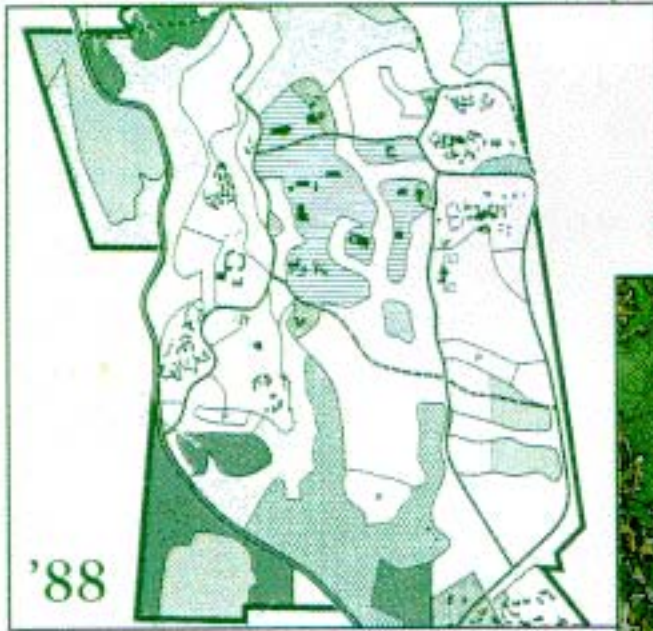


# *Landscape Management Program 1995*



UNIVERSITY OF CALIFORNIA,  
SANTA CRUZ

*Landscape Management  
Program*

May 1995

Jeanine Scaramozzino  
UC Santa Cruz Grounds Department

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*Instead of remaking the land, the land must remake our standard conceptions of building the plaza and parking lot... It must be kept in mind, to avoid future recrimination, that one of the inevitable results of building in a forest is that as man enters, nature recedes. Romantics must be warned that covers of fern, johnny jump-ups and shooting stars prefer to disappear rather than face our advanced civilization. With the exception of areas especially preserved in their natural state the general effect in the main campus must be one of a sensitive collaboration between the designer and this spectacular environment with the intent that neither shall impose unduly upon the other. The wall to wall forest carpet will disappear and in its place must come — not the asphalt jungle, not the standard campus we have always known, not an automobile under every redwood — but a vast area in which to live and study. It must be magnificent in conception, daring and forthright in its architecture — but gentle be the hand it lays upon the land.*

Thomas D. Church, Landscape Architect

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This booklet provides the policies of the L&M Program and provides landscape management tools used to be successful. The campus has already committed to being a link by adopting guidelines set forth in the L&M Program. The Landscape Management Program can help you succeed realizing these guidelines. Subsequent steps include development of a comprehensive Landscape Resource Inventory Plan as well as a Landscape Planning and Design Program.

The Landscape Management Program is provided to campus, staff, and we look forward to working with the L&M Program. Specifically, the program will:

- Provide a comprehensive management tool for use by the Grounds Department as well as for the campus landscape.
- Provide a resource for students, staff, faculty, and administrators concerning landscape issues.

Subsequent to the plan will continued focus on the ongoing maintenance of existing and plant success opportunities for the L&M program. This includes plants and program development with maintenance around the campus, staff and student participation, plant maintenance with proper identification, proper maintenance, proper soil, timing, and watering, and a variety of tools and methods. The Landscape Management Program recognizes plant growth and has identified these activities that are essential to successful planting activities, and the economics through collaboration with the campus community and grounds.

The program will continue with the L&M Program guidelines supporting the campus landscape and provide comprehensive services. The program will continue that maintenance of the campus landscape is carried on by the Physical Plant Grounds Service personnel and staff the Grounds Department, especially in the L&M and program. The program will continue with the management principles that provide the program.

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## EXECUTIVE SUMMARY

The UCSC campus lands are at a critical point in their development. The 1988 Long Range Development Plan (LRDP) proposal to increase the student population to 15,000 is placing an additional strain on the campus's landscape due to human impacts. A number of buildings are in various planning and construction stages and new college landscapes are being designed and must be maintained. The campus's environmental systems must be managed to maintain their integrity and mitigate damage as a result of human encroachment. This program uses the Long Range Development Plan Implementation Program (LRDPIP) guidelines as its foundation and recognizes that the care of the campus lands falls within the purview of the Physical Plant Grounds Services.

Clear linkage between the policies of the LRDP and practical landscape management tools need to be identified. The campus has already committed to forging a link by adopting guidelines set forth in the LRDPIP. The Landscape Management Program is the first step towards realizing these guidelines. Subsequent steps entail development of a comprehensive Landscape Resource Conservation Plan as well as a Landscape Planning and Design Program.

The Landscape Management Program is intended to develop, refine, and set forth the means to comply with the LRDPIP guidelines. Specifically, the program is to:

- Provide a comprehensive management tool for use by the Grounds Department in caring for the campus landscape
- Provide a resource for students, staff, faculty, and consultants concerning landscape issues

- Provide a framework for the general care of the campus lands
- Provide a process for the maintenance of the campus's ecosystems

The program investigates the implications of historical land use policies and identifies guiding principles for the maintenance of the campus landscape. The ecology and preservation of the meadows, forests, and canyons are explored. General guidelines are presented for the care of college and building landscapes, as well as specifics concerning fire prevention, trees, and human safety. Educational opportunities, such as campus stewardship, are outlined in detail.

Information for the plan was collected from: the extensive collection of reports and plans written specifically for the UCSC campus, plus landscape plans and programs from various other Universities around the country; state and national park/reserve plans; interviews with expert consultants; campus committee suggestions; campus staff, faculty, and students; and a variety of books and manuals. The Landscape Management Program recognizes alternatives and has identified those solutions that are most effective in terms of ecology, aesthetics, and/or economics, through dialogue with the campus community and specialists.

The program specifically outlines the LRDPIP guidelines concerning the campus landscape and presents management options. The program also recognizes that maintenance of the campus landscape is carried out by the Physical Plant Grounds Service personnel and that the Grounds Superintendent essentially is the UCSC land manager. The program outlines specific management principles that provide a framework

for landscape management decisions. Using this framework the Grounds Superintendent, participating in consultation with the Campus Land Use Management Advisory Committee (CLUMAC) and the Campus Architect, may effectively care for the campus lands.

The campus's landscape development and preservation must be a forethought in the planning and construction of this university. Many positive steps towards this end have preceded this document, but

more must be done. Education and stewardship must become a tradition upheld by this institution; construction moneys should be budgeted for the installation and maintenance of new landscapes; alumni and gift sources could be found to support the restoration and preservation of the campus's ecosystems; and a detailed Landscape Planning and Design Program can be adopted to provide guidelines for future landscape projects.

The program recognizes the importance of human factors in landscape design and planning. The program will provide a process for the maintenance of the campus's ecosystems.

Information for the plan was collected from the creative collection of reports and plans within the office for the UCCS campus. This landscape plan and program from various other disciplines around the campus, state and national guidelines, plans, inventories, and expert consultation; campus committee suggestions; campus staff, faculty, and students; and a variety of books and manuals. The Landscape Management Program recognizes that the campus and its identified areas within the campus are not separate in terms of ecology, aesthetic and/or economic, through dialogue with the campus community and specialists.

The program specifically outlines the LAMP's goals and objectives concerning the campus landscape and preservation. The program also recognizes that maintenance of the campus landscape is carried out by the Physical Plant Grounds Service personnel and that the Grounds Superintendent essentially is the UCCS landscape manager. The program outlines the management principles that provide a framework

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- Provide a comprehensive management tool for use by the Grounds Department in caring for the campus landscape.
- Provide a resource for students, staff, faculty, and consultants concerning landscape issues.

# 1

## INTRODUCTION

The LRDPIP guidelines have set out to clarify intentions and to invite invention, they are not solutions to specific issues (LRDPIP 1993). The campus has accepted the guidelines of the LRDPIP as the blueprint for a framework that must be developed by planning consultants, architects, facilities and maintenance staff, and other interested campus and community groups (LRDPIP 1993). The Grounds Department, as one of those groups listed above, has worked with the campus community to develop a landscape plan that outlines a framework that executes the LRDPIP guidelines.

The Landscape Management Program is intended to be a management tool for use by the Grounds Department that outlines useful, practical procedures for the care of the UC Santa Cruz landscape. These procedures take into account ecological, safety, economic and aesthetic concerns while being in concert with the guidelines of the 1988 LRDP, LRDPIP, and other various planning and consultant documents. There is an urgent need for a comprehensive, integrated approach to deal with landscaping issues for the campus. With this need in mind and the realization that the campus is growing in the number of students and buildings, the Campus Grounds Department has set out to outline its purpose and responsibilities for itself and the campus community.

The Landscape Management Program serves a dual purpose. It is a practical tool for the Grounds Department which defines standard maintenance strategies, while it acts as a resource to inform the campus community and executive architects of the Department's responsibilities, land management issues, and the costs associated with campus maintenance.

The campus community is constantly being asked to make decisions that affect the landscape. There are building site issues, plant replacement issues, drainage issues, ecological issues, etc. Campus development has created an anthropogenic landscape within a forest. Management guidelines must be sensitive to that reality. A reference for making landscaping decisions would be useful. The Landscape Management Program is a step in that direction, using the LRDPIP as its foundation.

Formalization of practices and procedures that are now only "common knowledge" allows for ease in transfer of common information. As the campus grows, there is an increasing landscape that must be attended to. This program is supported by the knowledge of the problems and successes the campus landscape has seen in the last thirty years. By collating what is known, educated decisions and policies can be enacted concerning the campus lands.

This program is a resource for new and old personnel alike. It documents and defines the benefits of the "tried and true" practices that are currently in use as well as outlining fresh strategies for tackling challenges. It also acts to standardize landscaping procedures, so that despite the uniqueness of each College or Area landscape, there is a common thread among them.

The guiding principles of the Landscape Management Program incorporate the LRDPIP guidelines and the Department's desire to restore and enhance the condition of the natural systems of the UC Santa Cruz campus landscape while achieving a balance between the ecological systems and the human activities required to run a University.

The University has sought to have a place of higher learning coexist with its natural surroundings. Which is to survive and which is to change for the purposes of the other?

