrue to the campus from its trees in the form of cleaner air, cleaner water, and lower energy bills.

To provide relevant examples of trees on campus and the value of their ecosystem services, we have examined two prominent groups of trees and applied the technique for benefit analysis developed by The Center for Urban Forest Research (McPherson et al. 2000) for use in southern California coastal communities (Table 2).

Table 2. Annual economic benefits from two tree types characteristic of the UCLA campus.

Size tree	UCLA example	Annual benefits year 40	Annual costs year 40	Net benefit year 40	40 year average net benefit	Photograph
Medium	Jacaranda	$57.61	$21.34	$36	$25	
Large	Eucalyptus	$128.48	$33.70	$95	$65	

The annual benefit from the ten jacaranda trees in the Franklin D. Murphy Sculpture Garden, 40 years after their initial planting,[1] would be approximately $360. There are approximately 90 mature blue gum eucalyptus (*Eucalyptus globulus*) trees along Sunset Boulevard north of the athletic fields, and the annual benefit from this group of trees currently would be about $8,550 (McPherson et al. 2000).

Assuming an approximately equal number of medium- and large-sized trees on the campus, its 15,000 trees provide on the order of $675,000 in annual net benefits.

2.3 Trends in Number, Age, and Diversity of Trees

As a resource, the campus forest is dynamic. To maintain its value, it must be cared for and renewed over time. To put this dynamic nature in context, we discuss the general trends in the number and age of trees on campus. When mature trees are removed and replaced with young trees, tree number remains the same but valuable forest resources may be lost. Most trees are lost as a direct result of construction activities, but we also review an instance of large-scale tree removal not directly associated with construction, and attempt to identify the underlying causes. Finally, we review the issue of tree diversity — the inclusion of many different kinds of trees in the landscape.

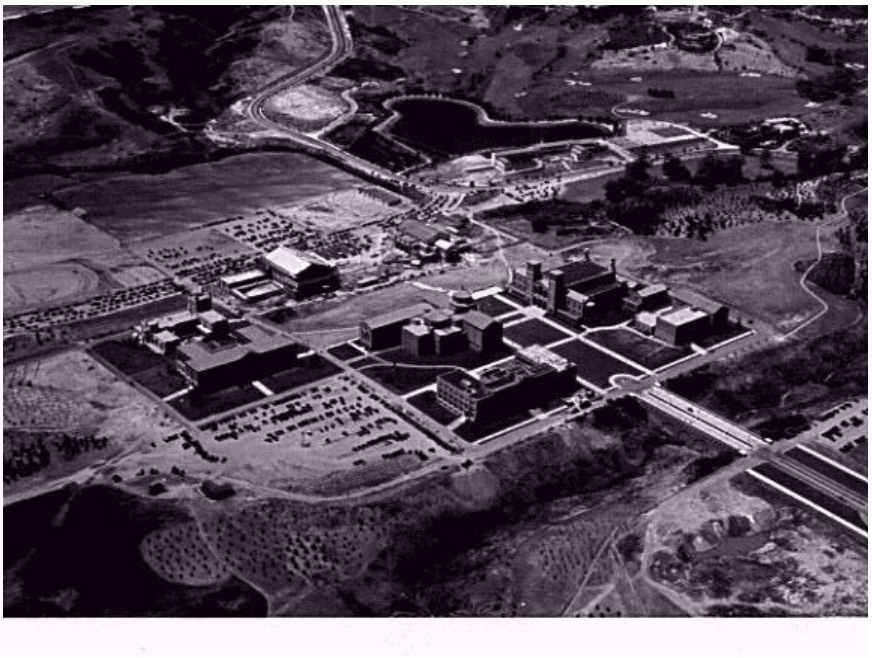
2.3.1 Historical Trends in Number and Age of Trees

The UCLA campus forest has undergone many changes over time. These are best seen in a sequence of aerial photographs taken from the time the campus was founded through the

[1] These trees are probably less than 40 years old, whereas the eucalyptus trees are older than 40 years.

present. These photographs are reprinted with permission from the Spence Collection, housed at the UCLA Department of Geography Air Photo Archives.

When the UCLA campus was founded, the distribution of trees on the site was limited, as seen in this photograph from 1928. The only native trees present were associated with watercourses. These would include coast live oaks and sycamores in Stone Canyon and Dry Canyon (along Veteran Avenue), and willows in the alluvial plain in the center of campus. The remaining vegetation was grassland and coastal sage scrub. Some of the larger scrub elements such as toyon (*Heteromeles arbutifolia*), Mexican elderberry (*Sambucus mexicana*) and laurel sumac (*Malosma laurina*) approached tree size.

