UCSD Urban Forest Management Plan

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Urban Forest Management Plan

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REGIONAL MAP OF UCSD

**UCSD's Designation as Tree Campus USA University, November, 2008:
L-R: AVC Russ Thackston, Assistant Director Chuck Morgan, VC Steve Relyea, Chancellor Marye Anne Fox, Rhonda Glasscock (Toyota Representative) & Woody Nelson (VP, National Arbor Day Foundation).**

VISION STATEMENT

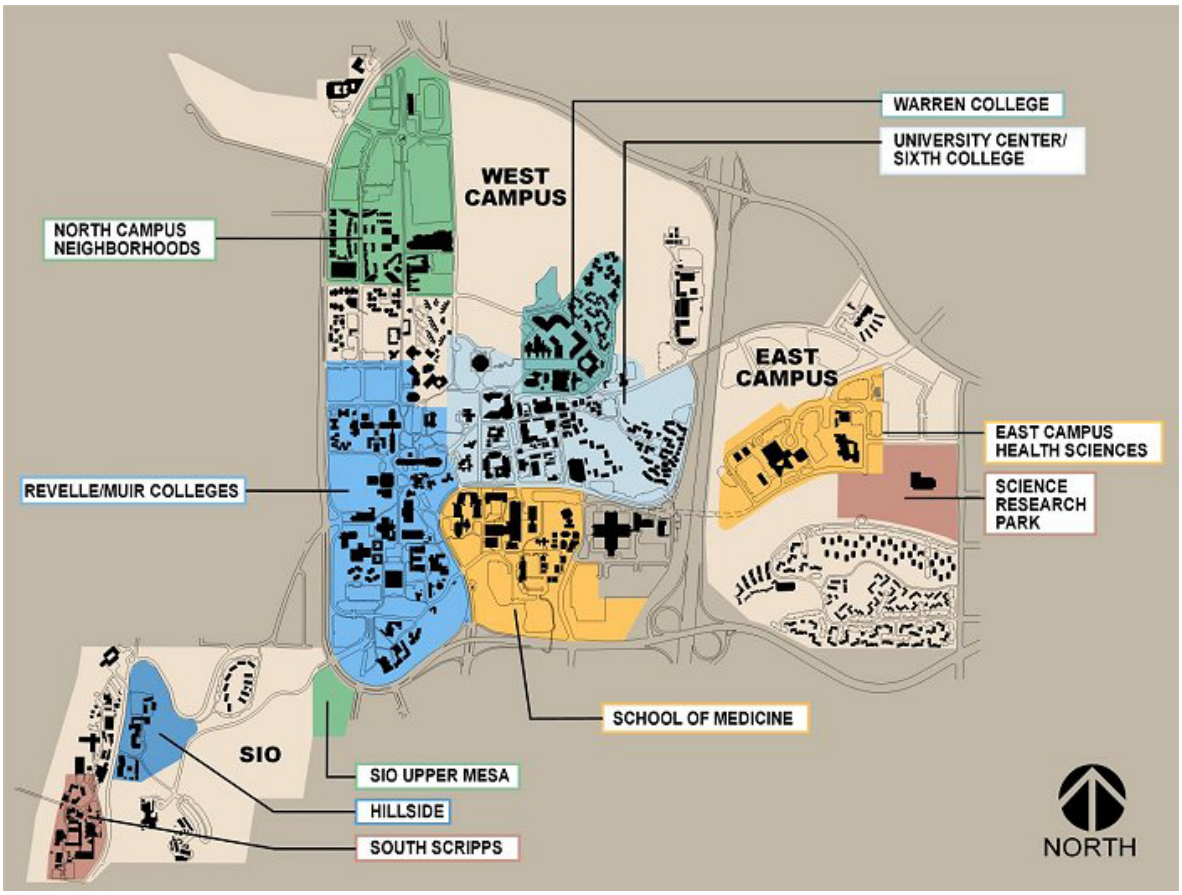
**Provide for
safety of life and property.
Create
a sense of environmental stewardship
in the UCSD Campus community
for its urban forest.**

MISSION STATEMENT

**Enhance the quality of life
of the UCSD Campus community
while promoting safety,
sustaining aesthetics,
and providing a living laboratory
for research, education, and recreation
through responsible urban forest stewardship.**

**2009 Earth Week Celebrations at UCSD:
Students learning proper tree planting method**

UCSD NEIGHBORHOOD MAP



1. Executive Summary.

Urban Forestry has been defined as "…the sustained planning, planting, protection, maintenance, and care of trees, forests, greenspace and related resources in and around cities and communities for economic, environmental, social, and public health benefits for people. The definition includes retaining trees and forest cover as urban populations expand into surrounding rural areas and restoring critical parts of the urban environment after construction. Expansion at the urban/rural interface raises environmental and public health and safety concerns as well as opportunities to create educational and environmental links between urban people and nature. In addition, urban and community forestry includes the development of citizen involvement and support for investments in long-term on-going tree planting, protection, and care programs." (Urban Forestry in North America: Towards a Global Ecosystem Perspective. pp 4-8. Deneke, F. 1993).

The University of California, San Diego (UCSD) has an estimated 250,000 trees on undeveloped parcels of its 1,200-acre coastal woodland. Most of the trees (86 genera, made up of 137 species) are Eucalyptus. This college urban forest shares with others many factors that prevent most urban trees from reaching their genetic potential. Inadequate growing space above and below ground, contaminated and compacted soils, physical damage by construction and landscape maintenance activities, and damage occasioned by vandals and errant motorists all contribute to the inherently difficult environment that grudgingly supports urban trees.

UCSD's arterial Gilman Drive, bordered with trees

2. Introduction.

2.1. Historical Overview.

The institution that became UCSD was first conceived by the University of California in the late 1950s during the post-war science boom. It was to be a graduate and research Institute of Technology and Engineering, providing instruction and research in mathematics, physics, chemistry, the earth and biological sciences, and engineering. These original plans were soon expanded into plans for a more general campus under the leadership of Roger Revelle, then Scripps Institution of Oceanography (SIO) director. The first faculty appointment was made in July 1957, and two years later, the UC Regents approved the University of California, La Jolla.

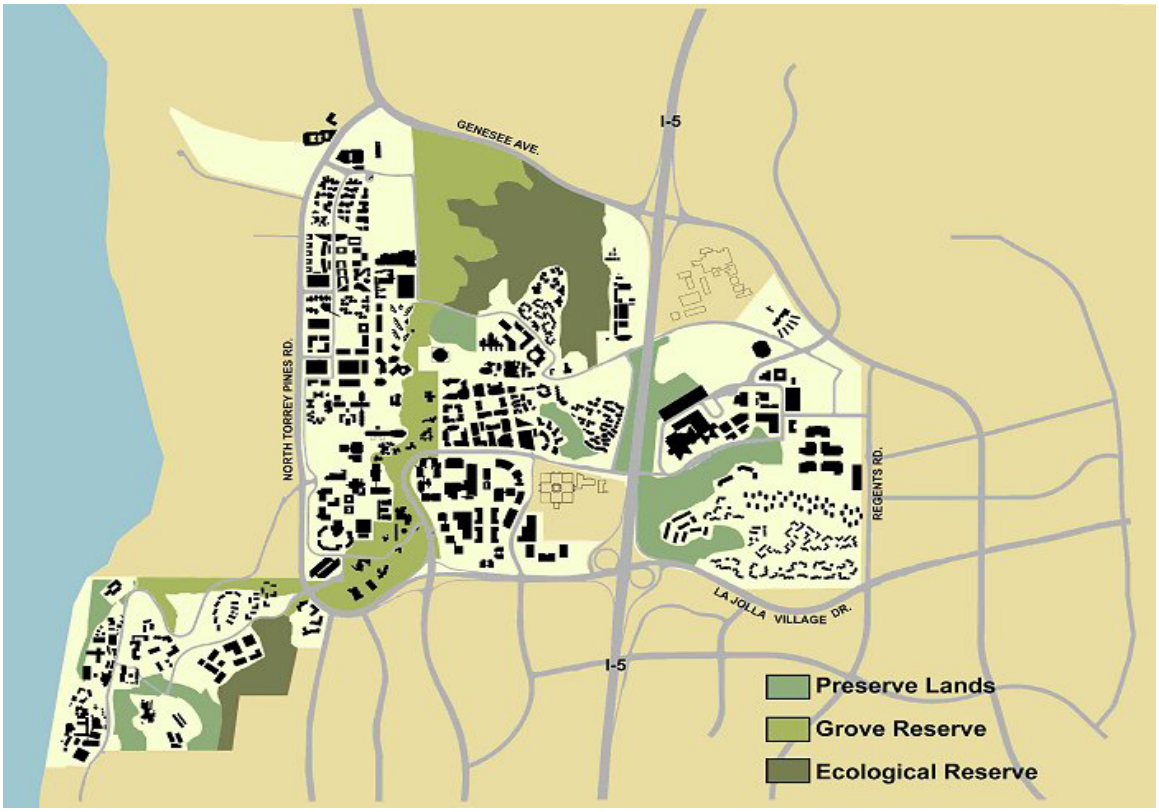
In 1960, the campus was renamed the University of California, San Diego, and its first graduate students were enrolled. UCSD admitted its first undergraduate students in 1964.

Aerial view of UCSD's main campus and La Jolla beach

The 1,200-acre UCSD campus is located in La Jolla in northern San Diego County on a dramatic mesa above the Pacific Ocean. It contains natural chaparral-filled canyons, eucalyptus groves, urban plazas, and green lawns. The campus architecture ranges from California cottages, World War II barracks, and structures from the fifties and sixties to more recent buildings influenced by postmodern architecture. Since its establishment in 1960, UCSD has emerged as one of the leading institutions of higher education in the United States. Including the Scripps Institution of Oceanography, the School of Medicine, and the Graduate School of International Relations and Pacific Studies, UCSD now has an enrollment of more than 25,000 graduate and

undergraduate students and is known worldwide for its research strengths in a variety of disciplines.

THE PARK AT UCSD



Located within the University of California, San Diego campus is a large, 112-acre belt of sugar gum *(Eucalyptus cladocalyx)* forest. Originally planted on a tight 8-foot grid for lumber supply in the early 1900's, the grove is a key feature of UCSD's beauty and identity. The Park Grove runs in a ribbon from Genesee Avenue in the north, through the heart of the central campus, to Scripps Institution of Oceanography in the south. Much of the original planting remains as a dense grid of 40 to 70 foot tall sugar gum eucalyptus. Irrigation systems have been installed in portions of the grove. Some areas have been replanted with young eucalyptus on 12-foot spacing. Three sections of the grove were identified as permanent overwintering sites for the Monarch butterfly (*Danaus plexippus*), one of the largest Monarch overwintering sites in Southern California. Its preservation is of paramount importance. The grove also promotes other wildlife, including small mammals and birds-of-prey. Artwork, part of the Stuart Collection, has been inspired by and placed within the grove.

"The Stonehenge" –
The Stuart Collection's La Jolla Project, 1984

Many of the grove trees are 45 to 70 years old and in declining health. Because of the planting density, there are too few resources (such as available water, soil nutrients, and sunlight) to sustain the grove in a healthy condition. Competition between trees is intense. With both natural and human pressure, many trees will continue to succumb to insects and disease.

Furthermore, beginning in 1967, the University of California, San Diego (UCSD) has lost an average of 350 trees annually to storms, pest infestation, and diseases. As there has been no major tree planting or forest regeneration thrust, it is safe to assume that the pre-1967 estimate of UCSD's tree population put at 250,000 has dwindled to an estimated 230,000.

2.2. Statement of Purpose.

Nestled along the Pacific Ocean on 1,200 acres of coastal woodland, the University of California, San Diego (UCSD) has a Eucalyptus Grove Reserve that is a physical feature of UCSD's natural setting, a distinguishing component of the campus' identity. Also scattered over the entire college grounds are pockets of other tree species, which comprise screens around facilities and street trees. All considered, UCSD has an ecological heritage - an acquired asset - that is at once a heterogeneous resource base for the sustainable provision of priceless benefits and a vast opportunity for environmental stewardship.