There have been various avenues to answer this question: committees, planning documents, and experts. Many have come to the realization that the landscape by nature is a dynamic and fluid system, one that may be managed by general, practical guidelines. But these general practices must have the ability to be applied to various situations; they are by definition flexible.

Not every item on this campus can be explicitly outlined because the essence of landscape is fluid and changing. As more information is acquired and more challenges appear that must be dealt with, this document will act as the first of many revisions, in the years to come, that deal with the issues of the times.

This program is the first step towards the development of a more detailed Land Planning and Design Program and a Landscape Conservation Plan/Resource Management System. There needs to be a clear linkage between the LRDP and LRDP/IP and future landscaping programs. The purpose of this document is to build a link between the LRDP/IP and operational guidelines.



## 2

### HISTORICAL BACKGROUND

The first inhabitants of UC Santa Cruz were the indigenous peoples collectively known as the Ohlone or Coastanoans. These native peoples seasonally burned the grasslands and chaparral to direct succession and promote growth of diverse plant and animal species, which they used for food, basketry, and religious materials (Warrick 1982).

When the Spanish settled California under the mission system, the 2000 acres that are now UC Santa Cruz were a small part of the unfenced pasture and agricultural lands of the Mission La Exaltacion de la Santa Cruz, established in 1791. Later as the lands were secularized the area became part of an enormous Mexican land grant and continued to be used as grazing lands (Kliwer 1988).

Albion Jordan and Isaac Davis purchased the land that is now the lower campus in 1849. They marketed the campus's large limestone resources in San Francisco. The old growth redwoods served as fuel

for the limestone kilns. One burning took 140 cords of wood and six days to complete. As early as 1862 their commercial sawmill operations were producing 15,000 board feet per day (Warrick 1982).

In 1865 and 1888 Henry Cowell bought out Jordan's and Davis's holdings respectively. The Santa Cruz property became the home ranch for the Cowell Empire (Kliwer 1988).

The Cowell Ranch management strategies involved grazing, vegetation removal and logging, some of which led to erosion and sedimentation of creeks. The forests were mostly clear cut by 1875 due to the extensive logging for lumber and fuel. No one knows the exact dates of the logging on the campus, only that much of the virgin redwoods were used as fuel (Warrick 1982).

In 1903 Henry Cowell died leaving his sons to run the business. After the 1906 San Francisco earthquake and fire the demand for cement increased.

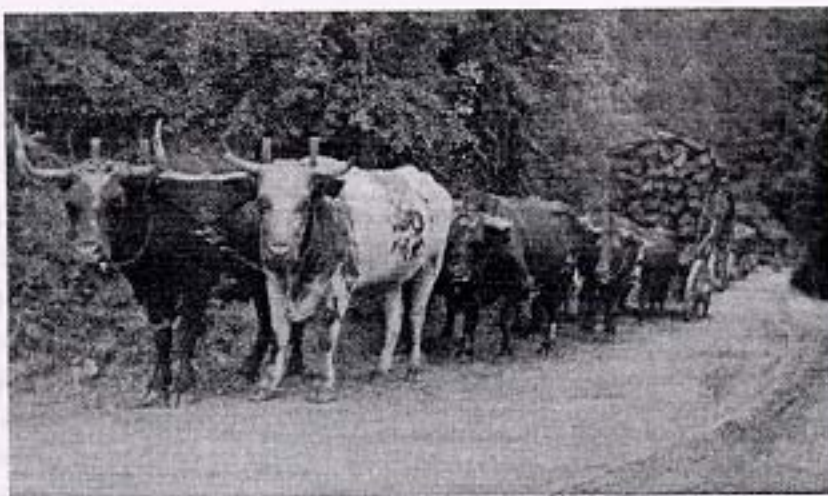
Therefore the logging of the area intensified to keep the limestone kilns running.

The history of cattle rotation on campus has not been well documented. In 1911 Henry's son Harry stopped the annual burning of the meadows. He began grazing which directed succession by trampling invading species and tree seedlings, and decreased the chance of wild-fire by the eating of dry summer grass. In 1925 he imported herds of elk, followed by buffalo. Tres-



Virgin redwoods were used as fuel for the limestone kilns.

## HISTORICAL BACKGROUND



Redwood being transported to the kilns.

passing hunters killed the elk and the buffalo were wiped out by disease (Warrick 1982).

Harry and Ernest ran the business until 1955 when they established the S.H. Cowell Foundation (Warrick 1982).

In October 1957 the Regents of the University of California authorized three new UC campuses to accommodate the expected influx of new students in the 1970s and 1980s. In 1961, the Regents of the University of California chose Cowell Ranch as the site for a new University campus, and the first residential college, Cowell College, was dedicated in 1966 (Kliwer 1988).

Dean E. McHenry was appointed founding chancellor in 1961. McHenry along with Clark Kerr, UC President, and the Regent's planning and design team, outlined a campus inspired by educational models such as Cambridge and Oxford, in which residential and academic models were unified (Warrick 1982).

Thomas Church, Landscape Architect, reinforced this academic vision with the architectural planning, stressing the goal of minimizing the human intrusions on the environment by sensitive placement of buildings. He urged that the colleges and other buildings be placed at the boundaries between forests and grasslands, thus abolishing the need for intensive landscaping (Warrick 1982).

One of "Tommy's" most famous quotes is from a memorandum in 1962 to Jack Wagstaff, Campus Architect: *Among all the natural features which make the site (UCSC) both provocative and difficult, it is the size of the redwood groves which must concern us the most... They are, therefore, to be thought of less as trees to enhance, screen and shelter buildings (although this they will do), but more as great vertical elements of the topography having form, mass and density against which to compose the architecture. The problem is more like building at the foot*

*of cliffs or in the Pinnacles National Monument.*

The master plan team under the guidance of the UCSC Campus Planning Committee, prepared the first Long Range Development Plan (LRDP) during 1962-1963. The 1963 LRDP was based on a residential college concept, with emphasis placed on undergraduate education. The campus was planned to grow large and diverse. The projected enrollment by 1990 was to be 27,500 students, based on the post-war "baby boom" and migration of people into California. The campus would eventually consist of fifteen to twenty residential colleges and ten professional schools surrounding a central campus core of academic and science centers. The Plan provided for the campus to grow out from the central core in satellite fashion.

The 1963 LRDP was revised by the 1971 LRDP. This new Plan carefully examined the projections of construction and student enrollment. The 1971 LRDP envisioned a simpler campus fabric than the 1963 Plan, and was not as architecturally specific, emphasizing planning and carefully phasing development to the year 2000. The 1971 LRDP still called for student enrollment of 27,500. The Plan also identified three large areas, Inclusion Areas, to accommodate activities that would provide facilities or services advantageous to the functioning of the University community. The plan also identified Natural Landscape Preserves and Open Meadow Preserves,

which were to remain undeveloped, and small Reserve Areas, where development could occur if approved by The Regents.

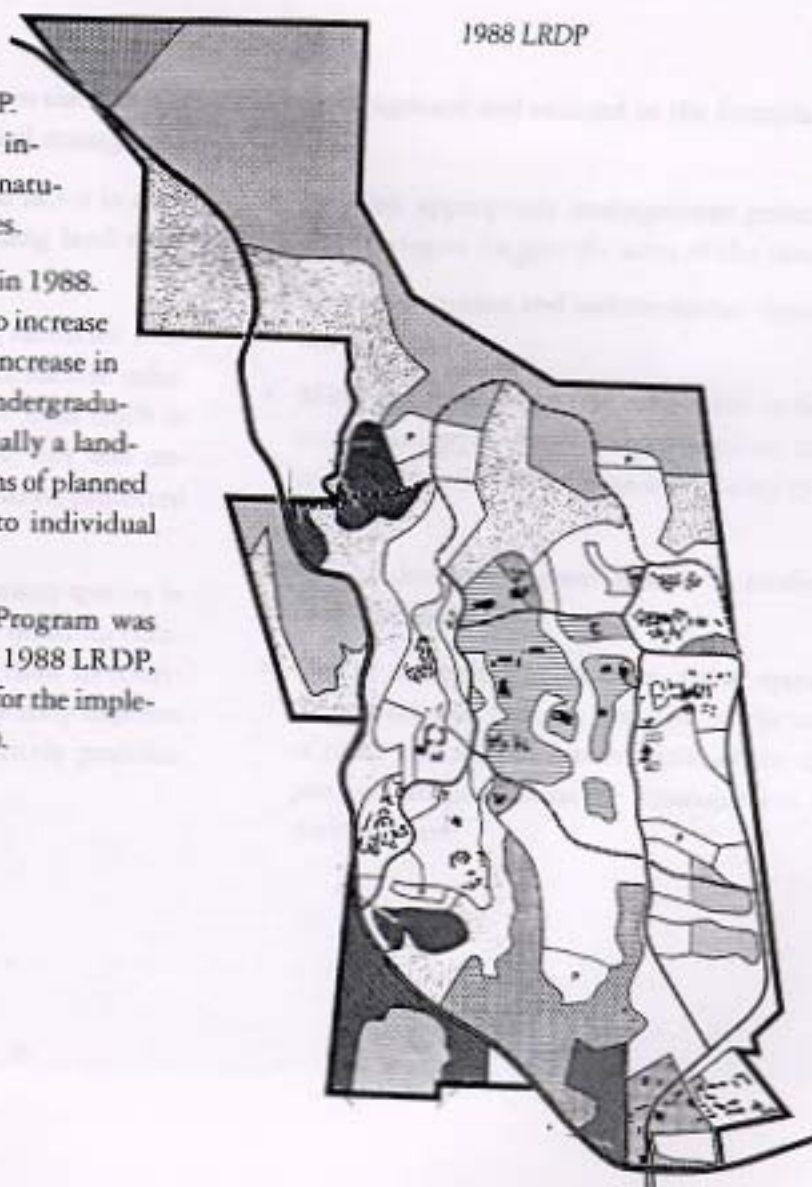
The 1971 LRDP was revised by the 1978 LRDP. This Plan set a framework that limited growth more than either of the previous Plans and made the moderate growth much more dense. This Plan identified building sites for a few new facilities needed to meet the needs of the small enrollment of 7,500 students. Like the 1971 LRDP the 1978 LRDP identified the three large Inclusion Areas and added a fourth. Due to budget cutbacks and reduced enrollment, many of the proposed building sites were eliminated and much of the campus was identified as Natural Resource Areas.