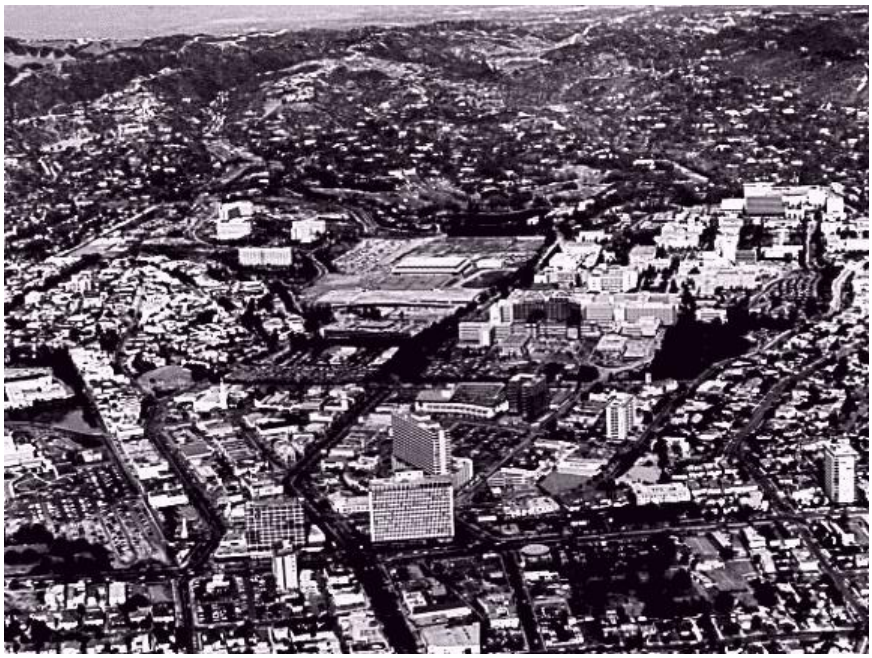


Following the construction of the core campus, many trees were planted in the surrounding areas. Forests of landscape trees were established, visible as regularly spaced plantings in this photograph from 1932. These followed the 1928 landscape plan of J.W. Gregg, which called for 10,000 trees to be planted on the campus. Some native elements remained — dense scrub on the northwest ridge (upper left of photograph) and in the arroyo, and oak woodland along Stone Canyon Creek (right above center).

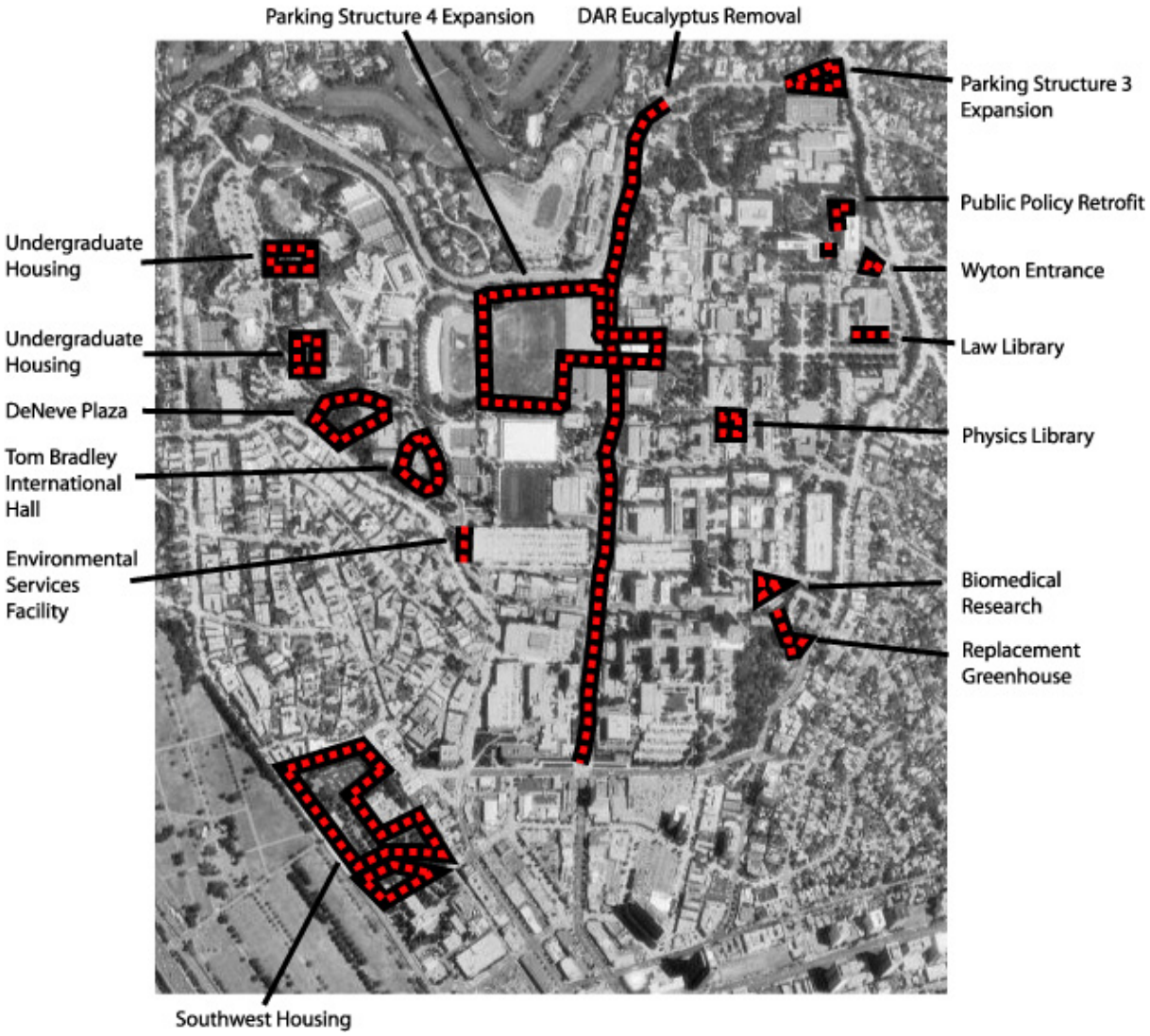
Increasing demand for parking spaces led to the removal of many of the earlier plantings by the time of this photograph in 1951. The arroyo on the east side of campus was filled. The allée of eucalyptus trees donated and planted by the Daughters of the American Revolution (DAR) is visible along Westwood Boulevard in the lower portion of the picture. This ongoing

development led Ralph Cornell to describe the landscape situation by the late 1950s as follows:

> This leaves the University, after it has existed and grown for almost thirty years, in the rather incongruous predicament of beginning anew a program of tree planting. Buildings are massive. Planting spaces are relatively small. Patterns are fixed within limits of available space. There is little opportunity for groves or tree masses which so delight the human eye and which have such positive value in any landscape treatment (Landscape Philosophy, *op cit*., February 24, 1958).



By 1966, development of the eastern half of the campus was approaching its current footprint. Dormitories were constructed on the western ridge and many trees were planted surrounding the new buildings. The Mildred E. Mathias Botanical Garden (right) and DAR eucalyptus trees (center) are particularly evident in this photograph.



Numerous large- and small-scale tree removals have been undertaken on campus in the last decade (Table 3). The total number of trees removed or relocated since 1995[2] approaches 10% of the total number of trees on campus. In some instances trees were relocated, and in all instances new young trees were planted as replacements. Most of these removals were associated with construction projects and are depicted in the figure above.

[2] The year 1995 is chosen as a the starting point for this analysis of "recent" tree removals because this is the first year for which the authors (TL, CR) have on file much of the environmental documentation prepared by UCLA for construction projects.

Table 3. Tree removals and relocations associated with selected campus construction projects, 1995–2003, as reported in campus environmental documents. Not all projects are included, and actual numbers for some projects will have changed during construction.

Project	Removals	Relocations
Southwest Housing Project	>300	~40
Northwest Housing Infill Project	238	15
Northwest Housing (DeNeve Plaza)	231	6
Health Sciences Replacement Structures Total	188	
Hospital	*64*	
Replacement Building 1	*32*	
Replacement Building 2	*1*	
Replacement Building 3	*65*	
CHS seismic	*12*	
Replacement Greenhouse	*3*	
Environmental Services Facility	*11*	
Tom Bradley International Hall	72	23
Parking Structure 3 Expansion	50	31
DAR Eucalyptus Removal	50	
Parking Structure 4 Expansion (IM Field)	35	
Morgan Center Expansion	34	
Science &Technology Research Building	30	
Parking Structure 4 Expansion	19	
Men's Gym Renovation and Wooden Center Addition	17	
Westwood Plaza (Strathmore) Office Building	16	
Wooden Center East Addition (Arthur Ashe Student Health & Wellness Center)	14	
Wyton Entrance	13	3
Kerckhoff Renovation	9	
Ackerman Union Expansion	8	15
Brain Mapping Facility	5	
Molecular Neuroscience Research Center (Gonda (Goldschmied) Neuroscience Genetics Research Center)	4	
Law Library Addition		8
Total	**>1,400**	**~140**

Occasionally, trees are removed for safety reasons not associated with construction projects. Usually these are single trees but on occasion many trees are removed at once. We analyze here an instance of a large-scale tree removal for any lessons it might hold to avoid the need for similar actions in the future.

In late summer 2001, the DAR eucalyptus trees were removed from Westwood Boulevard and along Sunset Boulevard. These trees were removed because of serious safety concerns discovered during a focused risk assessment. To prevent such an unfortunate situation, it is necessary to identify and understand the events that led to unsafe conditions in so many large trees, ultimately leading to their removal.

Most of the DAR trees were planted in the 1930s, and so were large mature trees when removed. Two consulting arborists contracted by UCLA to examine the trees' safety determined that the trees had root and root crown problems that could not be mitigated, and that the trees could be at risk of whole tree failure. The primary concern was that roots had been cut, and evidence of decay was found both in the root crown area and in the roots. Obviously such huge trees need healthy and strong root systems to hold them erect in storm conditions. Compounding the risk, the trees all existed in locations where any tree failure could cause significant property damage, injury, or loss of life.

The history leading to these unfortunate conditions cannot be recounted with certainty, but it is likely that the trees declined over several years as a result of the progressive development of the campus and its roadways without adequate regard for the protection of the trees. The following conditions were all noted during investigation of these trees prior to their removal. Some or all of them contributed to the removal of each tree in question.

- Soil levels elevated above original or natural grade.
- Severing of large roots close to trunks to accommodate curbs and sidewalks.
- Extensive paving added in tree root zones.
- Grass and other vegetative ground covers planted against tree trunks.
- Sprinklers placed where trunks would be wetted.
- Incompatible choices of landscape plants beneath trees.
- Excessive irrigation.
- Excessive pruning.

The removal of the DAR trees was not necessitated by campus growth per se. Rather, poor planning and a failure to protect trees in a changing environment led to their demise. Future such removals can be avoided if UCLA implements appropriate tree preservation guidelines to be incorporated into construction, landscape design, and maintenance decisions.