Over the years, UCSD's plans have emphasized the importance of preserving and enhancing the Grove as a visual, educational, recreational, and research amenity. Consequently, the University has designated the Eucalyptus Grove Reserve as an integral element of the UCSD Park to protect the open space amenity in perpetuity. Undeniably, however, large portions of the campus urban forest – especially the Eucalyptus Grove Reserve – are rapidly senescent.

Additionally, there are urban forest management issues that are begging for immediate attention and control. These include infrastructure conflicts, pests, and disease problems. Also, until recently, it was not uncommon to hear of tree removal for less than tenable reasons, by contractors that had not been vetted, on the instruction of some campus community members without prior consultation with the Landscape Services division of the Facilities Management department; scenarios such as this depict extra-departmental cultural practices that are incompatible with acceptable forestry and tree care industry standards.

Essentially, therefore, this Forest Management Plan sets out to provide a framework for the sustainable management and continuing enhancement of UCSD's urban forest resource by instituting and implementing specific cost-effective policies to guide campus tree planting, maintenance, and removal activities. The foregoing keystone program of procuring ecological, social and economic benefits in perpetuity is achievable by means of institutional strengthening, an unrelenting pursuit of optimal tree canopy density, and the active participation of the campus community in the environmentally progressive administration of the urban forest at UCSD. A melding of all these factors is certain to enhance the quality of life of the UCSD Campus community, while promoting safety, supporting aesthetics, providing a living laboratory for research and education, and affording amenities for recreation locally and regionally.

2.3. Synopsis of Benefits from UCSD's Urban Forest.

The USDA's Center for Urban Forest Research sited in the University of California at Davis has discovered that 100 mature trees intercept 210,000 gallons of rainwater per year. This translates to: (a) less storm water runoff and, consequently, less money spent on storm water control, (b) reduced soil erosion and water pollution, and (c) cleaner (forest-soil-filtered) storm water discharges. All the foregoing are of immense importance to UCSD, given its hilly, rugged location, with parts of its holdings on the Pacific Ocean beach actually designated as **Areas of Special Biological Significance** (ASBS).

Furthermore, from the standpoint of human health, the proper management of UCSD's urban forest enormously benefits both the region and the nation with the removal, by its estimated 230,000 trees, of 64,400 tons of carbon dioxide and 1.38 million pounds of pollutants from the atmosphere annually.

Moreover, according to a study conducted by the Human-Environment Laboratory of the University of Illinois at Urbana-Champaign, a tree-filled community, vis-à-vis one that is less forested, records a lower incidence of violence and vandalism, enjoys a safer and more sociable ambience, records lower stress levels in residents as well as affording them speedy recovery from ill-health. Where else could all of these benefits be sought after more keenly than at the University of California, San Diego, where 27,000 students live in campus halls of residence, and at least additional 26,000 people (faculty and staff) work on campus each day?

Economically speaking, judicious forest management which employs the right tree in the right place saves up to 34% of annual air condition costs, makes parking lots 3 degrees Fahrenheit cooler in summer months, prolongs the life of parking lots, makes the interior of parked cars 30 degrees Fahrenheit cooler, and saves 25% of winter heating costs. It is mind-boggling to imagine what these facts would mean to UCSD with its 736 buildings and 93 acres of paved parking lots!

_____

Except where indicated otherwise, the benefits of urban forest trees cited in this section are based on extracts from Temperate Interior West Tree Guide: Benefits, Costs, and Strategic Planting, General Technical Report # PSW-GTR-206 by Kelaine E. Vargas, et al, November 2007, Albany, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station.

2.4. Safeguard of Life and Property at UCSD.

The implementation of this urban forest management plan is expected to resolve and keep in abeyance the many and varied forest management issues that currently afflict UCSD's trees. There is inadequate tree care coupled with the twin problems of disease and pest infestation; there are also problems of improper irrigation, allocation of unsatisfactory tree growing space around facilities, unauthorized tree removal by unqualified people, and insufficient consideration for matters affecting tree resource improvement in land development planning.

As a consequence to the foregoing forest management issues, incidence of tree failure is not uncommon on the campus and this is a serious safety concern to the entire campus community. It is not an overstatement, therefore, to say that proper management of the urban forest at UCSD will reduce the presence of danger to life, reduce the incidence of damage to valuable property, minimize the probability of costly litigation, and prevent the wholesale loss of the myriad benefits accruable to the University from its urban forest.

3. Program Administration.

3.1. Tree Resource Enhancement.

The University of California, San Diego occupies 1,200 acres, with the main campus in La Jolla occupying 1076 acres and other facilities in outlying areas making up the remaining 124 acres. Only an estimated 129 acres (or about 12%) of the main campus land area has some form of forest cover. This falls far short of the 40% canopy density that is desirable for UCSD.

As has been noted in other parts of this document, different species of eucalyptus make up the majority (more than 90%) of the trees at UCSD. There is a great need to begin to diversify tree species in non-grove areas to undermine the problems associated with monocultural ecosystems.

Moreover, it has become a priority to embark on a twofold program of deliberate reforestation and increase in new plantings in order to avoid wholesale loss of trees and its attendant colossal loss of benefits. The imperative of deliberate reforestation stems from the loss of trees that UCSD has sustained over the last 50 years, and which is likely to continue into the foreseeable future on account of previously unabated tree loss factors that have already been mentioned.

2008 ARBOR DAY FOUNDATION/TOYOTA TREE CAMPUS USA CEREMONIES

UC San Diego Recognized for Best Practices in Campus Forestry by Arbor Day Foundation – November, 2008

Chancellor Marye Anne Fox leading the way in campus tree canopy enhancement

UCSD Facilities Management staff planting a tree

A partnership that works: Urban Corps of San Diego County planting a tree with UCSD Students

4. Program Management.

4.1. Actions/Tasks.

The day-to-day management of UCSD's urban forest, including the sustainable planning, coordination/correlation of and approval for tree removal and tree planting, protection, maintenance and care of trees in the university's urban forest for environmental, social, and public health benefits for the campus community, shall remain vested in the Campus Urban Forester. In all cases of catastrophic events involving trees, the Campus Urban Forester and the Tree Crew Superintendent /Supervisor shall be the first responders.

4.2. Forest Conservation Policies.

The following policies and operation plans provide direction for the maintenance and enhancement of the Campus Urban Forest at UCSD.

4.2.1. Tree Inventory.

There is a big question mark hanging over the actual number of trees in UCSD's forest tracts. Based on total land area occupied by the University (the main campus sits on 1076 acres in La Jolla), and the high density of the trees growing thereon, UCSD had an estimated 250,000 trees at inception in 1960. However, pests and disease problems, infrastructure conflicts, damage by storms, and unauthorized removal of trees have all contributed to the shrinkage of the tree population on the campus. Yet, the question remains: how many trees does UCSD really have? Only a tree inventory can satisfactorily address this question.

By its very nature and mode of implementation, a tree inventory spotlights individual trees rather than whole stands. The system is a method of obtaining and organizing information about the number, condition (of health), and distribution of urban trees. Information that is accurate, accessible, and simple is one of the best tools for making planning and management decisions. With tree inventory information, program resources can be allocated appropriately among the various tree management functions, work can be scheduled for maximum efficiency, and financial decision-makers can evaluate various work plan proposals by comparing expected results with projected budgets.

Safety is rightly of a large concern at UCSD, taking cognizance of the large population of faculty, students, staff, and public visitors that

occupy and/or travel through the campus daily; proactive forest management that minimizes risks to life and damage to facilities as well as optimizes benefits is therefore crucial. It is only logical that the first inventory of the trees on UCSD Campus should kick off from the University Center, the hub of all activities on Campus and its part that witnesses the highest volume of pedestrian and vehicular traffic. This is so that forest management issues that have safety components can begin to receive crucial direct attention, as soon as feasible, with the aid of facts and figures generated from tree inventory field operations.

From the commencement of field operations, it is estimated that the tree inventory exercise will take 3 to 5 years to complete, contingent on fund availability.

The following attributes, at the minimum, will be collected during the inventory of street, park and utility trees:

- **Mapping coordinates.** X and Y coordinate locations (latitude and longitude). Each tree and planting site will be located using GIS maps and/or GPS equipment.

- **Facility Vicinity.** The location of each street tree and planting site so that they can easily be identified for future work. Street trees and planting sites will be located using a street name, side of lot, tree number, and facility vicinity information (on street, from street, and to street).

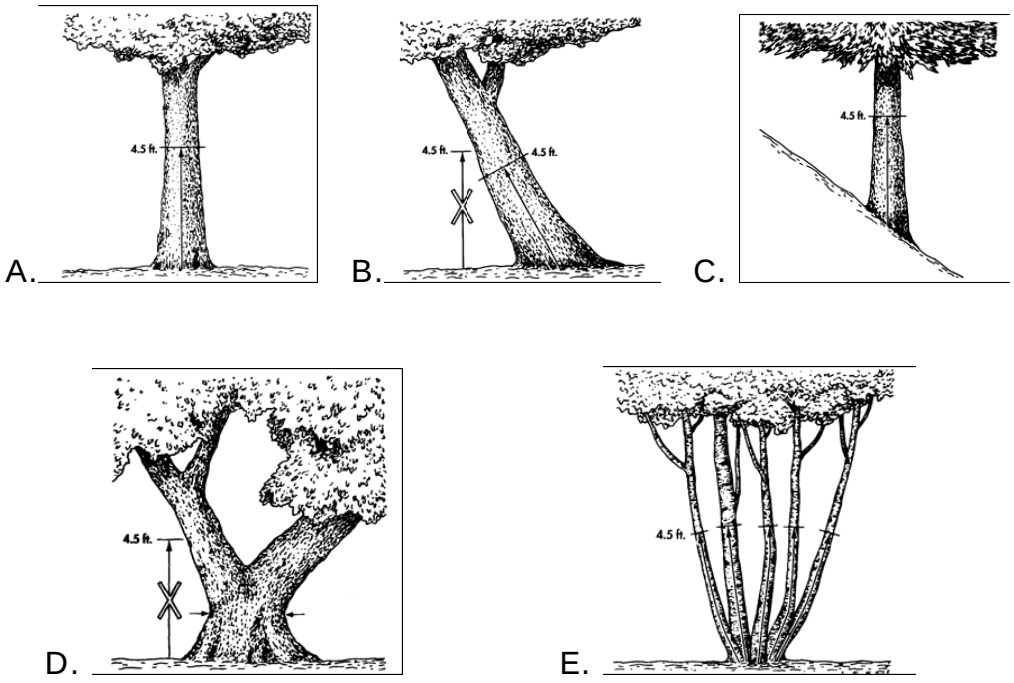
- **Area.** Tree locations will be identified by subdivision or campus code number.

- **Location.** The tree's physical location in relation to public Right of Way, important facilities, and/or public space will be recorded.

- **Species.** Trees will be identified by *genus* and *species,* and by common name.

- **Diameter.** Tree trunk diameter will be recorded. This shall be to the nearest 1 inch.

Illustration of Tree Measurement
(From: Guide for Plant Appraisals, 9th Ed).



a). Straight trunk: Trees with fairly straight, upright trunks should be measured four and a half (4.5) feet above the ground (See illustration A).

b). Trunk on an angle or on a slope: The trunk is measured at right angles to the trunk four and a half (4.5) feet along the center of the trunk axis, so the height is the average of the shortest and the longest sides of the trunk (see Illustrations B and C).

c). Trunk branching lower than four and a half (4.5) feet from the ground: When branching begins less than four and a half (4.5) feet from the ground, measure the smallest circumference below the lowest branch. In this example, an alternative would be to add the sum of the cross-sectional areas of the two stems measured about 12 inches above the crotch. Then average the sum of these two branch areas and the smallest cross-sectional area below the branches. This may give a better estimate of the tree size (see Illustration D).

d). Multi-stemmed tree: To determine the diameter of a multi-trunk tree, measure all the trunks; add the total diameter of the largest trunk to one-half (1/2) the diameter of each additional trunk (see Illustration E). A multi-trunked tree is differentiated from individual trees growing from a common root stock if there is a visible connection between the trunks above ground.