The UCSC Campus Natural Reserve was established as the Environmental Reserve in the subsequent 1988 LRDP. This land was set aside for formal and informal research and teaching about the natural processes of ecological communities.

The most recent LRDP was completed in 1988. This Plan calls for student enrollment to increase to 15,000 by the year 2004-5 and an increase in the breadth of studies available to undergraduates and graduates. The Plan is essentially a land-use plan which identifies general patterns of planned land use ranging from campus-scale to individual projects.

In 1993 the LRDP Implementation Program was written to clarify the vision behind the 1988 LRDP, develop the Plan, and develop a process for the implementation of the Plan (LRDPIP 1993).

Besides the various documents written over time and their respective committees, there have been other influential campus committees concerning landscape issues. For example the 1980 Ad Hoc Campus Land Use Committee, later the Campus Land Use Policy Committee (CLUPC), directly advised the Chancellor on land use and management policies. In 1981 the Committee wrote the Campus Land Management Plan. CLUPC was responsible for helping to establish the Campus Natural Reserve and other important land use policies. The CLUPC was disbanded in 1993. The most recent land use committee, the Campus Land Use Management Advisory Committee (CLUMAC) was established in 1995.



# 3

## GUIDING PRINCIPLES FOR LANDSCAPE MAINTENANCE

*It is desirable to maintain, and where possible, to restore and enhance the condition of the natural systems of the UC Santa Cruz campus landscape. This must be undertaken with the recognition that UC Santa Cruz is a fully functioning, major university campus, and that planning and management affecting the campus landscape must seek to achieve a balance between the functioning of ecological systems and the human activities necessary to achieve the mission of the University.*

*James Pepper, Professor Emeritus, Environmental Studies*

The following principles, given in the LRDPIP, should be recognized and utilized in the formulation of guidelines for campus land management:

- Human safety must be a critical factor in decision making processes concerning land management strategies.
- Minimize disturbance—both facilities construction and ad hoc disturbance such as informal paths—in sensitive habitat areas (such as seep zones, raptor nesting sites, rare and unusual flora, Campus Natural Reserve, protected landscapes, etc.).
- Utilize locally collected, indigenous species in landscaping beyond the edge of building complexes; limit the use of exotic flora to courtyards and areas within or immediately adjacent to building complexes; and strictly prohibit invasive exotic plantings.
- Develop appropriate management principles and strategies for specific areas of the campus.
- Minimize erosion and sedimentation throughout the campus.
- Minimize impacts to tree root-zones in facilities planning, design, and construction; maintain healthy trees rather than attempting to save all trees.
- Utilize drought tolerant species in landscape plans for facilities.
- Utilize ecological approaches, those management strategies that are sensitive to the needs of plant and animal communities of the campus, in campus landscape management and maintenance.

# 4

## UNDEVELOPED CAMPUS LAND MANAGEMENT

*The campus may be loosely divided into two sections: undeveloped and developed. The undeveloped campus refers to that part of the campus that has not been directly built on but still may have anthropogenic influences, may have a path through it and is slightly maintained or not maintained by the campus Grounds Department. The undeveloped areas are divided into three sub-groups, following the LRDPIP's example, the meadows, forests, and canyons. The developed campus refers to that part of the campus which has buildings on it, has extensive anthropogenic influences, and is maintained more heavily by the campus Grounds Department.*



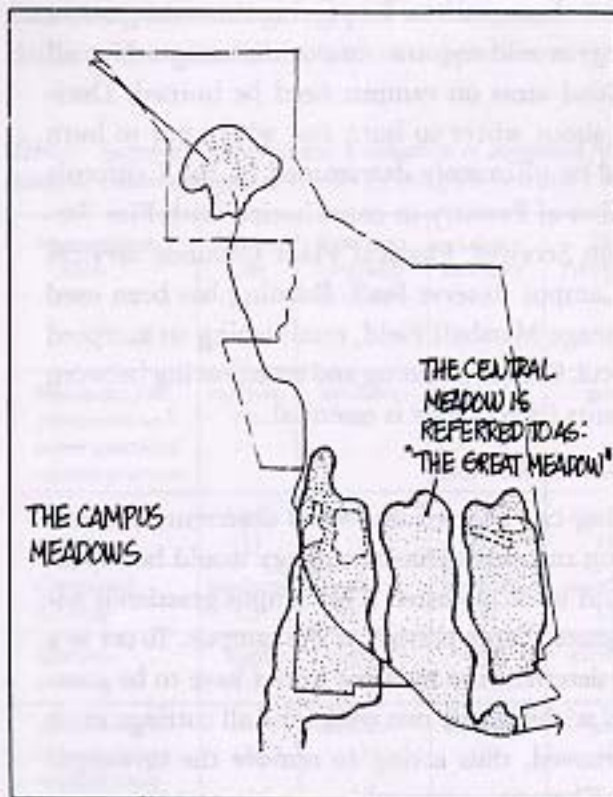
4

# Undeveloped Campus Land Management



# MEADOWS

*The meadows require management for fire control, coastal scrub succession, weed containment, and promotion of native grasses. Management may consist of monitoring of grazing, controlled burning, mowing practices, and aesthetic decision policies. Managing the grasslands allows for the protection and preservation of a rare plant and animal community. There are various types of grassland habitats on the campus, each responding in various ways to management practices. Three broad types are the coastal prairie in the mima mound areas, the meadows within the forested areas, and the great meadow. The grasslands consist of European naturalized annual grasses, native perennials and annuals, and coastal scrub species. The meadows are an area that the campus community wishes to see restored and preserved.*



LRDPIP 1993

## LANDSCAPE MANAGEMENT PROGRAM GOALS:

1. Outline the LRDPIP Guidelines concerning meadow care.
2. Define current management practices.
3. Present tools to be used in meadow management strategies.
4. Present relative cost-benefit recommendations.

## 1. LRDPIP GUIDELINES:

- Plant succession should not be allowed to change the overall visual character of the meadows. Campus expertise, such as the Grounds Department staff, Arboretum staff, Natural Reserves staff, and faculty, should be utilized in developing a restoration and management program for the meadows (3.2:13).<sup>†</sup>
- Non-native or "exotic" plant species should be limited to the developed areas (adjacent to or defined by buildings) (3.3:7).
- The grasslands between the Farm and High Street and east of the Arboretum eucalyptus grove should be maintained [Inclusion Area D] (7.5:2).
- Restore/reconstruct the ecotone between the lower campus grasslands and the forest edge along the southern boundary of the developed core (A.3:19).

## 2. CURRENT MANAGEMENT

The Grounds Department currently employs the following meadow management practices: mowing, burning, and cattle grazing. The perimeters of the grassland areas, throughout the campus, are mowed up to the fence line. This practice serves as part of the campus's fire prevention program, but also for safety (automotive visibility) and aesthetic reasons.

<sup>\*</sup> LRDPIP Guidelines throughout this document have been paraphrased and are noted by page and guideline number, i.e., page 3.2, guideline 13.

<sup>†</sup> The campus community has determined (for the preservation of a plant community and for aesthetic reasons) that management practices preventing succession to coastal scrub shall be used in the campus meadows.

Burning of the upper campus meadows has continued to enhance the diversity of the habitat and reduce spreading of weeds. Grazing continues in two areas (about 165 acres) on campus for both fire prevention and grassland enhancement. Timing of cattle on campus is significant as an effective weed removal technique; by having cattle here in mid-spring, the animals eat non-native annual grasses before they are able to disperse their seed.

### 3. MANAGEMENT STRATEGIES

The following practices may be used in solo or concert to serve the needs of the particular type of grassland, as well as safety and aesthetic concerns:

- minimum fire prevention and safety practices/current practices
- rotational grazing
- controlled burning
- intensive mowing
- monitoring
- reseeding

### 4. MANAGEMENT TOOL RECOMMENDATIONS (PLEASE REFER TO TABLE 1)

#### MINIMUM FIRE PREVENTION AND SAFETY PRACTICES/CURRENT PRACTICES:

Employing this management strategy would be the least expensive. The only money and labor that would be utilized would be to mow from the road to the fencing along the major roads of the campus, burn portions of the campus meadows, and continue with the current cattle lease. This would be consistent with what is currently being done. This strategy takes into account human safety, fire prevention strategies, and is consistent with current aesthetic concerns.

#### ROTATIONAL GRAZING:

Employing this management strategy would require a specific grazing plan and careful monitoring. Caution needs to be exercised in deciding on time of year to graze, where to graze, and how to control cattle movements. Rotational grazing can create diverse floras by grazing different parts of the area in succession. By regulating the number and type of animals and the time of grazing, the more aggressive and

dominant grasses may be kept in control. For efficient operation of rotational grazing, portable solar electric fences could be used. The number of fences and cost would increase with the complexity of the rotational system (Duffey *et al.* 1974). Grazing can be diversified by timing, intensity, number and type of animals. Cost and labor would vary depending on the specific grazing plan adopted.

#### CONTROLLED BURNING:

Properly timed burning of grasslands encourages growth of native annuals and perennials and deters weeds and non-natives. Employing this management strategy would require campus discussion. Not all grassland areas on campus need be burned. Decisions about where to burn and where not to burn would be ultimately determined by the California Division of Forestry in consultation with Fire Prevention Services, Physical Plant Grounds Services and Campus Reserve Staff. Burning has been used to manage Marshall Field, establishing an accepted protocol. Careful planning and coordinating between the units listed above is essential.

#### INTENSIVE MOWING:

Mowing can be used as a weed deterrent, but employing this management strategy would be expensive and labor intensive. The campus grasslands encompasses a large portion of the campus. To act as a weed deterrent the mowing would have to be completed within about two weeks and all cuttings must be removed, thus acting to remove the unwanted seeds. There are some problems with intensive mowing: some areas are not accessible with large tractors and equipment; many areas have established coastal scrub species; many areas have large rocks and materials that act as homes for wildlife, but would damage the blades of equipment. The campus community would need to decide which areas of the campus would most benefit from this type of management and acquire the additional equipment and labor needed.

#### MONITORING:

Employing this management strategy would require the contracting with a grassland specialist for a one to two week period to evaluate the state of the mead-



ows and identify the weeds of significant threat outlined by the California Exotic Pest Plant Council, 210 Chestnut Ave., Sonoma, AC 95476, that are on campus. That individual would act as a consultant to recommend what type of management tools may be necessary and the timing of use of those tools. This can be an invaluable way to monitor the state of the grasslands and recognize the changes over time. It also allows for flexibility in choice of management tools.