2.3.2 Trends in Tree Diversity

For a considerable period of time, the diversity of trees on the UCLA campus was influenced by the faculty. Rare plants were brought back to campus and planted, both in the Botanical Garden and elsewhere on campus. Professor Mildred Mathias, for whom the Botanical Garden was later named, was especially committed to including interesting and diverse plants in the campus landscape. Because of this faculty involvement, and the judgment and skill of renowned landscape architect Ralph Cornell, UCLA had become a showplace for landscape plants. *The University Garden* was published in 1968 and included four self-guided walking tours of the important landscape plants of the campus. As a proxy measure to discern trends in tree diversity, we (TL) retraced these routes to see what specimens were left after 35 years. Only tree species were considered, although the text describes vines and shrubs as well. Approximately 45% of over 100 significant trees mentioned by name have been removed.

Current landscape plantings do not include rare and unusual species of the sort identified in *The University Garden*. To the contrary, new plantings include many trees that are currently in vogue in urban landscape design, or are already well represented on the campus. Because

usual and rare species are not being planted, the overall trend on campus is to one of decreasing tree diversity.

2.3.3 Trees in Decline

In our (JCS, CC) survey of the campus, we observed many mature trees in decline. While it is beyond the scope of this report to analyze the causes of decline for each tree, we identify representative examples and possible causes. We discuss below several declining trees and groups of trees, which represent a limited sample of those in decline. We regret to note that the number of trees in trouble seems alarmingly high.

Large Italian stone pine on the north side of the top of Janss Steps. This is one of a pair of grand trees at this location. Evidence of decline can be seen by closely examining the photograph. Large portions of the right side of the canopy are slightly off color indicating a probable root or root crown disease. Conditions surrounding this tree are not ideal. There is foliage growing close to the root crown, and this area appears to be irrigated as well. Although these conditions alone may not explain the decline, the landscape practices are questionable around what is probably one of the most significant trees on campus.

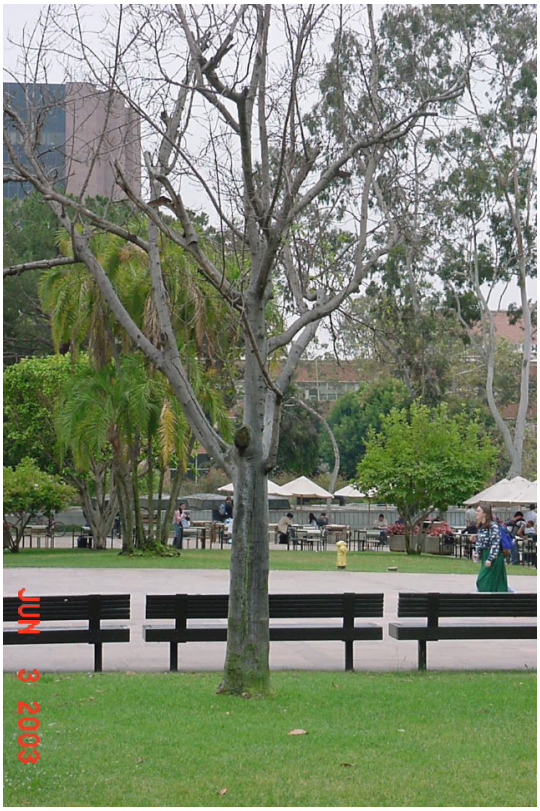
Rustyleaf fig trees in front of the School of Law. A number of mature ficus trees along the roadway between Murphy Hall and the School of Law are exhibiting symptoms of extreme environmental stress. Several of these trees appear to be on the verge of dying. Conditions here are not ideal for such trees. Lawn has been planted up to their trunks, and there are indications of excessive watering as well. Decline of these trees initiated with construction of the law library addition when soil was compacted under the trees.

Ficus trees along Le Conte Avenue at the south end of campus on either side of Westwood Boulevard. The ficus trees here are not doing very well. These were transplanted to make room for the law library addition and suffer from similar problems as do those that remained at the construction site in the example above. Note the irrigation wetting on the trunk in the photograph.

Mindanao gum trees (*Eucalyptus deglupta*) west of Melnitz Hall. Trees in this beautiful grouping of three appear to be in decline as indicated by significant dieback at the tops of their canopies. While this location is not as dramatic as the front of Murphy Hall, it is still an important pedestrian point of entry to campus.

Coast redwoods in courtyard of the School of Law. These trees have been showing symptoms of environmental stress and/or disease for at least 10 years. Although this is not uncommon in the Los Angeles basin, it is often treatable.

Hong Kong orchid trees (*Bauhinia blakeana*) southeast of the Math Sciences Building. These trees are nearly dead. Cultural conditions are a factor, including excessive lawn watering, lawn planted against the trunk, and possibly drainage problems.



Cape chestnut (*Calodendrum capense*) east of the Geology Building. This is a dead tree in a lawn area with grass planted up to the trunk and irrigation wetting the trunk on a regular basis.

Deodar cedar (*Cedrus deodara*) northeast of Moore Hall. This tree is exhibiting dieback in its canopy, probably a symptom of root disease. Obvious problems exist, including lawn planted against the trunk, sprinklers wetting the trunk, and excessive watering for this species of tree.