- **Stems.** The number of stems a tree has will be recorded.

- **Observations.** General observations referring to a tree's health, structure, and location will be made.

- **Clearance Requirement.** Trees, which are causing or may cause visibility or clearance difficulties for pedestrians or vehicles, will be identified, as well as those trees blocking clear visibility of signs or traffic signals.

- **Hardscape Damage.** Damage to sidewalks and curbs by tree roots are noted. Notes on potential fixes for the problem are encouraged (redesign options, etc).

- **Overhead Utilities.** The inventory indicates whether overhead conductors or other utilities are present at the tree site that could result in conflicts with the tree.

- **Grow space.** The area within the growing space is categorized as:

  T Tree Lawn
  W Well/Pit
  M Median
  P Parking Lot
  R Raised Planter
  O Open/Unrestricted
  I Island
  U Unmaintained Area

- **Space Size.** The narrowest dimension of the Grow Space, in feet (i.e. 3'x3' cutout, 4' street planting strip, open parkland, etc).

- **Notes.** Additional information regarding disease, insect, mechanical damage, etc can be included in this field.

  Condition. In general, the condition of each tree will be recorded in one of the following categories adapted from the rating system established by the International Society of Arboriculture:

Excellent	100%
Very Good	90%
Good	80%
Fair	60%

Poor	40%
Critical	20%
Dead	0%

- **Required maintenance.** A summary of scheduled maintenance works and time frames.

- **Maintenance history.** Provision shall be made for recording maintenance history of each tree.

Tree Inventory Field Data Sheet

Date: _____ Location: _____

Surveyor: _____ Weather: _____

ID#	Coordinates	Species	DBH	Height	Grow space/ Space size	Condition	Comments	Required Mtce	Hazard

Condition Rating:

4: Excellent (textbook perfect)
3: Good (good but a few defects)
2: Fair (OK, but some defects)
1: Poor (decline, many defects)
0: Dead

Comment Key:

TG: Existing Target
LN: Lean
MT: Multiple Trunks
CD: Co-dominant Trunk
CA: Cavities & Decay
CR: Cracks
HA: Hangers
DB: Dead Branches/Dieback
IN: Included Attachments
PS: Pests
DS: Disease
SP: Sap/Gum Flow
CK: Cankers/Galls
HV: Heaving Soil
RT: Root Problem/Girdling
TR: Wetted Trunk
OTH: Other (please indicate as clearly as possible)

Hazard Key:

NH: No Hazard
LH: Low Hazard
MH: Moderate Hazard
SH: Severe Hazard

NOTE: Data recorded on this form consists of purely subjective delineations based on external indicators only; additional observation and analysis will be required to produce more accurate conclusions and more proper recommendations on management and/or abatement.

4.2.2. Tree Pruning and Tree Removal.

All tree pruning and removal works, in total conformity with ANSI A300 Pruning Standard, shall be handled by Facilities Management's Tree Crew or a tree care industry contractor approved by the Campus Urban Forester. The following service priority gradations will be observed in determining trees to be pruned or removed:

1. **Priority 1 Prune (Trees ≥6" DBH, ≥12' Height).** Trees that require Priority 1 Pruning are recommended for trimming to remove hazardous deadwood, hangers, or broken branches. These trees have broken or hanging limbs, hazardous deadwood, and dead, dying, or diseased limbs or leaders greater than four inches in diameter.
2. **Priority 2 Prune (Trees ≥6" DBH, ≥12' Height).** These trees have dead, dying, diseased, or weakened branches between two and four inches in diameter and are potential safety hazards.
3. **Large Tree Routine Prune (Trees ≥20" DBH, ≥50' Height).** These trees require routine horticultural pruning to correct structural problems or growth patterns, which would eventually obstruct traffic or interfere with utility wires or buildings. Trees in this category are large enough to require bucket truck access or manual climbing.
4. **Small Tree Routine Prune (Trees 2"-6" DBH, ≤12' Height).** These trees require routine horticultural pruning to correct structural problems or growth patterns, which would eventually obstruct traffic or interfere with utility wires or buildings. These trees are small growing, mature trees that can be evaluated and pruned from the ground.
5. **Training Prune (Trees 1"-2" DBH, ≤8' Height).** Young, large-growing trees that are still small must be pruned to correct or eliminate weak, interfering, or objectionable

branches in order to minimize future maintenance requirements. These trees, up to 20 feet in height, can be worked with a pole saw by a person standing on the ground.

6. **Priority 1 Removal.** Trees designated for removal have defects that cannot be cost-effectively or practically treated. The majority of the trees in this category has a large percentage of dead crowns and poses an elevated level of risk for failure. Any hazards that could be seen as potential dangers to persons or property and seen as potential liabilities would be in this category. Large dead and dying trees that are high liability risks are included in this category. These trees are the first ones that should be removed, and they should be removed as soon as possible.

7. **Priority 2 Removal.** Trees that should be removed but do not pose a liability as great as the first priority will be identified here. This category would need attention as soon as "Priority One" trees are removed.

8. **Priority 3 Removal.** Trees that should be removed, but that pose minimal liability to persons or property, will be identified in this category.

9. **Tree Removal Adjacent to Protected Trees.** When trees are removed and adjacent trees must be protected, then the following tree removal practices apply:

   a. ***Tree Removal -*** Removal of trees that extend into the branches or roots of protected trees shall not be attempted by grading or other heavy equipment. A certified arborist or tree worker shall remove the tree carefully in a manner that causes no damage above or below ground to trees that remain.

   b. ***Stump Removal –*** Before commencing stump removal, all underground utilities within the vicinity of the tree stump, allowing one foot for every inch of stump diameter, must be identified and clearly marked out. Proper precautions must be taken to prevent damage to utilities within tree stump removal areas.

   In sidewalk or small planter areas to be replanted with a new tree, the entire stump shall be removed and the planting pit dug to a depth of 30 inches. If dug below 30 inches, compact the backfill to prevent settling. Large surface roots 3 feet from the outside circumference shall be removed, including the spoils and backfilled with

University-approved topsoil to grade, and the area tamped to settle the soil.

Before performing stump extraction, the tree worker or project contractor shall first consider if roots may be entangled with trees that are to remain. If so, these stumps shall have their roots severed before extracting the stump.

When a tree root is to be ground, as opposed to being pulled out (depending on accessibility, topography, proximity to a building/pathway or other considerations), removal shall include the grinding of stump and roots to a minimum depth of 24 inches but expose soil beneath stump to provide drainage.

Regular work order requests are for all tree maintenance works that do not fall under the **Tree Emergencies** category. These types of requests include pruning of trees not posing an immediate hazard to human life or property or for large-scale projects (for example, trees blocking light fixtures, signs, or impeding walkway/road clearance), and require a work order submitted to the Landscape Services division. Work orders will be reviewed and prioritized by the Tree Crew supervisor or the Campus Urban Forester.

Trees that pose immediate danger to life and property have a pride of place over all else; such trees are to be dealt with as soon as feasible after the presence of a qualifying hazardous condition has been ascertained.

4.2.3. Protection of Trees during Construction.

The objective of this section is to reduce the negative effects of construction on trees to a less than significant level. Land development, one of the greatest causes of tree decline and death in urban areas, is a complex process and is even more challenging when trees are involved. The long-term goal of the Urban Forestry unit of UCSD's Landscape Services division is urban forest sustainability. This describes the maintenance of social, recreational, ecological and economic functions of trees and their benefits over time. Stewardship of naturally occurring and planted trees is a central element in forest sustainability. Concerns about tree health and structure, preservation during development and redevelopment, species and site selection, quality of planting stock, standards of performance, and maintenance

practices in our parks, and recycling are integral to a sustainable urban forest.

Tree protection should not begin subsequent to construction. If preservation measures are delayed or ignored until construction begins, the trees may be destined to fail. Because in most cases construction effects to trees cannot be completely eliminated, the goal for our facilities planners and designers is to keep injury to trees to a minimum and allow building projects to proceed at the same time. Successful tree preservation occurs when designers, construction personnel, and project managers are **committed to tree preservation**.

All trees cannot and should not be preserved. Trees that are structurally unstable, in poor health, or unable to survive the effects of construction become a liability to the project and should be removed. A realistic tree preservation program acknowledges that conflicts between trees and infrastructure development may sometimes result in the removal of some trees and also recognizes the detrimental effect to the project and community when trees die after construction is completed.

Successful tree preservation occurs when construction impacts to trees are minimized or avoided altogether. The challenge is to determine when impacts will be too severe for the tree to survive, not only in the short term, but also in the long term. There are no quantitative methods to calculate this critical level. Determining the optimum tree protection zone provides a guideline, although trees sometimes survive and flourish with smaller protection areas.

The following are the 3 guiding principles for tree preservation:

- The acknowledgement that not all trees are in excellent health or have good structural stability.

- Tree preservation cannot be the responsibility of the urban forestry unit staff alone. Each development participant must understand that his or her activities and decisions influence the success of tree preservation efforts. Each development participant is encouraged to read the set of guidelines defining the University's *Tree Pruning and Tree Removal Policy* and *Protection of Trees during Construction Guidelines* (Sections 4.2.2. and 4.2.3. of this Forest Management Plan).

- The ability of an arborist to cure construction injury is very limited, so the focus of preservation efforts is the *prevention* of damage.

Following the above principles will increase the chance for success and reduce the possibility that trees will die. Efforts at preservation must include acknowledgement of the tree and its ecological support system.

Capital improvement projects, in-house construction projects, sport field renovations, and even the addition of a few sprinkler lines affect trees. UCSD considers trees as important assets and requires plotting tree locations on plans for all projects.

4.2.3.1. Planning and Designing for Capital Improvement Projects

All design teams shall be given a set of guidelines defining the University's *Tree Pruning and Tree Removal Policy* and *Protection of Trees during Construction Guidelines* (Sections 4.2.2. and 4.2.3. of the Forest Management Plan), to ensure that trees are accounted for from project initiation forward.

A) Survey before Planning: The survey must accurately plot the trunk locations within the project site. Include construction staging areas and delivery routes.

B) Plan and Design with Knowledge of Trees: The health and structural confirmation of the surveyed trees must be evaluated in order to anticipate how well they will respond to development. The evaluation must describe the character of trees and their suitability for preservation at a level of detail appropriate for the project and phase of planning. An arboricultural or forestry consultant must be obtained for this evaluation.

C) Plan with a Vision: Disturbance of any tree by construction activities may negatively affect its physiological processes, and cause depletion of energy reserves and decline in vigor, often resulting in tree death. Typically this does not manifest until many years after the tree is disturbed. Preservation of mature trees during construction has limitless benefits to the success of a project.

When new trees are planted, consideration should be given to species diversity and appropriateness of location. To prevent destructive clearance pruning in future years, keep in mind the ultimate canopy and root spread.

D) Plan for all Aspects and Entire Duration of Project: Construction projects are multi-level and often require participation of various construction trades and subcontractors. It is important to plan for tree protection with an understanding of construction dynamics. Trees must be protected in the staging area, construction employee parking area, adjacent properties, as well as on the actual construction site.

4.2.3.2. Managing In-House Construction Projects

The in-house Construction team should be given a set of guidelines that define the Facilities Management Department's *Tree Preservation* and *Tree Protection* procedures (Sections 4.2.2. and 4.2.3. of this Forest Management Plan), and to assure that trees are accounted for from project initiation forward.

A) Survey before Planning: For all in-house projects, contact the Urban Forestry unit for an accurate survey of trees on the job site.