#### RESEEDING:

This management strategy would be used in conjunction with monitoring and weed control. Seed drilling the grasslands with site specific natives

would promote the restoration of the grasslands. It would require the purchase of seed and the contracting of seed drillers and their equipment.

#### GENERAL SUMMARY

##### (PLEASE REFER TO TABLE 1)

The numbers below are relative numbers, representing a general summary. Depending on the specific site's requirements for safety, aesthetics, restoration, resources, etc., various management tools may be utilized. There is room for experimentation and pilot programs for each tool to determine which is most appropriate in particular situations. The specifics will need to be determined by the campus community.

Table 1. Summary and Numeric Evaluation of Suggested Management Tools: Each management tool has been assigned a numeric value between 1-24, with 24 being the best and 1 being the poorest tool, based on 8 different criteria.\*

Management Tools	Relative Cost	Resources - available or needed	Labor Intensity	Fire Prevention	Aesthetics	Safety and Visibility	Weed Control/ Deterrent of Coastal Scrub Succession	Promotion of Native Grass Species/ Restoration	Total
Minimum fire prevention and safety practices/ current practices	medium (2)	available (3)	medium (2)	good (2)	excellent (3)	excellent (3)	poor (1)	poor (1)	17
Intensive grazing	high (1)	needed (1)	high (1)	excellent (3)	excellent (3)	excellent (3)	good (2)	poor (1)	15
Controlled burning	medium (2)	available (3)	medium (2)	excellent (3)	good (2)	good (2)	excellent (3)	excellent (3)	20
Intensive mowing	high (1)	needed (1)	high (1)	excellent (3)	good (2)	excellent (3)	excellent (3)	good (2)	16
Monitoring to help in timing of other tools	low (3)	available (3)	medium (2)	good (2)	good (2)	good (2)	good (2)	good (2)	18
Reseeding with site specific native seeds	high (1)	needed (1)	medium (2)	good (2)	excellent (3)	good (2)	good (2)	excellent (3)	16

\* Key to Numeric values:

Relative cost: low (3), medium (2), high (1)

Resources - available or needed: available (3), needed (1)

Labor intensity: low (3), medium (2), high (1)

Fire prevention: excellent (3), good (2), poor (1)

Aesthetics: excellent (3), good (2), poor (1)

Safety and visibility: excellent (3), good (2), poor (1)

Weed control/deterrent of coastal scrub succession: excellent (3), good (2), poor (1)

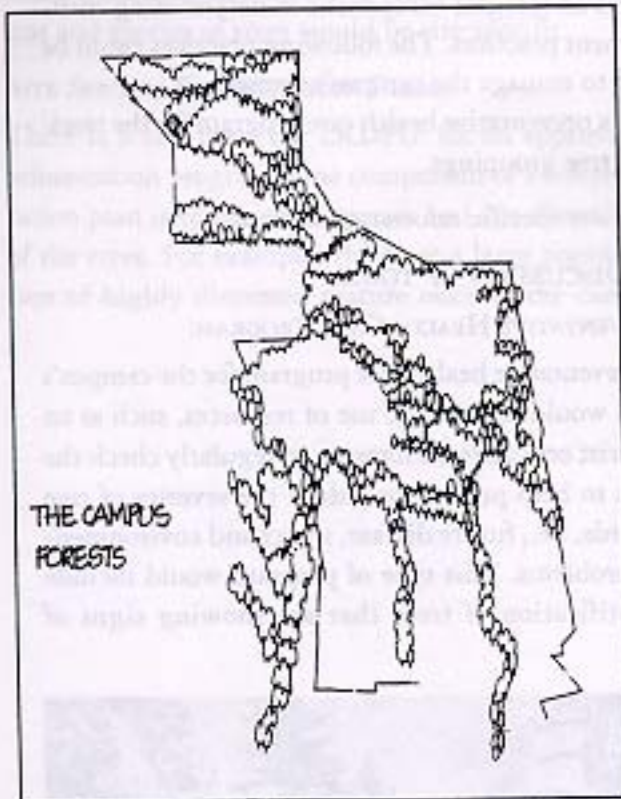
Promotion of native grass species/restoration: excellent (3), good (2), poor (1)

## UNDEVELOPED CAMPUS LAND MANAGEMENT



# FORESTS

*The campus's forest is one of the first things that comes to most people's minds when they think of UC Santa Cruz. It is one of the most prevalent features of the campus. There is concern about preserving and maintaining what forest is already in existence. The forests require management for continuing species and age diversity, health, and safety. Major tree removal has been discouraged since the beginning of the campus. As the campus faces development to 15,000 students, it must commit to a stewardship of the forest for future generations (LRDPIP 1993).*



LRDPIP 1993

## LANDSCAPE MANAGEMENT PROGRAM GOALS:

1. Outline the LRDPIP Guidelines concerning forest care.
2. Define current management practices.
3. Present tools to be used in forest management.
4. Discussion of management tools.

## 1. LRDPIP GUIDELINES:

- Maintain the ecological functioning of the larger forest landscape by retaining a lattice of tree canopies and natural understory to provide connection between canyons to the east and west (5.2:5).
- Campus expertise, such as that of the Arboretum staff, should be utilized to develop a restoration and management program for campus landscapes (3.2:13).
- Preserved trees should be of mixed species and age. Saving only mature trees does not maintain forest diversity or invest in future generations (3.3:3, A.2:3).
- Forested areas should be managed on the basis of ecological and safety principles. Management based on visual concerns should be limited to developed areas (3.3:4).
- Formulate a reforestation program and/or a forest recovery program which includes site development guidelines. For example, if trees are removed due to a building project, that project could be responsible for replanting trees within a designated portion of the forest. An alternate program would be one that identifies an equivalent acreage of weakened tree stands on campus that will be improved through a program recommended by a registered forester or arborist (3.3:6).

- Non-native or "exotic" plant species should be limited to the developed areas (adjacent to or defined by buildings). Exotic plant species should not replace existing forest landscape (3.3:7).
- Formulate an ecotone restoration program and plan to plant oak trees and associated native vegetation at the edge of the Great Meadow between the Student Center and the University House (5.5:9).
- The open space framed by Visual Arts and the future Music Facility should remain as a meadow grassland with a scattering of oaks. The oak trees could be brought down the hill to meet the edge of the Music Facility and to soften the blank walls, which face back to Visual Arts (5.5:4).

## 2. CURRENT MANAGEMENT

The Grounds Department currently does not actively manage the forests but monitors the forest environment for access, safety, and tree health. The forests are primarily left to themselves to proceed with their natural processes. However, there are many stands of trees on the campus that are not directly in a developed area, but a path or parking lot is in close association. Trees that surround parking lots and paved areas are regularly checked by a certified arborist to identify and evaluate safety risks and recommend actions. Trees are also "dead wooded," where all dead limbs and tree materials are removed from the tree as needed for long-term tree health and ongoing safety mitigation. Preliminary steps toward developing a reforestation plan have begun in the Grounds Department. The Department has already collected site specific acorns and has planted the seeds in containers. There is hope that

at least half of those planted will produce seedlings. This project is being conducted on a very small scale, about 200 seedlings. More labor and resources will be required to complete the undertaking.

## 3. MANAGEMENT STRATEGIES

The LRDPIP calls for active management of the forest on campus, maintaining the tree stands ecologically. The forest on campus consists of trees that have relatively long lifetimes as compared to humans, and this is an integral component in determining management practices. The following practices could be used to manage the campus's forests:

- a preventative health care program for the trees/tree groupings
- site specific reforestation plans

## 4. DISCUSSION OF TOOLS

### PREVENTATIVE HEALTH CARE PROGRAM:

A preventative health care program for the campus's trees would require the use of resources, such as an arborist or registered forester, to regularly check the trees to help prevent or reduce the severity of tree hazards, i.e., future disease, insect and environmental problems. This type of program would include identification of trees that are showing signs of



*A preventative health care program for the campus's trees would help prevent or reduce the severity of tree hazards.*

"stress" or weakening and note any probable causes. Thus the program would be a type of monitoring system that would provide recommendations based on a systematic inventory of trees that includes potential targets, a narrative description, site map, etc. (Appendix C provides a sample). This collection would be the basis of a comprehensive preventative health care program. A certified arborist would need to identify the most effective way to monitor the trees. Recommendations for various parts of the campus and species of trees would be site specific.

#### SITE SPECIFIC REFORESTATION PLANS:

There is a call from the LRDPIP for an approved reforestation program. One component of a reforestation plan is to maintain species and age diversity of the trees. For example, there are a large population of highly dispersed mature oaks on the cam-



LRDPIP 07/02

#### LANDSCAPE MANAGEMENT PROGRAM GOALS

1. Outline the LRDPIP Guidelines concerning campus protection.
2. Define current management practices.
3. Identification of priorities.
4. Creation of landscape campus management strategies.

#### 1. LRDPIP GUIDELINES:

- Consider the targets as part of the campus's general landscape system where sized species

pus. New, young trees need to be established now so that they will be able to take the place of mature trees as they die. This can be done by identifying maturing or mature trees and systematically replanting, in preparation for the death of the older trees. In this way the campus maintains its supply of trees, keeps the gene pool intact, and re-extends the ecotone. To maintain tree cover in areas some overly mature trees may need to be removed to allow sun and nutrients to reach younger trees trying to establish themselves. A reforestation program would address the protection of "heritage" trees, losses due to development, native plant protection, and aid in habitat conservation. The Grounds Department would need to hire a registered forester or arborist to outline the most effective general reforestation plan and give specifics on sites throughout the campus.

- Any earthfilling, grading, or reshaping within or at the edges of campus must contain that which necessary will not be disrupted, that means will not change significantly and that visual resources will be preserved (p. 15).
- The campus should be managed to ensure that water quality of wildlife corridors (p. 20).

#### 2. Current Management

Currently, the Grounds Department manages the overall faculty and student centers (p. 16-17) etc. The Department manages other areas as the budget allows and identified as a design within financial policy and the department's other goals, tree health, management, etc. It is one of many units that has little regulatory oversight (i.e., zoning, site planing, earthfilling, etc.) that occur in the campus and provide input on possible damages and how to minimize those damages.