Maidenhair tree (*Ginkgo biloba*) dying in lawn south of Moore Hall. This tree is also exhibiting dieback in its canopy, probably a symptom of root disease. Again, obvious problems exist, including lawn planted against the trunk, sprinklers wetting the trunk, and probably excessive watering for this species of tree.

Red-flowering gum (*Eucalyptus ficifolia*) near the bottom of Janss Steps. This is another tree exhibiting canopy dieback and very poor cultural conditions.

3.0 Future of the Campus Forest

The future of the UCLA campus forest will depend on recognition that it is an inherently valuable resource, coupled with a commitment to maintain that resource. While there is some room for improvement in maintenance practices, those instances of suboptimal landscape maintenance conditions could be ameliorated fairly easily. A far greater challenge will be to balance the protection of the campus forest with the further development of the campus.

3.1 Campus Construction

The development of new structures on the campus poses the largest threat to the campus forest. The 2002 Long Range Development Plan (LRDP) for the campus reaffirms the intention to construct 1.7 million square feet of new buildings. This construction will result in both direct removal of trees and indirect impacts that harm trees. The most serious impact is direct removal, requiring replacement plantings. Trees in the path of construction may also be relocated, although, as we discuss below, this is not necessarily a desirable course of action. Trees to be maintained in construction zones must also be protected and we document noncompliance with tree protection guidelines below.

3.1.1 Replacement Plantings

Since 1995, over 1,400 trees have been removed (or are planned to be removed in association with already approved projects) to make way for construction. For most projects, mitigation was, or is being, provided in the form of new tree plantings at a 1:1 mitigation ratio. For some projects, a lower mitigation ratio was used, usually 1:2. Recently, however, UCLA agreed to implement a 1:1 tree mitigation ratio for all future projects, with a preference for locating such replacement plantings first on the project site, then, if not feasible, elsewhere on the campus, and finally, if that too is infeasible (i.e., no more room for trees on campus), planting native shrubs in ecologically appropriate locations. This will provide some assurance that the total number of trees on campus will not be further reduced through construction activities until such time as the campus is deemed to be "full," with no more space for trees. Even so, the number of mature trees, and their far greater aesthetic, wildlife, and economic value is reduced by tree removal for construction. Mitigation, even if well planned, is less desirable than avoiding tree removals.

UCLA does not have a publicly available landscape plan that describes the principles that will guide future landscape design. Planting plans are developed in association with capital projects, and indeed part of the mitigation for new buildings or major renovations is that the projects will include a landscape plan and replacement plantings. Occasionally non-building hardscape improvements include relandscaping, both tree removal and tree planting. While various campus entities may have internal documents that guide landscape planting decisions, no current overall landscape plan for the campus has been articulated to the public.

Given that no principles for landscape design have been made public, several concerns arise about the choice and locations of tree plantings. One concern is the maintenance of species diversity and structural complexity over time. As discussed above (Section 2.3.2), many unusual species have been introduced into the campus landscape. Following new construction, unique species may not be replaced in kind, but rather with species that already are commonly

found on campus. Over time, this will result in a significant loss in species diversity. Furthermore, the design of recent campus landscaping is simpler than in the past, with fewer understory elements and decreased structural complexity. UCLA reports on campus mitigation measures have stated a desire to "simplify the landscape" in certain areas of campus. This simplification, both in terms of numbers of species and the structural complexity of plantings, will reduce the attractiveness of the campus to birds, as well as reducing the horticultural significance of the campus forest as a whole.

3.1.2 Transplantation of Mature Trees

One of the strategies that UCLA has used to deal with the conflicts between planned new construction and existing mature trees on campus has been to relocate trees to new locations. In many instances these have been quite large trees. We have examined situations on campus where large trees have been transplanted in this way and do not believe that this is an entirely desirable strategy.

Former UCLA campus landscape architect Ralph Cornell provided this commentary on the tradeoff between installing larger trees (including transplants) and smaller trees (Mellon and Associates 1997):

> The difference between landscaping UCLA and a private garden is that the client is not in a hurry. A university will be there a long time, and you can plan for the future, the way nature plans. The owner of the individual garden wants it today. For that reason many a landscaping job never looks as good as the day it was finished. The owner wants full-grown trees, or at least mature ones, while the best growth always comes from seedlings. Some plants will tolerate more abuse than others, but no tree is ever benefited by having its roots curled up in a can. The smaller the tree the better.

Transplanting mature trees provides an instant landscape, but does not result in healthy trees. It also avoids killing some trees that would otherwise be removed, which reduces the emotional discomfort associated with the removal of mature trees.

Canary Island pines lining Westwood Boulevard on main south campus entry. These trees were moved here to replace the large DAR eucalyptus trees that were removed for safety reasons. They are surviving for now, although not all of them appear to be adapting to the new conditions well.

Chinese flame trees (*Koelreuteria bipinnata*) recently planted along the west side of Melnitz Hall were transplanted from the other side of a walkway to allow for renovation of the Dickson Art Center (renamed Broad Art Center). These trees did not look very healthy when we photographed them in June 2003. This may be a temporary location until construction is finished, but even so, it is a poor location for these trees because it is too constrained.

A ficus tree transplanted near the northeast corner of the Wooden Center appears to declining.

Two of the Italian stone pines transplanted near Ackerman Union are in severe stress and may not survive. These trees provided a replacement for the DAR eucalyptus trees.