B) Plan and Design with Knowledge of Trees: In order to better understand the condition of the affected trees, the Urban Forestry unit will make available the results of the tree evaluation. This evaluation will provide the in-house Construction team with knowledge of the resources and the anticipated construction tolerance of the affected trees.

C) Plan with a Vision: Obtain information about trees and minimize negative impacts on the urban forest. Conduct all projects with tree preservation in mind.

D) Plan for all Aspects and for the Entire Duration of the Project: Trees must be protected in the staging area, construction employee parking area, and during demolition and grading. Arrange with the Urban Forester for trees to be watered and for the soil to be protected from compaction.

4.2.3.3. Pre-Construction Requirements

- Tree Protection and Preservation Plan.

Prior to the commencement of a development project, the Campus Urban Forester must be assured that if any activity of the project is within the dripline of *Protected Trees* (all trees 6" dbh and above), a site specific tree protection plan is prepared. The following six steps shall be incorporated as part of the Tree Protection and Preservation Plan:

A) Site Plan: For all projects, site plans must indicate accurately plotted trunk locations and *the dripline* areas of all trees or group of trees to be preserved within the development area. Additionally, for all *Protected Trees* the plans shall accurately show the trunk diameter, the dripline and clearly identified *tree protection zones.* The type of protective fencing shall be specified and indicated with a bold dashed line.

B) Protective tree fencing for all categories of *Protected Trees*: Fenced enclosures shall be erected around trees to be protected. This will achieve 3 primary goals:

(1) To keep crowns and branching structure clear from contact by equipment, materials, and activities;

(2) To preserve roots and soil condition in an intact and non-compacted state; and

(3) To identify the *Tree Protection Zone* in which no soil disturbance is permitted and activities are restricted, unless otherwise approved by the Campus Urban Forester.

All trees to be preserved shall be protected with physical barriers approved by the University's Urban Forester. Tree barriers shall be erected before demolition, grading, or construction begins and remain until final inspection of the project. There shall be a "Warning" sign prominently displayed on each protective fence. The sign shall be a minimum of 8.5 inches x 11 inches and clearly state the following:

TREE PROTECTION ZONE
This Barrier Shall Not Be Removed.
Warning: Critical Root Zone, No Encroachment.

All work within the *Tree Protection Zone* requires approval of the Campus Urban Forester.

A) Type I Tree Protection Barrier is for trees to be preserved throughout the duration of the project. The fences shall enclose the entire area under the canopy dripline or *Tree Protection Zone,* if specified by the Campus Urban Forester.

If fencing must be located on paving or concrete that will not be demolished, an appropriate grade level concrete base may support the posts.

B) Type II Tree Protection Fence is for trees situated in small planting areas, where only the planting area is enclosed with the required chain link protective fencing. The walkways and traffic areas are left open to the public.

C) Type III Tree Protection Fence is for trees in small tree wells, building site planters or sidewalk planters. Trees shall be wrapped with 2 inches of orange plastic fencing from the ground to the first branch and overlaid with 2-inch thick wooden slats that are bound securely (slats shall not be allowed to dig into the bark). During installation of the plastic fencing, caution shall be used to avoid damaging branches. Major scaffold limbs may also require plastic fencing as directed by the Campus Urban Forester.

No storage of material, topsoil, vehicles, or equipment shall be permitted within the fenced area throughout the entire duration of the construction project.

- Verification of tree protection.

The project contractor or construction supervisor shall verify in writing that all preconstruction tree preservation conditions have been met as follows:

A) Tree fencing installed

B) Erosion control secured

C) Tree pruning completed

D) Soil compaction preventive measures installed

E) Tree maintenance schedule established.

The Project Manager, the Project Inspector, and the Campus Urban Forester must sign this verification.

- Pre-construction meetings.

The Campus Urban Forester shall attend all pre-construction meetings to ensure that everyone fully understands previously reviewed procedures and tree protective measures concerning the project site, staging areas, hauling routes, watering, contacts, etc.

- The Tree Protection Zone.

Each tree to be retained shall have a designated *Tree Protection Zone,* identifying the area sufficiently large enough to protect it and its roots from disturbance. The *Tree Protection Zone* shall be shown on all site plans: Demolition, Grading, Irrigation, Electrical, Landscape, etc. Improvements or activities such as paving, utility and irrigation trenching, including other ancillary activities, shall occur outside the *Tree Protection Zone* unless otherwise specified. The protection fence shall serve as the *Tree Protection Zone.*

A) Activities prohibited within the *Tree Protection Zone* include:

i. Parking vehicles or equipment, storage of building materials, refuse, or excavated soils, or dumping poisonous material on or around trees and roots. Poisonous materials include but are not limited to paint, petroleum products, concrete, stucco mix, dirty water or any material that may be harmful to tree health

ii. The use of tree trunks as backstops, winch supports, anchorages, as temporary power poles, signposts or other similar functions

iii. Cutting of tree roots by utility trenching, foundation digging, placement of curbs and trenches, or other miscellaneous excavations without prior approval of the Campus Urban Forester

iv. Soil disturbance or grade change

v. Drainage or hydrological changes.

B) Activities permitted or required within the *Tree Protective Zone* include:

i. Mulch: During construction, wood chips may be spread within the *Tree Protection Zone* to a two- to four-inch depth, leaving the trunk clear of mulch. This will minimize inadvertent soil compaction and moisture loss. Mulch shall be ≤ 2-inch unpainted, untreated shredded wood or other approved material.

ii. Root Buffer: When areas under the tree canopy cannot be fenced, a temporary buffer is required and shall cover the root zone and remain in place at the specified thickness until the final grading stage. The protective buffer shall consist of shredded wood chips spread over the roots at a minimum of 6-inches in depth (keeping the trunk clear of chips), and layered by ¾-inch quarry gravel to stabilize the 3/4–inch plywood sheets laid on top. Steel plates can also be used.

iii. Irrigation, Aeration, fertilization, mycorrhizae treatments or other beneficial practices that have been specifically approved for use within the *Tree Protection Zone.*

C) Erosion Control:

If a tree is adjacent to or in the immediate proximity to a grade slope of 8% (23 degrees) or more, approved erosion control or silt barriers shall be installed outside the Tree Protection Zone to prevent siltation and/or erosion within the zone.

- Tree Pruning and Removal

Prior to construction, various trees may need to be pruned away from structures or proposed construction activity. ***Construction or contractor personnel shall not attempt pruning.*** Only personnel approved by the Campus Urban Forester can perform pruning operations.

A) Removal of trees adjacent to trees that are to remain requires a great amount of finesse. Only personnel approved by the Campus Urban Forester shall engage in tree removal.

B) Removal of trees that extend into branches or roots of protected trees shall not be attempted by the demolition or construction crew, or by grading or other heavy equipment. Before removing tree stumps, the project manager shall determine if roots are entangled with trees that are to remain. If so, these stumps shall have their roots severed before extracting them.

4.2.4. Activities and Demolition near Trees during Construction.

Soil disturbance or other damaging activities within the Tree Protection Zone is prohibited unless approved by the Campus Urban Forester and mitigation for specific injuries is implemented. **No encroachment within 10 feet of a trunk will be permitted without the prior notification and approval of the University's representative.**

- Soil Compaction

Soil compaction is the largest single factor responsible for the decline of trees on construction sites. The degree of compaction depends on several factors: amount and type of pressure applied, presence and

depth of surface organic litter, soil texture and structure, and soil moisture level.

The greatest increase in soil density occurs during the first few equipment passes over the soil, which underscores the importance of implementing protective measures before the project begins and equipment arrives at the site. To distribute traffic weight, mulch and temporary root buffers can be used. The following techniques can lessen compaction: vertical mulching, soil fracturing, core venting, and radial trenching. Do not compact soil to higher density than needed: to 95% Proctor density (moisture – density) in improved areas for asphalt or concrete pavements, and not to exceed 85% in unimproved open landscape areas that use water jet compaction.

- Grading Limitations within the Tree Protection Zone

Lowering the grade around trees can have an immediate and long-term effect on trees. Typically, most roots are within the top 3 feet of soil, and most of the fine roots active in water and nutrient absorption are in the top 12 inches.

A) Grade changes within the *Tree Protection Zone* are not permitted.

B) Grade changes outside the *Tree Protection Zone* shall not significantly alter drainage.

C) Grade changes under specifically approved circumstances shall not allow more than 6 inches of fill soil or allow more than 4 inches of existing soil to be removed from natural grade, unless mitigated.

D) Grade fills over 6 inches or impervious overlay shall incorporate an approved permanent aeration system, permeable material, or other approved mitigation.

E) Grade cuts exceeding 4 inches shall incorporate retaining walls or an appropriate transition equivalent.

- Trenching, Excavation and Equipment Use

Trenching, excavation or boring within the *Tree Protection Zone* shall be limited to activities approved by the Campus Urban Forester. Explore alternatives for trenching outside the root zone. Avoid exposing roots during hot, dry weather. Backfill trenches as soon as possible with soil and soak with water the same day. Small roots can die in 10 to 15 minutes and large roots may not survive an hour of

exposure. If the trench must be left open all roots must be kept moist by wrapping them in peat moss and burlap.

If trenching is unavoidable, the following distances shall be maintained:

Trunk Diameter (measured at 4½ feet above natural grade)	Distance from both sides of the Trunk	Recommended Tunnel Depth for Utilities
Up to 6 inches	Past dripline	1½ feet
6-9 inches	6 feet	2½ feet
10-14 inches	10 feet	3 feet
15-19 inches	12 feet	3½ feet
Over 19 inches	15 feet.	4 feet

A) Root Severance: No roots measuring 2 inches or greater in diameter shall be cut without the approval of the Campus Urban Forester. Tunneling under roots is the approved alternative. Prior to excavation for foundation/footing/walls, or grading or trenching within the *Tree Protection Zone,* roots shall be severed cleanly one-foot outside the *Tree Protection Zone* to the depth of the planned excavation. When roots must be cut, they shall be cut cleanly with a sharp saw to sound wood and flush with the trench site.

B) Excavation: Any approved excavation, demolition, or extraction of material shall be performed with equipment that is placed outside the *Tree Protection Zone*. Hand digging, hydraulic, or pneumatic excavation are permitted methods for excavation within the *Tree Protection Zone.*

C) Heavy Equipment: Use of backhoes, Ditch Witches, steel tread tractors or other heavy vehicles within the *Tree Protection Zone* is prohibited unless approved by the Campus Urban Forester. If allowed, a protective root buffer is required.

- Tunneling and Directional Drilling

Approved trenching or pipe installation within the *Tree Protection Zone* shall be accomplished by hand, by air-spade, or by mechanically boring a tunnel under the roots with a horizontal directional drill, using hydraulic or pneumatic air excavation technology. In all cases, install the utility pipe immediately, backfill with soil and soak with water within the same day. Tunneling under the root system can greatly reduce both damage to the tree and the cost to repair landscape and other features destroyed in the trenching process. There are times,

such as when working in rocky soils and slopes, when tunneling is not a reasonable alternative.

- Alternative Methods for Hardscape to Prevent Root Cutting

The following remedies should be considered as an alternative to severing tree roots:

A) Grinding a raised walkway or concrete pad

B) Ramping the walkway surface over the roots or lifted slab with pliable paving.

C) Routing the walkway around tree roots

D) Employing permeable paving materials (e.g., decomposed granite), interlocking pavers, or flagstone walkways on sand foundations.

- Using Alternative Base Course Materials

Engineered structural soil mix is an alternative material for hardscape areas near trees. More information can be found at www.amereq.com.