#### 3. Planning

There are extensive profiles developed in the past years, general categories include:

- site plans
- drainage management
- site planning for best

# CANYONS

*Within the forest there is a relatively extensive canyon system that acts as an important wildlife corridor. This system helps to define the colleges from the central academic core (LRDPIP 1993). The 1988 LRDP states that as the canyons are part of the protected landscape, stormwater runoff should be controlled in a way to avoid erosion, and temporary uses that physically disrupt the canyon landscape should not be allowed to occur. The canyon system throughout the campus needs to be managed to mitigate deteriorating conditions from increased encroachment by pathways, roads, buildings, mountain bikers, joggers, deer over-browsing and erosion due to problematic drainage.*



LRDPIP 1993

## LANDSCAPE MANAGEMENT PROGRAM GOALS:

1. Outline the LRDPIP Guidelines concerning canyon protection.
2. Define current management practices.
3. Identification of problems.
4. Discussion of various canyon management strategies.

## 1. LRDPIP GUIDELINES:

- Consider the canyons as part of the campus's protected landscape system whose visual quali-

ties and ecological values will be protected for future generations (1.7:3).

- Stormwater runoff should be retained and released in a way that would avoid erosion or damage to visual resources within the canyons (3.5:2).
- Any earth filling, grading, or reshaping within or at the edges of canyons must ensure that wildlife corridors will not be disrupted, that erosion will not increase significantly, and that visual resources will be protected (3.5:3).
- The canyons should be managed to ensure their continued use as wildlife corridors (3.5:6).

## 2. CURRENT MANAGEMENT

Currently, the Grounds Department maintains the canyons for safety and aesthetic concerns (i.e. litter). The Department removes fallen trees in the event that they are identified as a danger towards human safety and also disassembles tree swings, tree houses, encampments, etc. It is one of many units that has input capabilities on events (i.e., running, cycle racing, horse riding, etc.) that occur in the canyons and provides input on possible damages and ways to minimize those damages.

## 3. PROBLEMS

There are extensive problems that occur in the canyons; general categories include:

- sink holes
- drainage management
- over-browsing by deer

## UNDEVELOPED CAMPUS LAND MANAGEMENT

- trash collection
- taking trees down that are safety hazards
- ad-hoc path clearance
- proliferation of non-native plant species
- joggers, mountain bikers, special events

### 4. VARIOUS CANYON MANAGEMENT STRATEGIES.

#### SINK HOLES, DRAINAGE MANAGEMENT, AND OVERBROWSING BY DEER CREATING EROSION PROBLEMS:

The Campus Drainage Plan 1988 by Haro, Kasunich, and Associates, Inc. (Appendix A of the 1988 LRDP) thoroughly discusses specific temporary and permanent erosion control methods that include preventing the over sedimentation of sink holes. A specific implementation plan and resource allocation is required to follow the recommendations.

#### TRASH COLLECTION:

Intensive trash collection in the canyons twice a year and requiring all special events to pick up and remove all their trash would maintain the canyons as relatively clean. This would require additional resources for the Grounds Department by establishing an implementation program in order to determine what time of year trash collection should be conducted. Weather conditions, number of students on campus, and factors affecting the natural system would need to be taken into account. Summer and winter vacations may be a preferable time.

#### TAKING TREES DOWN:

The canyons reside within the forested areas. Therefore tree maintenance in these areas would be maintained as forest. (Please refer to the Forest section of this document.) It should be noted that some of the campus main infrastructures (storm drains, bridges, etc.) are located in the canyons and access for periodic maintenance is required.

#### AD-HOC PATH CLEARANCE:

If an ad-hoc path obstruction is identified as being hazardous by the Grounds Department or by Environmental Health and Safety, action will be taken. The canyons are to be maintained as wildlife corridors. If there is extensive management of these areas for humans the areas may be less effective as wildlife corridors. A balance must be found between human safety and wildlife use.

#### PROLIFERATION OF NON-NATIVE PLANT SPECIES:

The canyons act as major water ways for campus drainage. The water carries with it all the sediment and materials it collects along its way. Often seeds from non-native plants are carried down the canyons and eventually establish themselves. Management of these non-natives requires the collaboration of the Grounds Department, the Natural Reserves, the Farm, and Arboretum. Specific responsibilities, guidelines, actions, etc., ought to be established. A preventative approach to ridding the canyons of this proliferation begins with this collaborative effort. Resources from the various units could be devoted to such a program, establishing priorities within a phased plan.

#### JOGGERS, MOUNTAIN BIKERS, SPECIAL EVENTS:

Current campus policy allows joggers and some special events within the canyons, but does not allow off-road bikes. Mountain bikes are restricted to the fire roads during dry season only. This policy should be enforced to protect the canyons. Educating the campus community is an effective way to deter damage to the canyons by joggers, mountain bikers, and special events. Special events should continue to solicit the opinion of the Grounds Department on the potential damage to the canyons. The campus may also decide to prohibit any type of travel through the canyons to protect the canyons as wildlife corridors.

## LANDSCAPE ARCHITECTURE

# 5

## DEVELOPED CAMPUS LAND MANAGEMENT

*The campus may be loosely divided into two sections: developed and undeveloped. The developed campus refers to that part of the campus which has buildings on it, has extensive anthropogenic influences, and is maintained more heavily by the campus Grounds Department. These areas include the colleges, academic, and state buildings. The undeveloped campus refers to the areas of the campus that have less anthropogenic influences.*





# LANDSCAPED AREAS

*There are various types of landscaping care required on this campus ranging from management of natural areas like meadows to landscaped areas in colleges and building clusters. Developed landscape care on the UC Santa Cruz campus entails an array of different duties, including management of flower gardens, planters, lawns, groundcovers, trees, shrubs, erosion control, pest control and weeds, irrigation, general sanitation, maintenance of roads and other hard surfaces. The following discussion primarily centers on development of general guidelines for decision making processes in developed landscape areas. Specifics on cleaning hard surfaces, turf care, planning schedules, fertilization, plant care, oak tree care, planting approval, safety, small power equipment, irrigation, pest control, erosion control, etc., are discussed within other sections of this document or within the Grounds Department Procedure Manual (1992). This section of the Landscape Management Program serves to provide a framework for making general developed landscaping decisions.*

## LANDSCAPE MANAGEMENT PROGRAM GOALS:

1. Outline LRDPIP Guidelines concerning landscaped areas.
2. Outline LRDPIP Guidelines concerning site amenities.
3. Discussion of intra-campus boundaries.
4. Discussion of plant palette and data base.
5. Analyzing landscape sites.
6. Discussion of landscape theme in building clusters and guideline parameters.
7. Discussion of landscape theme throughout campus and guideline parameters.
8. Final recommendations.

### 1. LRDPIP GUIDELINES - LANDSCAPING:

- Utilize approaches that take into account affected organisms and their environment in campus landscape management and maintenance decisions (A.3:20).
- Design exterior landscaping to relate to the surrounding native plant community utilizing native plants or in limited locations, ornamentals; choose predominantly drought-tolerant species, requiring little or no irrigation for ex-

terior landscaping; limit the use of non-native species to non-invasive species in order to preserve natural floral diversity (1988 LRDP 52, 5.7:4, 5.9:2, A.3:19).

- Trim vegetation to maintain an overhead clearance of seven feet minimum (8.6:5).
- Close ad-hoc trails and access ways. Actively seek funding to restore the closed trails with site specific native plants. Use boardwalk or permeable paving materials for pedestrian ways to reduce impact on the wildlife and landscape (8.7:b,c).
- The landscape within which a building cluster or college is set needs to respect the larger campus landscape. Spaces defined by buildings can accept plantings not native to the campus, which may require more water and more care (6.2:3, 7.9:3).

### 2. LRDPIP GUIDELINES - SITE AMENITIES:

- Careful design attention is essential for all required fences so that they provide a unifying design (7.7:1, 7.9:4).
- Signage represents a great opportunity for achieving visual unity, coordinated signage that is part of the family of well-scaled wood signs

\* "Developed landscaped areas" from here on will be referred to simply as "landscaped areas."

with white lettering that are found throughout the campus. The entry buildings, bus shelters, and information buildings should again be of a family that relates to the ranch aesthetic (7.7:3).

### 3. INTRA-CAMPUS BOUNDARIES

The campus can be loosely divided into three different land types: developed landscapes that are actively maintained, transition zones that are minimally maintained, and native vegetation areas of forests, grasslands, coastal scrub, etc., that are not maintained. These three areas do not have strict boundaries. Forested areas that are not intentionally maintained by the campus may have paths running throughout them that are maintained. It is therefore necessary to be flexible in decision making processes. The college system is integral to this campus, and it must be recognized that residential areas are adjacent to classrooms and faculty offices. Maintenance of these adjoining boundaries presents challenges of varying complexity.

### 4. PLANT PALETTE

A campus plant palette is not easily defined. The campus encompasses a host of different soil types and microclimates. It is difficult to look in a book to determine the proper plant to place in an area that will fit criteria for plant materials previously defined by the campus (deer and pest resistant, non-invasive, drought tolerant, etc.). Development of a database ought to be undertaken by the Grounds Department as a method of developing a plant palette. Please refer to number 8.

Specifically a plant palette ideally would incorporate all criteria, but this would create a fairly restricted palette. Therefore choosing plant materials that fit a few of the criteria allows the campus a more diverse array of plants to choose from. How these decisions should be made is discussed in sections 6 and 7.

### 5. ANALYZING LANDSCAPE SITES

Analyzing and planning for landscape sites (Chengrian 1995) by Grounds Department employ-

ees may include some or all of the following topical areas. How particular decisions will be made is discussed below in section 6 and 7.