Deodar cedars between Charles E. Young Drive North and Sunset Boulevard and just west of the intersection with Westwood Plaza still have support cables on their trunks. We assume that these trees were transplanted several years ago and the cables were never removed. Although the trees look fine now, that may not continue if the cables are not removed soon.

3.1.3 Protection of Trees During Construction

Trees are especially vulnerable to damage when construction is taking place around them. Heavy equipment and materials compact the ground and easily damage foliage, limbs, and trunks. Dust often coats the leaves.

UCLA has long recognized the need to protect trees during construction. As long ago as 1958 UCLA architects and engineers were requested to include a tree protection provision in all contracts. Similar requirements are included in construction contracts to this day.

> All existing trees located within the work limits of this project shall be barricaded with posts and 2 x 4's – 4 feet high to the drip line of the tree, or as directed. In no event shall any debris, construction material, equipment, or any other objects be stored or placed even for a short period of time within the edges of the barricades. Any tree which is so mishandled will be replaced at the contractor's expense with a tree of equal size and quality at the University's discretion. The University maintenance men shall be permitted to irrigate those trees which fall within the contract limits. (Memorandum, Harry Harmon, October 21, 1958).

In our assessment of the trees on campus 45 years later, we observed several instances where trees were receiving inadequate protection (or no protection at all) from construction projects. Of the several construction areas we found on campus, not one included sufficient measures for tree preservation.

The root zone is the most important portion of a tree to protect from construction activity. While it is often impractical to restrict activity in the entire root zone of a tree or group of trees, what little tree protection measures we observed were insufficient because they failed to protect the root zone at all. As a rule, effective tree protection should protect as much of the area below a tree's dripline as possible. Examples of protection measures that did not achieve this minimum include (1) 2" x 4" planks of wood attached in a circle around the tree trunk itself, and (2) chain link fencing or wooden exclosures installed too close to the tree to do much good.

Fencing off a tree's root zone (approximately to the dripline, or farther from the trunk if possible) with durable, largely inaccessible chain link material is the most effective way to prevent construction damage. A simple fence, appropriately placed, can protect a tree from construction materials and equipment, and prevent damage to the tree and its root zone.

When protection is not adequately established prior to construction, several conditions that are potentially fatal to trees can result:

- mechanical damage to roots, trunk, or branches

- soil compaction in the root zone

- burying of root crown with soil, creating an environment susceptible to decay

- change to growing conditions (irrigation removed or installed, grade lowered or elevated, drainage patterns changed, inappropriate landscape plants added)

- arbitrary or unnecessary cutting of roots or branches

Any of the above factors can contribute to or cause the decline of a tree, sometimes creating hazardous conditions, and sometimes requiring removal. With a small degree of planning, all of the above impacts can be avoided or significantly reduced. While it is our understanding that tree protection measures are included in all environmental documentation for UCLA construction projects, our survey of ongoing construction sites reveals a systematic failure to implement those mitigation measures.

3.2 Ongoing Maintenance

Trees in the landscape may require care to be healthy. We (JCS, CC) reviewed tree health across the campus and have identified situations in which better care could be provided. Some landscape maintenance practices may be influenced by limited funding — for instance it is tempting to overprune a tree when funds for pruning are insufficient and pruning must therefore be infrequent. This, however, is a poor allocation of scarce resources.

Improper irrigation is also a problem for trees. At UCLA this is more often an issue of poor design of the sprinkler system rather than over- or under-watering once the system is installed. In addition, vegetation adjacent to tree trunks poses problems for tree health.

3.2.1 Pruning Practices

In our (JCS, CC) professional opinion, many trees on campus show evidence of unnecessary or excessive pruning. Overpruning creates several problems for campus landscape management. Excessive pruning often causes the tree to grow back more quickly than it would have were it not pruned as radically, meaning that the tree needs to be pruned again sooner. Excessive pruning also stresses a tree, resulting in a loss of vigor and possible susceptibility to pathogens and pests (Harris, Clark, and Matheny 2004).

Canary Island pines provide typical examples of unnecessary or excessive pruning on campus. These trees really need little or no pruning in the sense that they are usually safe, attractive, and healthy without pruning. Pruning of the pines on the left of this photograph is excessive and unnecessary.

This photograph shows a good comparison of a healthy, un-pruned Canary Island pine (right of center) next to an over-pruned Canary Island pine (left of center).

An example of a severely over-pruned ficus tree on campus, where improper topping cuts were made.

A once beautiful coral tree, near the Neuropsychiatric Institute, has been pruned excessively and improperly. Although it is true that this type of tree needs frequent pruning to prevent it from breaking, this is an example of excessive pruning. Again, note the topping cuts.

This fern pine (*Podocarpus gracilior*) has been pruned poorly and excessively. Close examination shows several large topping cuts. This is once again a species of tree that would benefit from more frequent but less invasive pruning. This type of periodic severe pruning leads to excessive re-growth, new limbs that are poorly attached, and possible decay and failure at wound sites.

3.2.2 Irrigation Practices

During past years we (JCS) noted drastic overwatering on many occasions and in numerous locations on campus. During our current investigation, we were pleasantly surprised to discover far fewer examples of poor watering practices than had been noted in previous years. The problems that we did find were more often the result of poor design, rather than poor irrigation scheduling.