4.2.5. Tree Maintenance during Construction.

Providing adequate maintenance can mitigate stressful changes that occur to a tree's environment during construction. To remain vigorous the tree needs to maintain stored carbohydrates and preserve the effectiveness of its growth regulators. It is recommended that large projects provide:

- Irrigation

Providing supplemental irrigation for trees under water stress may be the single most important treatment needed to reinvigorate them. Irrigation should be designed to wet the soil within the *Tree Protection Zone* to the depth of the root zone and to replace that water once it is depleted. Light, frequent irrigation should be avoided. Create a six-inch berm around trees at the edge of the *Tree Protection Zone* and fill with no more than six inches of mulch. Fill the basin with water. Irrigation should wet the top two to three feet of soil to replicate similar volumes and normal seasonal distribution.

- Soil Compaction Mitigation

To prevent negligent encroachment into the *Tree Protection Zone,* trees to be preserved during construction must have the specified type of protection fences in place at all times. Removal of fences, even temporarily, to allow deliveries or equipment access is not allowed unless approved by the Campus Urban Forester and a root buffer is installed. The root buffer components (mulch, gravel and plywood) must be maintained continually to ensure its effectiveness against soil compaction.

- Dust Control

During periods of extended drought, wind or grading, trunks, limbs and foliage should be sprayed with water at the end of workday to remove accumulated construction-engendered dust.

4.2.6. Damage to Trees.

4.2.6.1. Reporting Injury to Trees

Any damage or injury to trees shall be reported as soon as possible to the Project Manager or/and the Project Inspector, and always to the Campus Urban Forester. The Campus Urban Forester needs to be aware of an injured tree in order to monitor its recovery or progress. Injuries to roots and branches must be repaired immediately.

4.2.6.2. Contractor(s) Subject to Penalties

If a tree designated to remain is removed or irreversibly damaged as determined by the Campus Urban Forester, a contractor will be required to install a replacement tree matching in size, quality and variety, using a Tree Care contractor designated by the Campus Urban Forester. If an acceptable replacement tree is not available, the contractor will be required to pay damages to the University for the value of the damaged tree in accordance with the guidelines set forth below.

S/N	Diameter Class (inches)	Cost/Tree ($)
1	1 - 5	$3,000.00
2	6 - 12	$7,500.00
3	13 - 18	$15,000.00
4	Over 18	Add $1,200.00/caliper inch

A penalty will be assessed for tree limb damage at **$200** (Two Hundred Dollars) per inch of limb diameter for any limb larger than 1½ inches in diameter, measured where the limb should be pruned to make a proper thinning cut.

Fines are doubled when a grove or park tree meant to be retained or protected is damaged or removed without the Campus Urban Forester's prior approval.

Additionally, a liable Contractor shall replace any vegetation (other than trees) that died or sustained injury from the result of the Contractor's negligence to provide adequate required vegetation protection, pruning, or maintenance during the course of construction operations, as evaluated by the University's Representative. Compensation shall be awarded to the University as follows:

1. Contractor shall thoroughly remove damaged vegetation at no cost to the University, and at the direction of the University's Representative.

2. Contractor shall furnish and install five (5) gallon container stock minimum (as applicable) of the same form, species, and in the same quantity as vegetation that was damaged, at the direction of the University's Representative.

The University's Representative shall make the final judgment on whether trees and/or vegetation have been damaged by the Contractor during the execution of the Work, and their decision is final.

Warranty of Replacement Plant Material: Contractor shall warrant that all replacement plant materials shall be healthy and in flourishing condition of active growth at the end of the warranty period of 1 calendar year from the date of final acceptance.

4.2.6.3. Departments Subject to Fines

In the event of damage to above- or below-ground parts of urban forest trees at any time, the Campus Urban Forester shall conduct an investigation to determine the cause of the damage. If it is found that damage was caused due to the error, negligence, or willfulness of a University department, then that University department will be required to pay the same damages imposed on Contractor Subject to Penalties.

4.2.6.4. Employees Subject to Discipline

In the event of damage to above- or below-ground parts of urban forest trees at any time, the Campus Urban Forester shall conduct an investigation to determine the cause of the damage. If it is found that damage was caused due to the error, negligence, or willfulness of a University employee, then that employee will be subject to appropriate disciplinary action.

4.2.7. Tree Planting.

4.2.7.1. Campus Urban Forest Restocking

During the Tree Inventory exercise, vacant planting sites, in addition to other apparent street and grove sites whence numerous trees have been lost, will be identified by nearby facilities. The size of the site is designated as small, medium, or large (indicating the ultimate size that the tree will attain), depending on the growing space available and the presence of overhead utility lines.

As soon as feasible, contingent on availability of funds, a major reforestation thrust will undertake the planting and establishment of 1,000 trees annually. The yearly urban forest restocking program stands apart from such trees as are associated with new facilities. This will definitely, in time, restore the diminishing campus tree canopy density while deliberately increasing UCSD's tree species diversity.

4.2.7.2. Choice of Trees

In all cases of tree planting, the guiding principle shall be to install the right tree, in both form and function, in the right place. **When specifying trees for planting on UCSD campus, consideration shall be given to tree species recommended for Southern California.** All proposed trees shall be in compliance with established UCSD design guidelines.

4.2.7.3. Tree Species Diversity Planting Requirements

The Campus Urban Forester will review plans to ensure species diversity (i.e. to avoid creating monocultures, or areas of plantings made up of only one species of trees). Monocultures are undesirable because if a certain species is prone to a particular disease or is more susceptible to storm damage or temperature extremes, then it is likely the entire stand could die or be destroyed by a single disease or

weather event. Creating planting areas of several species creates a more diverse, and therefore more resilient, urban forest.

Factors to be considered in acceptable and successful tree planting include the long term health of the tree in its location and its compatibility with adjacent uses as well as design considerations.

In consideration of the financial impact realized by the UCSD, it is important that long term maintenance of proposed trees be considered prior to their selection.

Any tree species known to have an aggressive or rampant root system shall not be planted along campus streets to avoid damage to sidewalks, utilities and curbs.

4.2.7.4. Planting distances/spacing requirements

No large or medium tree species shall be planted within any power or utility easements or under overhead utility distribution lines if the average mature height of the tree is greater than the lowest overhead wire.

Tree selection shall take into consideration requirements for future height clearances. As they grow, trees will need to be pruned to provide pedestrian clearance of at least 8 feet over sidewalks, and vehicular clearance of 14 feet over roads.

4.2.7.5. Supply of Tree Planting Stock

Since the first step in avoiding *future* hazard trees is to plant high quality stock, poor stock trees will not be approved for planting in any part of the campus regardless of whether the trees are meant to complete in-house projects or supplied by contractors in association with facility development.

All trees delivered to UCSD for planting shall be inspected and approved by the Campus Urban Forester or his/her representative *before* installation. It is required that contractors or tree suppliers provide a minimum of two working days notice to the Campus Urban Forester for all inspections. For the reason that poor planting stock will end up costing much more money in the long run because of increased maintenance requirement and shorter life span, the University shall not neglect to exercise the right to reject poor quality trees upon delivery. The supplier(s)/contractor(s) shall bear the cost of evacuating such rejected tree stock from the campus.

Furthermore, all trees supplied by contractors in association with facility development shall be guaranteed for 1 year from acceptance after planting.

While inspecting trees delivered to UCSD for planting, the Campus Urban Forester or his/her representative shall look for the following:

PROPER IDENTIFICATION

All trees shall be true to name as ordered or shown on the planting plans and shall be labeled individually or in groups by species and cultivar (where appropriate).

TREE HEALTH

As typical for the species/cultivar, trees shall be healthy and vigorous, as indicated by:

- foliar crown density
- length of shoot growth (throughout crown)
- size, color and appearance of leaves
- uniform distribution of roots in the container media
- appearance of roots
- absence of twig and/or branch dieback
- relative freedom from insects and diseases

Note: some of these characteristics cannot be used to determine the health of deciduous trees during the dormant season.

CROWN

Form: Trees shall have a symmetrical form as typical for the species/cultivar and growth form.

Central Leader: Trees shall have a single, relatively straight central leader and tapered trunk, free of co-dominant stems and vigorous, upright branches that compete with the central leader. Preferably, the

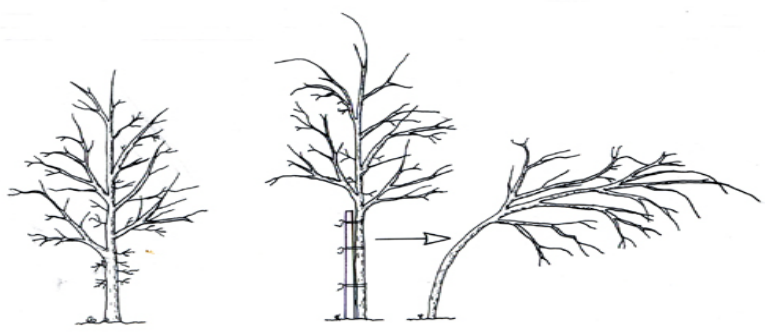
central leader should not have been headed. However, in cases where the original leader has been removed, an upright branch at least ½ (one-half) the diameter of the original leader just below the pruning point shall be present.

Note: This section applies to single trunk trees grown with normal straightness, as typically used for street or landscape planting. This specification does not apply to plants that have been specifically cultured in the nursery or selected for unusual or unique shape, such as contorted forms, topiary forms, espalier forms, multi-stem, or clump forms.

Evaluating trunk and branch structure

Trunk structure: Shade trees that are large at maturity, and most evergreen trees, with the best quality have a dominant or central leader or trunk up to the top of the canopy. Shade trees of lesser quality have two or more leaders or trunks; they could split apart as they grow older. Small ornamental trees can have several trunks.

1. Trunk diameter and taper shall be sufficient so that the tree will remain vertical without the support of a nursery stake.



2. The trunk shall be free of wounds (except properly-made pruning cuts), sunburned areas, conks (fungal fruiting-bodies), wood cracks, bleeding areas, signs of boring insects, galls, cankers and/or lesions.

3. Trunk diameter at 6" (six inches) above the soil surface shall be within the diameter range shown for each container size below:

Container Size	Soil Volume in Gallons (approx)	Trunk Diameter (in)	Soil Level from Container Top (in)
# 5	0.6	0.5 to 0.75	1.25 to 2
# 15	3.3	0.75 to 1.5	1.75 to 2.75
24-inch box	10.5	1.5 to 2.5	2.25 to 3

Branch structure: The better quality, large-maturing shade trees (below left) have all branches less than about two-thirds of the trunk diameter. Poor quality shade trees (below right) have larger upright branches. Trees such as crape myrtle and other small-maturing trees can have several trunks.

Desirable

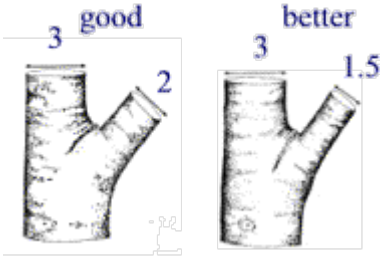
Not Desirable

Trees with extensive defects in branches such as cracks and included bark (below) represent lesser quality than trees free of these potential problems. Included bark can be seen between the two arrows below. Branches with bark inclusions are weakly attached to the tree and can split easily.

Potential Main Branches: Branches shall be distributed radially around and vertically along the trunk, forming a generally symmetrical crown typical for the species.

1. Potential main branches shall be evenly spaced and have appropriate space between them.

2. Branches shall be no larger than 2/3 (two thirds) the diameter of the trunk, measured 1" (one inch) above the branch.



3. The attachment of scaffold branches shall be free of included bark.

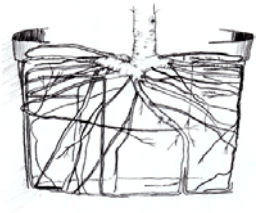
Temporary branches: Unless otherwise specified, small "temporary" branches should be present along the lower trunk below the first potential permanent branch, particularly for trees less than 1-1/2" (one and one-half inches) in trunk diameter. Temporary branches should be distributed around and vertically along the lower trunk. They should be no greater than 3/8" (three-eighths inch) in diameter and no greater than ½ (one-half) the diameter of the trunk at the point of attachment. Heading of temporary branches is usually necessary to limit their growth.