- a. site boundaries - clarify the areas under discussion
- b. utility locations - locate and identify any water, phone, cable, etc. lines
- c. drainage - inspect the grade around existing structures and paved areas, noting storm water deposition from gutters and down spouts; determine whether grade or drainage system will need alteration
- d. erosion control - determine any need for retaining walls, terracing, armoring, sodding, or plantings to minimize erosion damage
- e. water sources - ensure adequate water source - a current irrigation system, one to be installed or hand watering
- f. soil analysis - define soil characteristic, i.e., pH, texture, depth, and level of compaction
- g. exposure - a critical factor in plant selection is exposure to sun and shade and wind - are there walls or paved areas near by that reside near the area?
- h. site access - establish access for equipment and deliveries
- i. communication - determine who is/are the customer/s; develop a plan that satisfies the maintenance, cost, and aesthetic concerns of the customer
- j. aesthetics and plant material - establish a theme for the area and make sure it is consistent with the overall college theme

### 6. BUILDING CLUSTER THEME

Decisions concerning landscape areas depend slightly on who "owns" the buildings—are they state or non-state funded buildings and areas? Planting proposals need to be sensitive to the overall theme of an area; piecemeal decision making processes are unacceptable. Themes may be defined by a hired

consultant or the Grounds Department. Determination of plantings is made by either (a) replacing damaged or dying plants following the latest landscape plan or (b) the groundskeeper and supervisor developing a new landscape plan because the "latest" landscape plan is deemed out of date. A landscape plan may be deemed out of date because the plan calls for plantings that are not appropriate for an area. There may be problems with the plantings due to deer eating them, humans stepping on them, pests killing them, weather conditions, etc. The groundskeeper and supervisor may elect to develop a plan with or without hired consultants. Plantings that are non-labor intensive, non-invasive, drought-tolerant, deer- and pest-resistant, and/or native are preferable. Specific plantings will need to be flexible to change over time due to changes in climate, pest infiltration, administration, building use, etc.

## 7. UNIVERSITY THEME

Each college and building cluster has its own unique landscaped features. Each area is free to develop its own internal themes. However, there is a need for continuity between these areas to allow for a unifying campus theme. This unification is accomplished by the maintenance of transition zones between developed areas and through site amenities.

Transition zones refer to those areas of campus that create a border between landscaped areas and natural settings. These areas are maintained minimally. Maintenance includes:

- replacement of native plants that have died in the area
- removal of volunteer plant species (i.e., exotic species like lemon trees) before they establish themselves
- litter removal
- closing of ad hoc pathways that have developed with boulders, mulching, native plantings, and/or split redwood fencing

Site amenities include choices of outdoor furniture, trash receptacles, ash urns, bike racks, bollards,

paving, light fixtures, fencing, and signage. Uniform choice of site amenities creates a unifying theme that can be found throughout the campus that still respects the uniqueness of each area. Many site amenities, such as light fixtures, pathways, bollards, and bike racks are standardized in the *UCSC Campus Standards Handbook* (please refer to Appendix A). Other items such as signage have been developed individually in each college. Campus discussion to allow for a set standard for signs would aid in creating a unifying landscape.

## 8. FINAL RECOMMENDATIONS

Each area of the campus should be free to develop internal themes while maintaining continuity of the campus. A Graphical Information System (GIS) database funded to track the plant materials used could be maintained at the Grounds Department (please refer to Figure 1). This data base could be used to track pest and deer problems, what soil types and microclimates the plant prefers, whether the plant is drought tolerant, what level of care is required, etc. Grounds Department could contract the growing of site specific plant materials for use in landscaping.

UCSC PLANT DATABASE	
Date entered	5/15/93
Planted to	Quincy Halls
Botanical name	<i>Grevillea rostrata</i> / <i>Grevillea aquilina</i>
Common name	Grey leaf fern, Frilly Grevillea
Plant location	The 2 beds under tower area in front of Carriage House
Location use	perimeter area in both beds / center area of both beds
Observations	
Problem notes	
Comments	Grevillea like fertilizer very low in phosphorus when planted and a high nitrogen with chelated iron in the spring. too much phosphorus will make leaves turn black and die.
record #	1

Figure 1 Plant database example.

# LAND MANAGEMENT STUDY FOR FIRE PREVENTION

*This study defines possible fire hazards and management opportunities within the lower and central campus areas as part of a complete urban forest plan for the campus in relation to current and future vegetation management. The desired product is a vegetation management plan which outlines techniques to develop a more "fire-safe" campus. This study pertains primarily to wildland fuels in and around the developed campus area and suggested management practices to mitigate hazards to the facilities resulting from these fuels. These management practices will be partially determined by the California Department of Forestry and Fire Protection system for assessing fire hazard in local fire jurisdictions as required by state wide legislation (Assembly Bill 337, "Bates Bill," originally known as the Fire Prevention Act of 1992). This system takes into account fuels, topography, dwelling density, weather, and other factors. These factors are combined with local knowledge of fire behavior to arrive at a numerical rating of fire hazard. Access for fire fighting equipment and available water sources affect the final fire hazard rating. This study is on file with the Grounds Department and excerpts are included in Appendix B.*



## MAINTENANCE OF TREES IN LANDSCAPED AREAS

*The campus contains thousands of trees and has over 30 different tree species. Taking into account all the various types and sheer number of trees on campus one can sense the enormity of the task of maintaining them. Over the years the campus trees have been adversely affected by high impact events. Historical uses as well as construction and landscaping have changed the soil and drainage and introduced non-native tree species in landscaped areas. The purpose of the following guidelines and descriptions is to develop and preserve the health and structure of the trees in the developed landscape and transition areas on campus. (Please refer to the Forests section for information on maintenance of other stands of trees.)*

### LANDSCAPE MANAGEMENT PROGRAM GOALS:

1. Outline LRDPIP Guidelines concerning trees in landscaped areas.
2. Outline general guidelines for tree maintenance.
3. Outline major construction impacts and methods to minimize damage to trees.
4. Outline general guidelines for planting trees next to or near buildings.

### 1. LRDPIP GUIDELINES:

- Buildings should remain below the height of surrounding trees. The public space should be designed to accommodate active uses and main entrances to facilities (5.9:6).
- The landscape within which a building cluster or college is set needs to respect the larger campus landscape. Spaces defined by buildings can accept plantings not native to the campus, which may require more water and more care (6.2:3).
- Minimize impacts to tree root-zones in facilities planning, design, and construction; maintain healthy trees, rather than attempting to save all trees (A.3:19).
- Utilize ecological approaches in all aspects of campus landscape management and maintenance (A.3:20).

### 2. GENERAL GUIDELINES

These guidelines and descriptions are presented as a working model, recognizing that trees are individually unique in structure, form, and growth response within species and age. The appropriate sections should be referred to and/or modified depending on the species, the landscape site, the intended function of the tree, the present age and condition of the tree, the desired degree of pruning, and the aesthetic concerns of the campus community. The ideas are intentionally general in order to accommodate the varying situations presented on this campus.

#### GENERAL GUIDELINES FOR TREE MAINTENANCE:

- Remove excess soil beneath the tree's dripline (refer to figure 2) to within six inches of the natural soil level and around the root crown (base of the tree), down to the top of root flair.
- Aerate the soil surface beneath the tree. Drill holes 8-12 inches deep and space them 2-3 feet apart. Holes should be placed around the tree in concentric circles and extend well beyond the dripline.
- Fertilize the tree with a slow release, high nitrogen fertilizer. Apply fertilizer in January and again in March. The general rate of application is 2-4 lbs. per 1000 square foot to root area.

- Mulch the soil surface beneath the tree with 2-3 inches of wood chips. Keep the mulch six inches away from root crown.
- Irrigate, to mitigate stress, with a soaker hose, halfway out from the trunk to the dripline, throughout the dry season, usually from May through October.
- Remove any vines that might be growing on trees by snipping the vines roots at the base of the tree.
- For Pruning please refer to Appendix D on Pruning Standards.
- Suckers are to be removed from trees.

### 3. CONSTRUCTION IMPACTS AND MITIGATION

Construction impacts to existing trees have been one of the most serious causes of detrimental change. Issues concerning grade, soil, drainage, and mechanical injury often contribute to that change. Grade changes involve the addition or removal of soil within

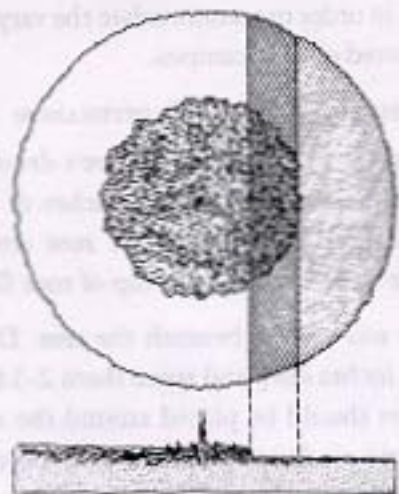


Figure 2 This sketch of a tree outlines the dripline, and the circle indicates the extent of most of the roots (Harris 1992).

a tree's dripline. Excavation can sever roots, while the addition of fill soil may suffocate them. Fill soils impede water infiltration and soil drainage, which

can lead to drought conditions or water logging. Often the soil conditions are seriously altered by construction. Entire areas around a tree are often lowered more than 6 inches and the tree may not survive unless soil is returned (Harris 1992). Grade changes that cause water to collect around a tree, especially near a trunk, are extremely detrimental to the health of a tree. Conversely, a grade that diverts a source of water that the tree depends on may cause drought stress.

Soil compaction due to frequent traffic and the operation of heavy equipment within the drip line squeezes soil particles together, thus eliminating much of the natural air space. This reduces the infiltration and storage of water and air, inhibiting root growth and the uptake of water and minerals (Harris 1992). Impermeable soil coverings such as asphalt or concrete restrict the amount of air, water, and minerals available to roots. This impairs root growth and function and can ultimately lead to their death (Harris 1992). If a hard surface is required, certain soil coverings, particularly permeable pavement (interlocking pavement) allow for water and air to reach tree roots. Root growth requires adequate food reserves, growth stimulating hormones, water and minerals. If these are available and there are no other restrictive influences or construction impacts, root growth and replacement will generally process rapidly. Low or depleted food reserves will delay root replacement. If the soil conditions have been seriously altered by construction, root replacement will be slowed or stopped. A delay from root loss will result in growth loss, dieback, or tree death. (Please refer to flow chart of Tree Preservation Interaction, Figure 3 and Table 2, Major Construction Impacts and Methods to Minimize Damage to Trees.)

As part of ongoing management practices for tree care, tree evaluation reports are written as part of the annual inspections; reports are also part of construction site impacts and potential impacts. These reports consist of location specifications, detailed narrative description, and recommendations. (Please refer to Appendix C for an example.)