One of the main problems with irrigation and landscape design is the placement of trees in lawn areas without adequate consideration for the watering needs of the trees. This has been discussed briefly in Section 2.3.3 about tree decline. In short, it is not a good idea to plant a drought-adapted tree species in a lawn area where it will be watered frequently. This becomes more critical if there are any drainage problems on the site. “Excessive” watering is defined for a particular tree in a particular situation — watering may be appropriate for vegetation surrounding a tree, such as a lawn, but not for the tree itself.

We noted one prevalent problem with irrigation practices on campus, the poor location of sprinkler heads in relation to tree trunks. Trees that are likely to become infected by root and root crown diseases such as *Phytophthora* and *Armillaria* are more likely to experience such problems if their trunks and root crowns are wetted by sprinklers (Harris, Clark, and Matheny 2004).

Eucalyptus west of Franz Hall with irrigated root crown and possible root crown disease.

Jacaranda with irrigated root crown and Ganoderma decay conk visible.

Eucalyptus with irrigated root crown and probable root crown disease.

Landscape designs often fail to take sprinkler and tree relationships into account, and sprinkler locations are often specified with no regard to tree trunk locations. White mineral deposits on the trunk of this Canary Island pine indicate that sprinklers are repeatedly wetting trunk.

This problem can be more serious if there is a pruning wound that is being wetted by irrigation.

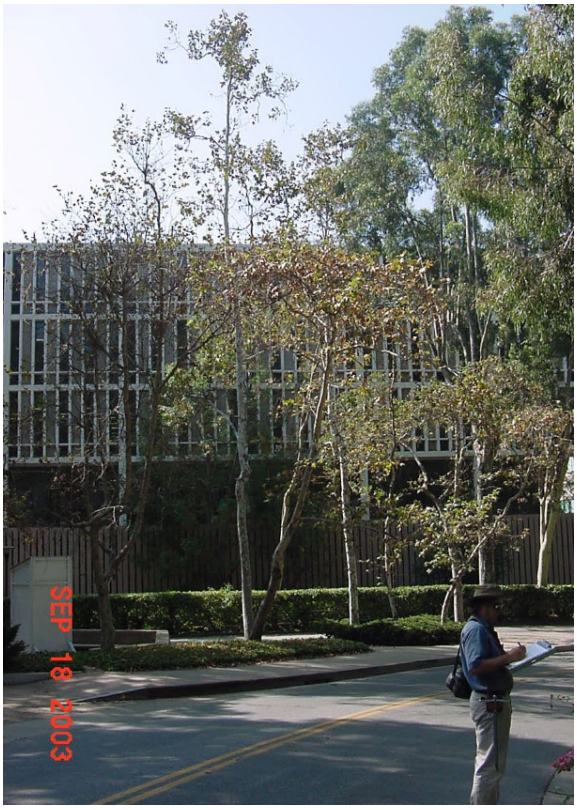
We noticed a few, but not many, areas on campus where watering is obviously excessive. Landscapes where watering is too frequent can become anaerobic and cause roots to become diseased or die.

Dead crape myrtle (*Lagerstroemia indica*) in the lawn at the Faculty Center may be the result of excessive or improper irrigation.

Wheel ruts indicate very wet lawn in Franklin D. Murphy Sculpture Garden.

Soggy lawn indicated by soil probe in area south of the Bruin Bear.

Lack of adequate water is a less common problem at UCLA, but we did see a few instances, such as these drought-stressed sycamore trees north of the Young Research Library.



3.2.3 Vegetation Adjacent to Tree Trunks

It is a good practice to keep the base of trees clear of vegetation. In lawn areas, grass should be kept at least two feet from all tree trunks. In ivy and other such groundcovers, the root crown of a tree should be clearly visible at all times. Ideally, there would be a large-radius "vegetation free" area around all trees, where a two- to four-inch deep layer of mulch would be maintained. The mulch should not be in contact with the tree's trunk. Mulch can be wood chips, bark, or other organic material.

It is desirable for a tree's root crown area to be clear of vegetation. Arborists need to be able to see the root crown of all trees in a landscape to assess their condition and identify any hazards. A visible root crown allows arborists to detect decay, disease, cracks, and other symptoms of trouble before they become unmanageable. For example, this Italian stone pine is surrounded by vegetation, which may hide root crown diseases and defects.

Also important is the need to keep the root crown areas of trees dry. Most trees in a natural setting do not get horizontal precipitation and are not well adapted to having a constantly wet trunk and root crown. As stated previously, it is best that sprinklers not wet tree trunks. Having a clearing around a tree eliminates the need for irrigation close to the trunk. It also allows good air circulation so the root crown area can dry out quickly if it gets wet, reducing the likelihood of disease developing in the root crown area. Anywhere lawn extends to the trunk of a tree, the trunk is likely irrigated. Wet trunks may become diseased or decayed.

Furthermore, when lawn is allowed to grow up to a tree's trunk, routine lawn maintenance activities, such as mowing and edging, may damage the tree.

4.0 Recommendations

Since the first UCLA buildings were constructed in Westwood, the campus has grown to include an urban forest of considerable diversity and significance. Based on our review of this history and current conditions, we offer suggestions to enhance the longevity of this resource for the enjoyment and benefit of the campus community.