ROOTS

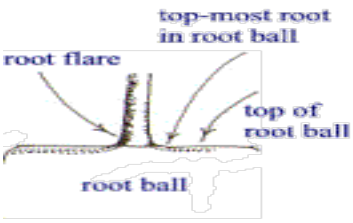
1. The trunk, root collar (root crown) and large roots shall be free of circling and/or kinked roots. Soil removal near the root collar may be

necessary in order to verify that circling and/or kinked roots are not present.

2. The tree shall be well rooted in the container. When the trunk is carefully lifted both the trunk and root system shall move as one.



3. The upper-most roots or root collar shall be within 1" (one inch) above or below the soil surface. The soil level should be within 2' (two inches) of the top of the container (see table above, under “Trunk Structure”).



4. When the container is removed, the root ball shall remain intact.

5. The root ball periphery should be free of large circling and bottom-matted roots. There should be a well developed root system, but not a dense mass from being pot-bound.

6. The root ball size should be suitable to the height of the tree (see *American Standard for Nursery Stock*).

7. On grafted or budded trees, there shall be no suckers from the root stock.

8. If balled and burlapped, only natural burlap or wire baskets are allowed.

All plants must conform to the current edition of the *American Standard for Nursery Stock ANSI Z60.1*.

MOISTURE STATUS

At time of inspection and delivery, the root ball shall be moist throughout, and the tree crown shall show no signs of moisture stress,

as indicated by wilt. Roots shall show no signs of being subjected to excess soil moisture conditions, as indicated by root discoloration, distortion, death, or foul odor.

4.2.7.6. Planting Site Preparation

Soil preparation and conditioning: All debris, wood chips, pavement, concrete and rocks over 2 inches in diameter shall be removed from the planting pit to a minimum of 24-inch depth, unless specified otherwise.

Planter pit preparation:

- Trees in a confined planter pit or sidewalk area: The planting hole shall be excavated to a minimum of 30 inches deep x the width of the exposed area. Scarify the sides of the pit. Soil beneath the rootball shall be compacted to prevent settling.

- Trees in all other areas:

  a). Mark out a planting area 2 to 3 times wider than the rootball diameter (the wider the better). Loosen this area to about 8 inches deep. This will enable the tree to extend a dense mat of tiny roots well out into the soil in the first one to ten weeks in the ground.

  b). Excavate the hole's width a minimum of two times the diameter of the container, and deep enough to allow the root ball of the container to rest on firm soil with the top of the root ball even with the grade. Scarify the sides and the bottom of the pit.

Drainage: Adequate drainage must be provided to the surrounding soil for the planting of new trees. If the trees are to be planted in impermeable or infertile soil and water infiltration rates are less than two (2) inches an hour, then one of the following drainage systems or other approved measures must be implemented:

- French drain, a minimum of three feet in depth

- Drain tiles or lines beneath the trees

- Auger six drain holes at the bottom perimeter of the planting pit, at a minimum of four (4) inches in diameter, twenty-four (24) inches deep and filled with medium sand or fine gravel.

Aeration tubes for trees: Trees planted in sidewalk planter pits, planting strip, parking islands, or medians shall use 4-inch diameter perforated aeration piping (rigid or flexible), circling the bottom of the planter connected to a 'T' fitting to two riser tubes with grated caps and wrapped with filter fabric. This detail shall be shown on the approved landscape plans.

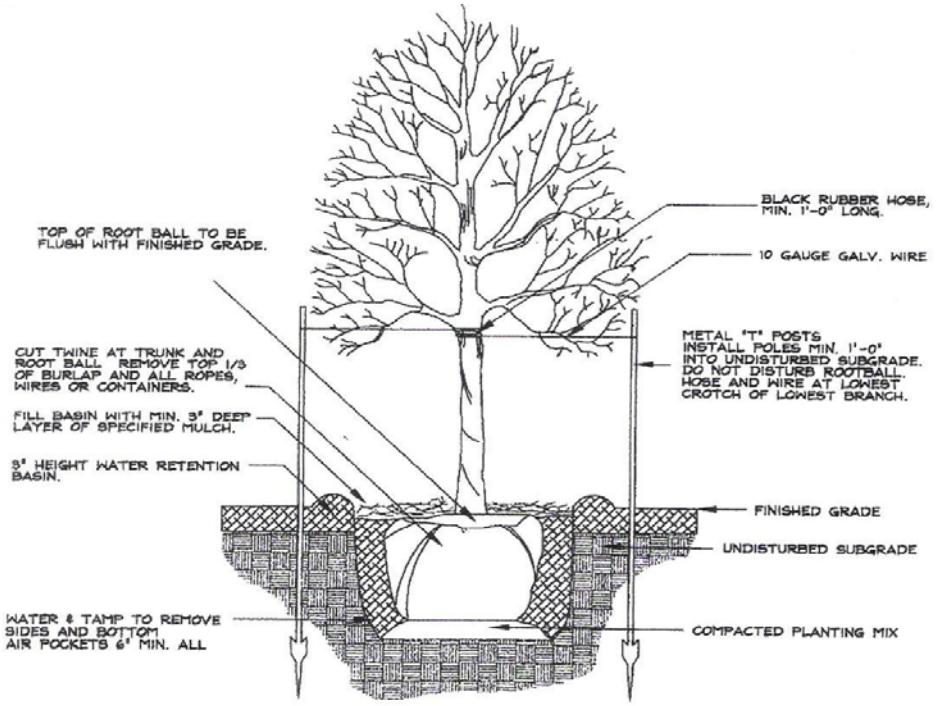
4.2.7.7. Planting the Tree

After the hole has been prepared as described above, the tree is ready to be planted.

Container grown tree: Pull the container away from the root ball. Don't pull the tree out by its trunk. Container grown trees often have circling or girdling roots running along the edge of the rootball. If they exist in this area, cut them and spread them apart. Place the root ball in the center of the hole and adjust the tree so it is straight and at the proper level. Make any adjustments prior to filling the hole with dirt.

Ball and burlapped tree: Rest the root ball in the center of the hole, and reshape the hole so the tree will be straight and at the proper level. After adjusting the tree, pull the burlap and any other material away from the sides and top of the root ball. Do not remove the burlap from the bottom. If you adjust or lift the tree after the burlap has been removed, you run the risk of damaging the root system.

Tree planting detail graphic:



Backfill soil, amended soil: Backfill with the original soil unless the original soil has been removed or the soil is poor. If soil must be amended, it shall be the most appropriate soil mix as directed by a Landscape Architect or a Certified Arborist, and in consultation with the Campus Urban Forester.

Filling the hole: Fill the tree hole until is half full. Flood the hole with a slow hose or tamp gently with your foot to firm the soil. Repeat until the hole is full. Do not press the soil too firmly, only firm enough to hold the tree upright. Backfilling with soil and water or gently tamping will remove large air pockets.
Construction of a berm or dam: Construct a small berm or dam three (3) feet in diameter around the tree. The berm should be approximately three (3) inches high.

Mulching: Cover the entire loosened area of soil with 2 to 4 inches of mulch composed of shredded wood or bark in the entire planting area. Mulch will be placed one to two inches away from the trunk of the tree.

4.2.7.8. Staking or Guying

Bamboo stakes, if any, will be removed. Staking or guying is to prevent movement of the lower trunk and root system until the new tree establishes strong anchorage. Movement of the top is desirable and will strengthen the tree. The stakes will be installed 12-18 inches in undisturbed soil outside of the planting hole. Depending on height and size of the tree, stakes shall be six, eight, or ten feet tall. Trees shall be staked with 3 lodgepole stakes. Stakes shall not be taller than the first main branches of the tree nor rub against tree trunks.

Tree ties will be located near the lowest main branch on the tree. Check a staked or guyed tree monthly during the growing season and after storms or strong wind. The system will be snug, but not to the point of making an impression on the stem or trunk. If that happens, the tie or wire around the trunk shall be loosened. No tree shall be staked any longer than absolutely necessary. One or two growing seasons is all that is needed.

4.2.7.9. Miscellaneous Materials

The following materials shall be used unless otherwise specified:

A. 

B. 

Tree stakes. 2-inch diameter Lodgepole stakes (A) or 2"x2" wooden stakes, arranged in a triangle, are the acceptable materials for protective staking of young trees. The R2 Staking System (B) shall be used for 15 gallon and 24-inch box size trees. It is a reusable screw-in auger-type steel stake with an adjustable anti-rotational tab and pin device that prevents the stake from turning or becoming loose in the ground.

Tree Ties. Cinch ties, made of rubber, are the acceptable ties for use with Lodgepole stakes

Mulch. All newly planted trees shall be mulched with 2-4 inches of organic mulch. Mulch should never be placed against the trunk of a tree. There should be a space of 1-2 inches between the trunk and mulch. Mulch should cover the entire tree planting hole. No volcano mulching is allowed.

Root Control Barriers. Use along all public sidewalks, and indicate on approved plans and drawings.

Tree grates. Where sidewalk width is less than 8 feet and new trees will be installed in a tree well, metal tree grates may be used as approved by the Campus Urban Forester. Minimum size grates shall be 4' x 4' unless otherwise specified. All tree grates shall be mounted in frames inset into a concrete foundation within the sidewalk or surface material, and shall be flush with the surrounding surface.

4.2.7.10. Pruning Newly Planted Trees

Young trees are pruned to allow for proper growth through the years. If the tree is of high quality stock, it should need little pruning. It is no longer common practice to automatically trim a certain percentage of

limbs from a newly planted tree. The tree needs as much foliage as can be available to assure rapid growth and desirable leaf structure. This includes refraining from “limbing up” and topping.

4.2.7.11. Pruning guidelines

All tree pruning operations must be in full conformity with ANSI A300 Standards for Tree Care Operations.

Scaffolding/permanent branches: Identify the scaffolding/permanent branches. The lowest permanent branch should have a diameter of one-half or less of the trunk diameter where the branch attaches to the trunk. The vertical spacing of permanent scaffold branches should equal a distance 3% of the tree's eventual height. Thus, a tree that will be 50 feet tall should have permanent scaffold branches spaced about 18 inches apart along the trunk. Avoid allowing two scaffold branches to arise one above the other on the same side of the tree. Maintain radial balance with branches growing outward in each direction.

Limb removal: The following may be removed -

a). Torn, damaged, dead branches: Remove the branch just outside of the branch collar.

Use the 3-cut method to remove a large limb.

On a dead branch that has a collar of live wood, the final cut should be just beyond the outer edge of the collar.

b). Double Leaders: Maintain a dominant trunk for at least six-eight feet without a major fork. If the trunk divides into two or more relatively equal stems, favor one strong stem and remove the others. Cut one stem back to a lateral branch.

c). Rubbing branches: Eliminate branches that are rubbing or will soon rub against another branch.

d). Crowding: Give each branch room to grow with minimal competition for sunlight. When possible, have major lateral branches evenly spaced eight to ten inches apart along the trunk. If the tree by its nature would lose too much foliage in the process of eliminating

crowding, maintain at least half the foliage on branches in the lower 2/3 of the tree.

e). Narrow Branch Angles/Included Bark: Remove one branch if the angle is 40% or narrower or if it appears that the bark from the branch is becoming pinched between the branch and the trunk.

f). Sprouts and Suckers: Remove sprouts and suckers.

g). Temporary branches: Leave temporary branches that are not competing with permanent, scaffolding branches.

4.2.8. Transplanting Trees.

Transplanting large trees is difficult, expensive, and requires expertise and equipment. Preapproval from the Campus Urban Forester and periodic inspections will be required for the transplanting of a tree deserving of such treatment.

When transplanting trees eight (8) inches in diameter and larger from existing landscapes, it is important to select healthy, vigorous trees, dig an appropriate size root ball, select a site that is consistent with the tree's cultural needs, provide a saucer shaped planting hole approximately three times the root ball width, and then protect the root ball, trunk, and crown during lifting, transportation, and storage.