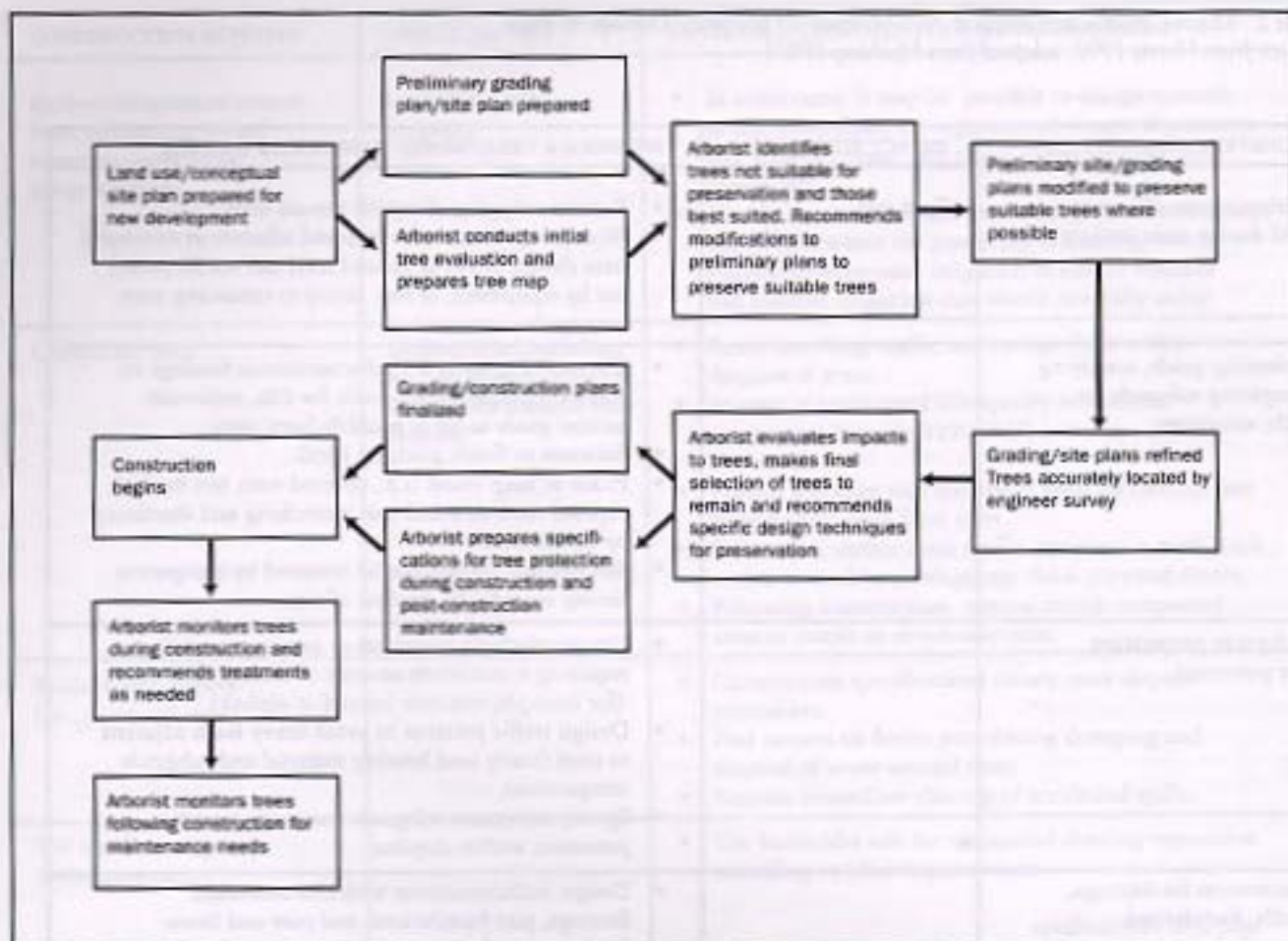


Figure 3 Flow Chart of Tree Preservation Interaction

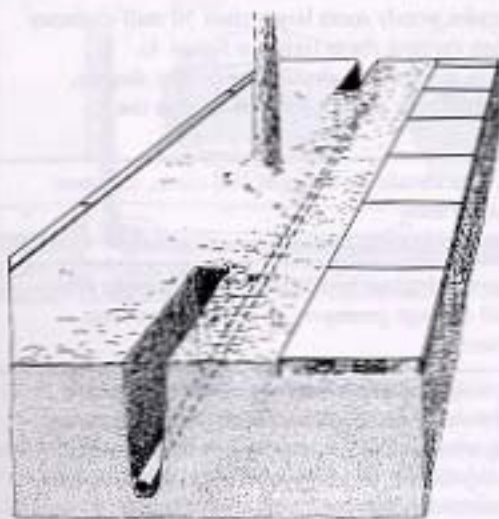


Figure 4 When major tree roots are encountered a hole is tunneled under the major roots and the trunk (Harris 1992).

#### 4. PLANTING NEAR BUILDINGS

When planting trees next to or near buildings it is important to recognize the size the tree will grow over its lifetime. Trunk diameter and tree height will vary with species.

- plant trees far enough way from building to allow for natural development
- recognize that walls and paved areas around the tree may change exposure levels and increase stress levels
- identify the ideal height and shape that complements the building; this allows for minimal pruning over time; thus the tree does not grow out of control

Table 2 Major Construction Impacts And Methods To Minimize Damage to Trees  
(Taken from Harris 1992, adapted from Matheny 1989)

CONSTRUCTION ACTIVITY	IMPACT TO TREE	METHODS & TREATMENTS TO MINIMIZE DAMAGE
Stripping site of surface soil during mass grading	Root loss	<ul style="list-style-type: none"> <li>Restrict stripping of topsoil around trees.</li> <li>Woody vegetation to be removed adjacent to remaining trees should be cut at ground level and not be pulled out by equipment, or root injury to remaining trees may result.</li> </ul>
Lowering grade, scarifying preparing subgrade for fills, structures		<ul style="list-style-type: none"> <li>Use retaining walls with discontinuous footings to maintain preparing subgrade for fills, structures natural grade as far as possible from trees.</li> <li>Excavate to finish grade by hand.</li> <li>Prune or keep moist (i.e., covered with wet burlap) exposed roots to avoid root wrenching and shattering by equipment.</li> <li>Soil beyond cut face can be removed by equipment sitting outside the dripline of tree.</li> </ul>
Subgrade preparation for pavement		<ul style="list-style-type: none"> <li>Use interlocking pavement or paving materials requiring a minimum amount of excavation (for example, concrete instead of asphalt).</li> <li>Design traffic patterns to avoid heavy loads adjacent to trees (heavy load bearing material and subgrade compaction).</li> <li>Specify minimum subgrade compaction under pavement within dripline.</li> </ul>
Excavation for footings, walls, foundations		<ul style="list-style-type: none"> <li>Design walls/structures with discontinuous footings, pier foundations, and post and beam footings.</li> <li>Excavate by hand.</li> <li>Avoid slab foundations.</li> </ul>
Trenching for utilities, drainage contractors.		<ul style="list-style-type: none"> <li>Coordinate utility trench locations with installation.</li> <li>Consolidate utility trenches.</li> <li>Excavate trenches by hand in areas with roots larger than 25 mm (1 in.) diameter.</li> <li>Tunnel under woody roots larger than 50 mm diameter rather than cutting them (refer to figure 4).</li> <li>If necessary, equipment should operate on double, overlapping, thick plywood sheets within the dripline.</li> </ul>
Various construction activities	Root injury	<ul style="list-style-type: none"> <li>Pruning cuts should be straight and clean, just past the damaged area.</li> <li>Coordinate with arborist.</li> </ul>
Injury from equipment (Mechanical injury)	Wounding top of tree	<ul style="list-style-type: none"> <li>Fence trees to enclose low branches and protect trunk.</li> <li>Report all damage promptly so arborist can treat appropriately.</li> </ul>
Pruning for vertical clearance for building, traffic, and construction equipment		<ul style="list-style-type: none"> <li>Prune to height requirements prior to construction.</li> <li>Consider maximum height requirements of construction equipment and emergency vehicles over roads.</li> <li>All pruning should be performed by an arborist, not by construction personnel.</li> </ul>

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CONSTRUCTION ACTIVITY	IMPACT TO TREE	METHODS & TREATMENTS TO MINIMIZE DAMAGE
Rechannelization of stream flow; redirecting runoff lowering water table; lowering grade	Inadequate soil moisture	<ul style="list-style-type: none"> <li>In some cases, it may be possible to design systems to allow low flows through normal stream alignments and provide bypass into storm drains for peak flow conditions.</li> <li>Usually flood control and engineering specifications are not flexible where the possibility of flooding occurs. Provide supplemental irrigation in similar volumes and seasonal irrigation that would normally occur.</li> </ul>
Compacted soils	Unfavorable conditions for root growth; chronic stress from reduced root systems	<ul style="list-style-type: none"> <li>Fence trees keep traffic and storage from within dripline of trees.</li> <li>In areas of engineered fills specify minimum compaction (usually 85%) if fill is not to support a structure.</li> <li>Provide a storage yard and traffic areas for construction activity well away from trees.</li> <li>Protect soil surface from traffic compaction with thick mulch or double, overlapping, thick plywood sheets.</li> <li>Following construction, vertical mulch compacted areas or install an aeration system.</li> </ul>
Spills, waste disposal (i.e., paint, oil, fuel)		<ul style="list-style-type: none"> <li>Construction specifications clearly state disposal procedures.</li> <li>Post notices on fences prohibiting dumping and disposal of waste around trees.</li> <li>Require immediate cleanup of accidental spills.</li> </ul>
Soil sterilants applied under pavement		<ul style="list-style-type: none"> <li>Use herbicides safe for use around existing vegetation according to label requirements.</li> </ul>

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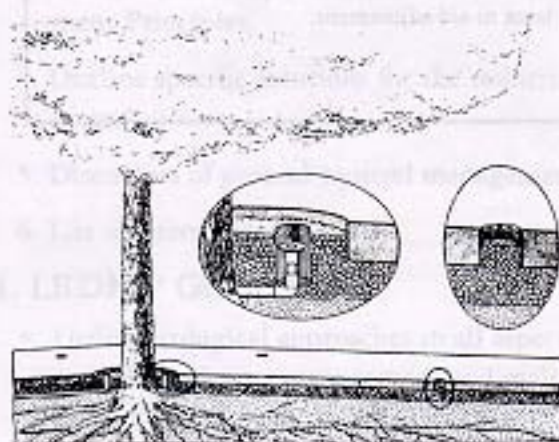


Figure 5 Pavement installation with minimum impact on a tree. Geotextile fabric is laid on carefully prepared soil surface. Aeration tubing or pipe and gravel are placed on the geotextile and covered with geotextile fabric. The aeration tubing loops can be 2 m (6 ft) apart since the gravel aids gas exchange. Each end of the tubing is attached to a metal riser (standpipe) with a protected top pointing into one of the two prevailing wind directions. The risers can be incorporated with landscape fixtures. Cement or rock base and asphalt can then be installed after the curb is in place (Harris 1992).