Our most important recommendation is that the campus should develop a mechanism, perhaps in the form of a hired liaison, to integrate the landscape with the academic program of the university. Many courses in biology, geography, and the environmental sciences use elements of the campus landscape for teaching and student research. For example, the upper-division Geography course Forest Ecosystems involves a quarter-long project where students must identify all of the tree species within a specified area of campus. It has been our (CR, TL) experience that there is no formal mechanism for campus planners to incorporate such information into decisions affecting the campus landscape.

4.1 Planning and Construction

The following suggestions pertain to the planning and construction that will accompany the 1.7 million square feet of new development proposed by the campus.

- Develop a program to identify significant trees and groupings of trees on the campus that will be afforded a greater degree of protection in future campus planning efforts. The current Long Range Development Plan recognizes several significant landscape areas on campus, but this analysis should be extended to unusual and rare trees. These trees should be preserved, or replaced with specimens of the same species if ever removed. For example, UC Santa Cruz identifies heritage trees (Mellon and Associates 1997). These trees receive special care and although there is a process to petition for removal, this action is discouraged.

- Continue to include native trees in landscape design, as has been done with the recently planted oaks near Ackerman Union and the Student Activities Center and the sycamores along Sunset Boulevard. In a nationwide survey, 51% of college and university campuses planted native trees and plants at locations throughout the campus, and 37% designed plantings explicitly to provide food and shelter for wildlife (McIntosh 2001). UCLA could further enhance its campus forest by incorporating more native shrubs into the planting palette.

- For trees removed for development, provide a payment into a landscape maintenance fund equal to the appraised specimen value of each tree, following the “trunk formula” method.

- Reconsider use of transplantation as a form of mitigation for construction impacts. Relocation of mature trees should be considered only in extraordinary circumstances. This is a difficult recommendation, because, if implemented, it will result in the death of trees that would otherwise be relocated. But, as Ralph Cornell observed, saplings always produce the best specimens, and transplantation is usually the first step in a long decline to death.

- Review implementation of tree protection guidelines during construction. A mechanism to identify and rectify improper tree protection during construction should be pursued vigorously.

- Ensure that a qualified arborist reviews all construction plans for long- and short-term impacts to trees. The gradual creation of hazardous situations through incremental construction could thereby be identified and avoided. UCLA does review impacts to trees in its environmental documentation for large projects, but the implementation of tree protection measures is uneven, and smaller projects that may have significant adverse effects on trees should receive the same degree of scrutiny as do larger projects.

4.2 Maintenance Practices

Surveys of campus showed some maintenance practices that could be improved. We make these suggestions to address those conditions and to indicate other programs that might enhance maintenance activities.

- Review existing landscape maintenance practices and make minor modifications to make them more "tree friendly." Suggested changes include:

    - remove vegetation in at least two foot diameter around tree trunks in formally landscaped areas and mulch this area instead (we note that cross-town rival USC takes this step to protect its trees);

    - specify that irrigation systems be installed so that they do not wet the trunks of trees, and gradually ensure compliance as systems are installed, replaced, or repaired; and

    - revise pruning guidelines (or their enforcement) to eliminate excessive and unnecessary tree pruning, incorporating the ANSI A300 Part 1-2001 Standard Practices guide.

- Initiate a Tree Risk Management program for the campus. In such a program, all campus trees would be surveyed on a regular basis to identify potential problems. In this manner, limited pruning resources can be assigned to potentially dangerous trees. Furthermore, potentially hazardous situations can be identified earlier, and often corrected.

- Create a geospatial inventory of all campus trees in a Geographic Information System database. Such an inventory may exist, but it is not currently available to the public. Many university campuses create detailed maps of trees and landscape features (Rockwell 1996). Such an inventory would facilitate risk management and streamline environmental assessment of proposed development projects.

4.3 Opportunities for Community Involvement

UCLA's landscape is a source of pride for the campus and the surrounding community. The campus environment helps to attract faculty who might otherwise be wary of moving to urban Los Angeles. The urban forest is important to the educational and social environment of the campus. UCLA does not, however, have a tradition of allowing involvement of students, faculty, staff, alumni, or the surrounding community in shaping the natural landscape of campus. Nor is there a mechanism by which interested persons can donate funds to support the maintenance and replenishment of the campus' 15,000 trees and distinctive landscape features.

UC Berkeley provides a model for such an effort. The campus arborist at Berkeley recently established the "Tree Fund" (http://landscape.ced.berkeley.edu/~treefund/), "to raise money to buy and plant trees to replace those lost to disease, and to take more intensive care of the campus's oldest and most cherished trees" (Sanders 2004). This fund is advertised to both current campus users and alumni. No similar opportunities to donate to the UCLA campus are promoted by the campus or the Alumni Association.

Many other universities provide the opportunity for donors to direct money to campus landscaping. Nearly all trees planted at Tufts University result from donations (Barry 2003). The University of Delaware has a special fund to receive donations to care for its large elm trees and contribute to campus landscaping (University of Delaware Office of Public Relations 1996). Many universities complete major landscaping tasks supported entirely by private donations (Cohen and Albright 2002; McPherson 2001). Such donations are often available only for landscaping, and do not detract from other campus priority. We believe that UCLA could enhance the resources available to renew and maintain the campus forest by inviting greater participation from faculty, students, alumni, and the surrounding community.

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