The most important and hardest part in tree transplanting is creating and implementing a multi-year aftercare program, providing adequate moisture to the root ball.

When a tree is dug for transplanting, as much as 90% of its root system is left behind, severed in the process of digging for transplanting. The tree has a hard time relying on 5-10 percent of its root system doing the work of the 90 percent that was lost. Until it is well established, the root system will have difficulty supplying enough water to the leaves. This stress impacts vigor of the tree and also exposes the tree to the risk of being vulnerable to pests and diseases. The tree is also less able to adapt to or withstand drought, extreme cold, and drying winds.

4.2.8.1. Considerations for Successful Tree Transplanting

Proper attention to the following issues should assist in providing a successful transplanting. Considering the size of the important trees

being transplanted, a professional arborist is required to assist in the process.

Site: Before transplanting make sure the tree is a good match for the new site.

Timing: Recommended timing for transplanting trees is during the dormant season, when the tree is not trying to support its leafy crown.

Health of tree: Select a tree that is in good health and shape and has no major defects in its trunk branch structure.

Success rate: Different species have different success rates in transplanting.

Tree size: Most commonly transplanted trees range in size from 5-15 diameter inches.

4.2.8.2. Transplanting process

Digging up the tree: Dig up a wide root ball with appropriate depth and wrap burlap material with wire and twine to save intact as much of the root ball as possible. A rule of thumb for trees over six inches in diameter is that a root ball = 10 inches in diameter for every inch of tree trunk diameter measured at 4 ½ feet above the ground. In other words, a 10 inch tree should have a 100 inch diameter rootball. Likewise, the ball depth should be about 60% of the ball diameter. The same 10 inch tree should have a 60 inch depth.

While smaller trees can be transplanted using a tree spade or other specialty equipment/techniques, larger trees will require mechanical digging equipment and appropriate hoists and heavy equipment for moving the tree.

4.2.8.3. Transporting the tree

During transportation, the tree crown should always be covered with tarp to protect the tree from drying out and windburn.

4.2.8.4. After transplanting

Keep the root ball moist at all times. Anticipate watering three times a week or, in very hot weather, every day. Continued watering will be required for several years.

Do not prune newly transplanted trees to reduce crown and compensate for root loss. That will only further weaken the tree.

Mulch the transplanted tree with 2-4 inches of organic mulch to cover root ball.

The process of regenerating a normal root system will take several years, especially for large trees. Immediately after transplanting, the tree will be susceptible to extreme stress. Moisture is a critical factor in new root growth. Soil structure (compacted soil, etc) and soil temperature also impact the growth of roots.

(Abridged from “Transplanting Trees”, by Patrice Peltier and Gary W. Watson. Arbor Age, January-March 2000.)

APPENDIX A: DEFINITIONS.

For the purposes of this Forest Management Plan, the following definitions apply. Additional definitions may be found in the Management Plan.

Certified Arborist is an individual who has demonstrated knowledge and competency through obtainment of the current International Society of Arboriculture arborist certification, or who is a member of the American Society of Consulting Arborists.

Compaction means compression of the soil structure or texture by any means that creates an upper layer that is impermeable. Compaction is injurious to roots and the health of a tree.

Dangerous tree see Hazardous tree.

Dead Tree means a tree that is dead or that has been damaged beyond repair or is in an advanced state of decline (where an insufficient amount of live tissue, green leaves, limbs or branches, exists to sustain life) and has been determined to be such by a the Campus Urban Forester or a Certified Arborist. If the tree has been certified dead, removal is permitted as defined in the Management Plan.

Disturbance refers to all of the various activities from construction or development that may damage trees.

Excessive Pruning means removing in excess, one-fourth (25 percent) or greater, of the functioning leaf, stem or root area. Pruning in excess of 25 percent is injurious to the tree and is a prohibited act. Excessive pruning typically results in the tree appearing as a 'bonsai', 'lion's-tailed', 'lolly-popped' or overly thinned.

> *Unbalanced Crown.* Excessive pruning also includes removal of the leaf or stem area predominantly on one side, topping, or excessive tree canopy or crown raising. Exceptions are when clearance from overhead utilities or public improvements is required or to abate a hazardous condition or a public nuisance.
>
> *Roots.* Excessive pruning may include the cutting of any root 1½ inches or greater in diameter and/or severing in excess of 25 percent of the roots.

Hazardous Tree refers to a tree that possesses a structural defect which poses an imminent risk if the tree or part of the tree that would fall on someone or something of value (target).

> *Structural defect* means any structural weakness or deformity of a tree or its parts. A tree with a structural defect can be verified to be hazardous by a certified arborist and confirmed as such by the Campus Urban Forester. The Campus Urban Forester retains discretionary right to approve or amend a hazardous rating, in writing, and recommend any action that may reduce the condition to a less-than significant level of hazard. If the tree has been determined to be hazardous, removal of the tree is permitted as provided for in the Management Plan.

Injury means a wound resulting from any activity, including but not limited to 'excessive pruning', cutting, trenching, excavating, altering the grade, paving or compaction within the tree protection zone of a tree. Injury shall include bruising, scarring, tearing or breaking of roots, bark, trunk, branches or foliage, herbicide application or poisoning, or any other action foreseeably leading to the death or permanent damage to tree health.

Management Plan means this Forest Management Plan.

Protective Tree Fencing means a temporary enclosure erected around a tree to be protected at the boundary of the tree protection zone. The fence serves three primary functions: 1) to keep the foliage, crown, branch structure and trunk clear from direct contact and damage by equipment, materials or disturbances; 2) to preserve roots and soil in an intact and non-compacted state; and 3) to identify the tree protection zone in which no soil disturbance is permitted and activities are restricted. (Covered in Forest Management Plan)

Root Buffer means a temporary layer of material to protect the soil texture and roots. The buffer shall consist of a base course of tree chips or mulch spread over the root area to a minimum of 6-inch depth.

Site Plan means a set of drawings (e.g. preliminary drawings, site plan, grading, demolition, building, utilities, landscape, irrigation, tree survey, etc.) that show existing site conditions and proposed landscape improvements, including trees to be removed, relocated or to be retained. Site plans shall include the following minimum information that may impact trees:

• Surveyed tree location, species, size, dripline area (including trees located on adjacent area that overhang the project site) and protected trees within 30-feet of the project site.

• Paving, concrete, trenching or grade change located within the tree protection zone.

• Existing and proposed utility pathways.

• Surface and subsurface drainage and aeration systems to be used.

• Walls, tree wells, retaining walls and grade change barriers, both temporary and permanent.

• Landscaping, irrigation and lighting within dripline of trees, including all lines, valves, etc.

• Location of other landscaping and significant features.

• All of the final approved site plan sheets shall reference tree protection instructions.

Soil Compaction means the compression of soil particles that may result from the movement of heavy machinery and trucks, storage of construction materials, structures, paving, etc. within the tree protection zone. Soil compaction can result in atrophy of roots and potential death of the tree, with symptoms often taking 3 to 10 years to manifest.

Soil Fracturing means the loosening of hard or compacted soil around a tree by means of a pneumatic soil probe that delivers sudden bursts of air to crack, loosen or expand the soil to improve the root growing environment.

Target is a term used to include people, vehicles, structures or something subject to damage by a tree.

Note: A tree may not be a hazard if a “target” is absent within the falling distance of a tree or its parts (e.g., a defective tree in a non-populated area away from pathways may not be considered a hazard)

Trenching means any excavation to provide irrigation, install foundations, utility lines, services, pipe, drainage or other property improvements below grade. Trenching within the Critical Root Zone (CRZ) is injurious to roots and tree health and is prohibited, unless

approved. If trenching is approved within the CRZ, it must be in accordance with instructions and table outlined in this Management Plan.

Verification of Tree Protection means the development Project Manager shall verify to the Campus Urban Forester, in writing, that all preconstruction conditions have been met (tree fencing, erosion control, pruning, etc.) and are in place. An initial inspection of protective fencing and written verification must be submitted to the Campus Urban Forester **prior** to demolition, grading or any construction work.

Vertical Mulching means augering, hydraulic or air excavation of vertical holes within a tree's root zone to loosen and aerate the soil, typically to mitigate soil compaction. Holes are typically penetrated 4 to 6 feet on center, 2 to 3 feet deep, 2 to 6 inches in diameter and backfilled with either perlite, vermiculite, peat moss or a mixture thereof.

APPENDIX B: TREE LIST 1.

Tree Species on UCSD Campus as of December, 2007.

Acacia longifolia
Acacia melanoxylon
Acacia pendula
Acer species
Agonis flexuosa
Albizia distachya
Alnus rhombifolia
Araucaria bidwillii
Araucaria heterophylla
Arbutus unedo
Archontophoenix cunninghamiana
Baccharis salicifolia
Bambusa oldhamii
Bauhinia blakeana
Bauhinia forficata
Bauhinia variegata
Betula pendula
Brahea armata
Callistemon citrinus
Callistemon viminalis
Cassia leptophylla
Cassia bicapsularis
Casuarina equisetifolia
Cedrus atlantica
Ceratonia siliqua
Cercidium hybrid
Cercis occidentalis
Chamaerops humilis
Chilopsis linearis
Chorisia speciosa
Cinnamomum camphora
Citrus species
Corymbia ficifolia
Cotoneaster parneyi
Cupaniopsis anarcardioides
Cupressocyparis leylandii
Cupressus macrocarpa
Dodonea viscosa
Dracaena draco
Eriobotrya deflexa
Eriobotrya japonica
Erythrina caffra
Erythrina coralloides
Erythrina falcata
Eucalyptus camaldulensis
Eucalyptus cinerea
Eucalyptus citriodora
Eucalyptus cladocalyx
Eucalyptus cornuta
Eucalyptus deglupta
Eucalyptus erythrocorys
Eucalyptus globulus
Eucalyptus globulus 'Compacta'
Eucalyptus gunnii
Eucalyptus lehmannii
Eucalyptus maculata
Eucalyptus nicholii
Eucalyptus polyanthemos
Eucalyptus rudis
Eucalyptus sideroxylon
Eucalyptus torquata
Eucalyptus viminalis
Feijoa sellowiana
Ficus benjamina
Ficus elastica
Ficus lyrata
Ficus microcarpa
Ficus microcarpa 'Variegata'
Ficus retusa 'Nitida'
Ficus rubiginosa
Fraxinus velutina
Geijera parviflora
Ginkgo biloba
Harpephyllum caffrum
Heteromeles arbutifolia
Hymenosporum flavum
Jacaranda mimosifolia
Koelreuteria bipinnata
Koelreuteria elegans
Koelreuteria paniculata
Lagerstroemia indica

Lagunaria patersonii
Leptospermum laevigatum
Liquidambar styraciflua
Livistona australis
Lophostemon confertus
Lyonothamnus floribundus
Magnolia grandiflora
Magnolia x soulangiana
Melaleuca nesophylla
Melaleuca quinquinervia
Metrosideros excelsus
Michelia champaca
Myoporum laetum
Nerium oleander
Olea europaea
Parkinsonia aculeata
Phoenix canariensis
Phoenix reclinata
Phoenix roebelenii
Photinia fraseri
Pinus canariensis
Pinus halepensis
Pinus pinea
Pinus radiata
Pinus thunbergii
Pinus torreyana
Pittosporum tobira
Pittosporum undulatum
Platanus racemosa
Platanus x acerifolia
Podocarpus gracilior
Podocarpus macrophyllus
Populus nigra 'Italica'
Prunus cerasifera 'Atropurpurea'
Prunus ilicifolia
Psidium cattleianum
Pyrus calleryana
Pyrus kawakamii
Quercus agrifolia
Quercus dumosa
Quercus engelmannii
Rhapiolepsis 'Majestic Beauty'
Rhus integrifolia
Robinia ambigua
Schinus molle
Schinus terebinthifolius
Sequoia sempervirens
Spathodea campanulata
Strelitzia nicolai
Syagrus romanzoffianum
Syzygium paniculatum
'Monterey Bay'
Tabebuia impetiginosa
Thevetia thevetioides
Tipuana tipu
Trachycarpus fortunei
Trithrinax acanthacoma
Tupidanthus calyptratus
Ulmus parvifolia
Washingtonia robusta
Washingtonia filifera
Yucca gloriosa.

APPENDIX C: TREE LIST 2.

Tree Species Approved for Planting on UCSD Campus.
(See Tree Lists for San Diego, California on following pages)

City of San Diego
STREET TREE SELECTION GUIDE

{In areas with contiguous sidewalks (sidewalks that extend all the way to the curb), trees shall be planted a minimum of two feet from sidewalk. In unimproved right-of-ways, contact the Street Tree Section for more information.}
Root Barriers Recommended but Not Required unless specified.
The following trees are recommended for parkways 2 feet and larger, and 3'x3' cutouts. See notes for specific maintenance requirements:

SMALL AND UPRIGHT TREES:

Botanical Name	Common Name	Form	Height	Spread	Type	Drought	Native
Acacia pendula***	Weeping Acacia	SC	20	20	E		
Acacia subporosa	River Wattle	SC	25	25	E		
Acacia stenophylla**	Shoestring Acacia	SC	30	20	E		
Acer palmatum+	Japanese Maple	SC	20	20	D		
Albizia julibrissin	Silk Tree	SC	30+	-25	D/F	Yes	
Arbutus unedo++	Strawberry Tree	SC	30	20	E/F		
Archontophoenix cunninghamiana	King Palm	U	40+	-20	P	Yes	
Bauhinia blakeana*	Hong Kong Orchid	SC	20+	-20	D/F		
Callistemon citrinus~#	Lemon Bottle Brush	U	-25	20+	E/F	Yes	
Callistemon salignus	White Bottlebrush	SC	25	25	E/F		
Cercis canadensis***	Eastern Redbud	SC	25	25	E/F		
Cercis mexicana***	Mexican Redbud	SC	25	25	D/F		
Cercis occidentalis***	Western Redbud	SC	25	25	D/F	Yes	Yes
Cercocarpus betuloides	Mountain Ironwood	SC	20	-20	E/F	Yes	Yes
Chiionanthus retusus	Chinese Fringe Tree	SC	-20	-20	D/F		
Heteromeles arbutifolia***	Toyon	SC	25	25	E	Yes	Yes
Hymenosporum flavum***	Sweetshade	SC	35	20	E/F		
Lagerstroemia indica*	Crape Myrtle	SC	-20	-20	D/F	Yes	
Lyonathamnus floribundus***	Catalina Ironwood	SC	50	35	E/F	Yes	Yes
Photinia fraserii***	Fraser Photinia	SC	20	20	E/F		
Raphiolepsis	'Majestic Beauty'	SC	-20	-20	E/F	Yes	
Syagrus romanzoffianum	Queen Palm	U	40+	-20	P	Yes	

Legend

Type
D - Deciduous
E - Evergreen
F - Flowering
P - Palm Species

Form
SC - Small Canopy Form: 15' to 25' spread. Minimum spacing = 20 feet.
LC - Large Canopy Form: 25' and larger spread. Minimum spacing = 30 feet.
U - Vertical / Upright Canopy Form : 15' to 25' spread. Minimum spacing = 20 feet

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City of San Diego
STREET TREE SELECTION GUIDE

LARGE TREES

*The following selections are recommended for **7.0 foot to 10 foot** parkways or larger and minimum 40 square foot cutouts.*
Root Barriers Recommended for all applications

Botanical Name	Common Name	Form	Height	Spread	Type	Drought	Native	
Arbutus menziesii	Madrona	LC	40+	40+	E	Yes	Yes	
Calocedrus decurrens	Incense Cedar	LC	40+	-40	E	Yes	Yes	
Cedrus deodara	Deodar Cedar	LC	40+	40+	E	Yes		
Cupressus forbesi***	Tecate Cypress	LC	25+	25	E			
Eucalyptus polyanthemos	Silver Dollar Gum	LC	40+	-40	E	Yes		
Eucalyptus leucoxylon	White Ironbark	LC	60+	40	E	Yes		
Koelreuteria bipinnata	Chinese Lantern	LC	-40	-40	D/F			
Koelreuteria paniculata	Golden Rain	LC	-40	-40	D/F	Yes		
Magnolia grandiflora	Southern Magnolia	LC	-40	-40	E/F			
Olea europaea~	Olive "fruitless"	SC	-40	-25	E	Yes		
Platanus acerifolia "Bloodgood"	London Plane	LC	40+	40+	D			
Pinus canariensis	Canary Island Pine	U	40+	-25	E	Yes		
Pinus pinea~	Italian Stone Pine	LC	40+	40+	E	Yes		
Pinus muricata***	Bishop Pine	LC	50	40	E			Yes
Plantanus racemosa***	California Sycamore	LC	60+	40+	D		Yes	
Podocarpus gracilior~	African Fern Pine	LC	40+	-40	E			
Tipuana tipu	Tipu Tree	LC	40+	40+	D/F			

*The following selections are recommended for **10-foot** or larger parkways and **10- foot** or larger center medians.*
Root Barriers Recommended for all applications

Botanical Name	Common Name	Form	Height	Spread	Type	Drought	Native
Liriodendron tulipifera***	Tulip Tree	LC	>66	30	D		
Pinus torreyana	Torrey Pine	LC	80+	80+	E	Yes	Yes
Quercus agrifolia***##	Coast Live Oak	LC	65	50	E	Yes##	Yes
Quercus engelmanii***##	Mesa Oak	LC	50	45	D	Yes	Yes
Quercus virginiana+##	S. Live Oak	LC	50	40	D/E		

Legend

Type
D - Deciduous
E - Evergreen
F - Flowering
P - Palm Species

Form
SC - Small Canopy Form: 15' to 25' spread. Minimum spacing = 20 feet.
LC - Large Canopy Form: 25' and larger spread. Minimum spacing = 30 feet.
U - Vertical / Upright Canopy Form : 15' to 25' spread. Minimum spacing = 20 feet

Tree Selection Tips and Notes

Additional Notes(symbols in left margin relate to symbols that appear adjacent to various tree selections)

\+ Prefers a moist, well-drained loam to which plenty of humus has been added.

++ Fruit production.

* Approved for use under power lines and/or Public View Corridors
note: Palm species may also be approved for view corridors.

** Tree has been identified by the San Diego Regional Asthma Coalition as an Allergy Producer

~ Tolerates Direct Coastal Exposure (Typically 1000' from shoreline)

Root Barriers are required when used in less than three foot parkway and where specified

Minimum Size Canopy = 24" Box

Minimum Size Palm Species = 10' BTH (14' BTH at Bus Stop or Red Curb)

BTH = Brown Trunk Height = height from ground level to live fronds

Non-Irrigated Settings Recommended

*** Specific maintenance needs – may require supplemental watering following establishment. See local nursery for more information.

APPENDIX D: BIBLIOGRAPHY

American Forests and National Association of Home Builders. Building Greener Neighborhoods. 2nd ed. Washington, DC: American Forests, 1998.

Burditt Associates. Urban Forest Management Plan, City of College Station, Texas. Conroe, TX: Burditt Associates, 2002.

Council of Tree and Landscape Appraisers. Guide for Plant Appraisal. 9th ed. Champaign, IL: International Society of Arboriculture, 2000.

Dockter, Dave. Tree Technical Manual: Standards and Specifications. Palo Alto, CA: City of Palo Alto, Department of Planning and Community Development, 2001.

Elmendorf, William. A Guide to Preserving Trees in Development Projects. University Park, PA: Pennsylvania State University, School of Forest Resources, 1999.

Kempf, Brian et al. Guideline Specifications for Nursery Tree Quality. Urban Tree Foundation, Visalia, California 2009.

Minnesota Department of Natural Resources, Division of Forestry. Conserving Wooded Areas in Developing Communities: Best Management Practices in Minnesota. St Paul, MN: Minnesota Department of Natural Resources, Division of Natural Resources, 1999.

Peltier, Patrice and Gary W. Watson. “Transplanting Trees, Part 1: Preparing the Plant and Site for a Successful Move.” Arbor Age January 2000: 8-15.

Peltier, Patrice and Gary W. Watson. “Transplanting Trees, Part 2: Improve Your Tree Transplanting Survival Rates with These Transportation and Storage Tips.” Arbor Age February 2000: 8-13.

Peltier, Patrice and Gary W. Watson. “Transplanting Trees, Part 1: The “After Care” of Transplanting Trees Is the Most Critical Step.” Arbor Age March 2000: 8-15.

Seattle, Urban Forest Coalition. A City Among the Trees, An Urban Forestry Resource Guide. Seattle, WA: City of Seattle, 1998.

TreeFolks. Tree Planting Guide. Austin, Texas: Tree Folks, 2000.

Vargas, Kelaine E., McPherson, E. Gregory et al: Temperate Interior West Tree Guide *Benefits, Costs, and Strategic Planting.* PSW-GTR-206, November 2007.

Watson, Gary W. and E. B. Himelick. Principles and Practice of Planting Trees and Shrubs. Savoy, IL: International Society of Arboriculture, 1997.

Additional Resources

American Association of Nurserymen. American Standard for Nursery Stock, ANSI Z60.1-1996. Washington, DC: American Association of Nurserymen, 1997.

ANSI Z133.1-1994. American National Standards Institute Standard for Tree Care Operations— Pruning, Trimming, Repairing, Maintaining and Removing Trees, and Cutting Brush— Safety Requirements.

ANZI A300-1995. American National Standards Institute Standard for Tree Care Operations— Pruning, Trimming, Repairing, Maintaining, and Removing Trees and Cutting Brush— Standard Practice.

Clark, James R., Richard W. Harris and Nelda P. Matheny. Arboriculture Integrated Management of Landscape Trees, Shrubs, And Vines. 3rd ed. Upper Saddle River, NJ: Prentice Hall, 1999.

Community Forest Management Plan, City Of Santa Monica, CA, September 1999.

Community Forest Management Plan, City Of Carlsbad, CA, April 2002.

Gilman, Edward F. An Illustrated Guide to Pruning. 2nd ed. Albany, NY: Delmar, 2002.

Matheny, Nelda and James R. Clark. Trees and Development, A Technical Guide to Preservation of Trees During Land Development. Champaign, IL: International Society of Arboriculture, 1998.

Miller, Nancy L., David M. Rathke, and Gary R. Johnson. Protecting Trees from Construction Damage, A Homeowner's Guide. St. Paul, MN: University of Minnesota, Minnesota Extension Service, 1993.

Moll, Gary and Stanley Young. Growing Greener Cities A Tree-Planting Handbook. Venice, CA: Living Planet Press, 1992.

Nursery Tree Selection and Planting Specifications, California Department of Forestry and Fire Protection website, January 2008.

Pasadena Tree Protection Ordinance, City of Pasadena, CA, May 2002.

Pirone, Thomas P., John R. Hartman and Mary Ann Sall. Pirone's Tree Maintenance. 7th ed. Oxford, NY: Oxford University Press, 2000.

Shigo, Alex L. Tree Pruning A Worldwide Photo Guide. Durham, NH: Shigo and Trees, Associates, 1989.

Texas Association of Nurseryman. Grades and Standards. Austin, TX: Texas Association of Nurseryman, n.d.

Tree Technical Manual: Standards and Specifications, City of Round Rock, Texas January 2005.

TreePeople. The Simple Act of Planting a Tree: A Citizen Forester's Guide to Healing Your Neighborhood, Your City, and Your World. Los Angeles, CA: Tarcher, 1990.

Urban Forest Program Document, Recreation and Parks Department, City of Los Angeles, CA, October 2004.