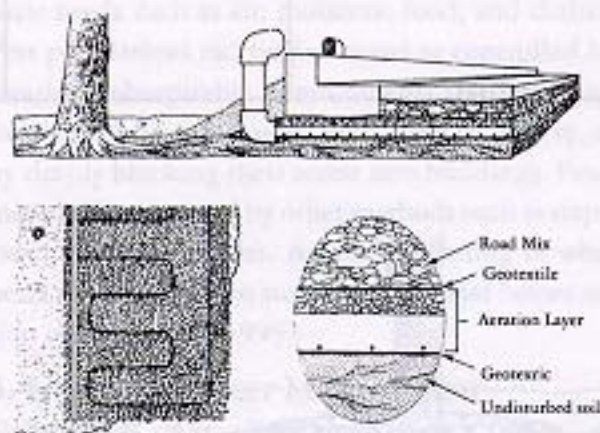


Figure 6 Most trees can be kept in good condition when paving for patios and courtyards (light traffic) is placed around them. The soil is graded to a slight slope away from the trunk, a layer of gravel is firmed in place, and the pavement installed. Irrigation bubblers at the tree trunk (left inset) and vents in the pavement at the dripline (right inset) should take care of irrigation and aeration (Harris 1992).

CONSTRUCTION ACTIVITY	IMPACT TO TREE	METHODS & TREATMENTS TO MINIMIZE DAMAGE
Impervious pavement over soil surface		<ul style="list-style-type: none"> <li>Utilize pervious paving materials (for example, interlocking blocks set on sand).</li> <li>Install aeration systems under impervious paving (refer to figures 5 and 6).</li> </ul>
Back-up of underground flow; at raised water table	Excessive moisture	<ul style="list-style-type: none"> <li>Fills placed across drainage courses must have culverts the bottom of the low flow so that water does not back up before reaching the elevation of the culvert.</li> <li>Study the geotechnical report for ground water characteristics to see that the walls and fills do not intercept underground flow.</li> </ul>
Lack of surface drainage that away from tree		<ul style="list-style-type: none"> <li>Where surface grades are to be modified make sure water will flow away from the trunk, that is, that the trunk base is higher than surrounding soil.</li> <li>If the tree is placed in a well, provide drainage from the bottom of the well (refer to figure 7).</li> </ul>
Compacted soils (many micropores but few macropores)		<ul style="list-style-type: none"> <li>Auger or water-jet aeration holes improve drainage.</li> </ul>
Irrigation of shallow-rooted moisture plants requiring frequent irrigation		<ul style="list-style-type: none"> <li>Avoid landscaping under trees sensitive to high and poor aeration or utilize plants that require little or no irrigation.</li> </ul>
Thinning stands, poorly removal of undergrowth	Increased exposure	<ul style="list-style-type: none"> <li>Preserve in groups or clusters species that perform when exposed.</li> <li>Maintain the natural undergrowth.</li> </ul>
Reflected heat from surrounding hard surfaces		<ul style="list-style-type: none"> <li>Minimize use of hard surfaces around trees.</li> <li>Monitor soil moisture needs where water use is expected to increase.</li> </ul>
Pruning		<ul style="list-style-type: none"> <li>Carefully thin tree stand; paint exposed bark with white latex to aid adjustment.</li> </ul>

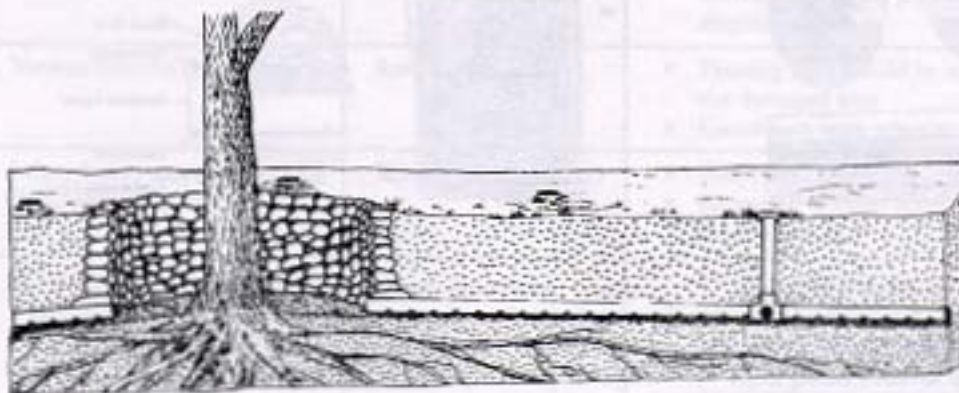


Figure 7 Aeration pipe laid on a ribbon of gravel radiating from a dry well 1 to 1.5 m (3-5 ft) in diameter provides gaseous exchange until new roots can grow in to the fill soil (Harris 1992).

# INTEGRATED PEST MANAGEMENT

*Integrated Pest Management (IPM) is an effective and environmentally sensitive approach to pest management that relies on a combination of practices. IPM programs use current, comprehensive information on the life cycles of pests and their interactions with the environment. This information is used to manage pest damage by the most environmentally sensitive means and with the least possible hazard to people, property, and the environment. IPM programs take advantage of all pest management options possibly including, but not limited to, the judicious use of pesticides (EPA 1993).*

*In any pest management process a decision needs to be made about the economic and/or aesthetic thresholds. An economic threshold is the pest density at which management action should be taken to prevent an increasing pest population from reaching the economic injury level (Pedigo 1989). The economic injury level (EIL) is the lowest number of pests that will cause economic damage (Pedigo 1989). And economic damage is the amount of pest induced injury that justifies the cost of applying pest control measures (Pedigo 1989). An aesthetic threshold is the point where management action should be taken before the aesthetic injury level. The aesthetic injury level (AIL) is the lowest number of pests that will cause aesthetic damage. In agriculture it is usually economic; in landscape management it is usually aesthetic. Different areas of the campus have different thresholds.*

## LANDSCAPE MANAGEMENT PROGRAMS

### GOALS:

1. Outline the LRDPIP guidelines concerning IMP.
2. Define a pest.
3. Define and formalize University Pest Management Principles.
4. Outline specific solutions for the reduction of pests.
5. Discussion of ground squirrel management.
6. List of references.

### 1. LRDPIP GUIDELINES:

- Utilize ecological approaches in all aspects of campus landscape management and maintenance (A.3:20).

### 2. DEFINING A PEST

One definition of a pest is any species that interferes with human activities, property, health, or is objectionable (Pedigo 1989). When dealing with pest management many people think of pesticides. This is why use of pesticides has become so widespread; there is a deceptive belief that one can spray away all pest problems. As more people become aware of

the many hazards and shortcomings resulting from primary reliance on pesticides, new opportunities for using less toxic approaches have materialized (Daar *et al.* 1992). IMP is one of those approaches.

Understanding pest needs is essential to implementing IPM effectively. Pests seek habitats that provide basic needs such as air, moisture, food, and shelter. Pest populations can be prevented or controlled by creating inhospitable environments, by removing some of the basic elements pests need to survive, or by simply blocking their access into buildings. Pests may also be managed by other methods such as traps, vacuums, or pesticides. An understanding of what pests need in order to survive is essential before action is taken (EPA 1993).

### 3. UNIVERSITY PEST MANAGEMENT PRINCIPLES (ADAPTED FROM THE ENVIRONMENTAL PROTECTION AGENCY)

Structural and landscape pests can pose significant problems to people, property, and the environment. Pesticides can also pose risks to people, property, and the environment. It is therefore the policy of the University to incorporate IPM procedures for control of structural and landscape pests.

Approved pest management plans (regulated by the Agriculture Department and Campus Environmental Health and Safety) should be developed for the site and should include any proposed pest management measures. Pests will be managed to: reduce any potential human health hazard or to protect against a significant threat to public safety; prevent loss of or damage to campus structures or property; prevent pests from spreading into the community or to plant and animal populations beyond the site; enhance the quality of life for students, faculty, and staff.

IPM procedures will determine when to control pests and whether to use mechanical, physical, chemical, cultural, or biological means. IPM practitioners depend on current, comprehensive information on the pest and its environment and the best available pest control methods. Applying IPM principles prevents unacceptable levels of pest activity and damage by the most economical means and with the least possible hazard to people, property, and the environment.

In addition, information concerning pest problems with particular species of plants will be added to the Grounds Department data base, so that pest populations may be monitored efficiently.

Groundskeepers are educated and trained in the principles and practices of IPM and the use of pesticides that have been approved by the Environmental Health and Safety office. They must follow regulations and label precautions. Applicators are required by the Department of Food and Agriculture to be trained annually in pesticide use. Please refer to Appendix F for outline of UCSC Grounds Pesticide Training Program.

#### 4. SPECIFIC SOLUTIONS FOR THE REDUCTION OF PESTS

- *Selection of plants* or structural materials that are resistant to pests, supportive of natural controls, and enhance ecosystem diversity and processes. Elimination of plant species that are repeatedly attacked by pests.
- *Habitat modification* for purposes of reducing pest harborage, food, and other requirements.
- *Human behavioral changes*, including: modification of horticultural or other resource management practices such as watering, fertilizing, pruning, mulching, cultivating, waste management, and human food storage; and modifications of aesthetic judgments regarding cosmetic damage and visual presence of certain animal species (such as insects).
- *Physical controls*, such as manual picking, weeding, etc., barriers, traps, and mechanical action. For example designing tennis courts, parking lot edges, and similar surfaces to extend pavement 6 to 8 in. out beyond the fence line, so weeds can easily be mowed and will not need to be sprayed (please refer to Figure 8).

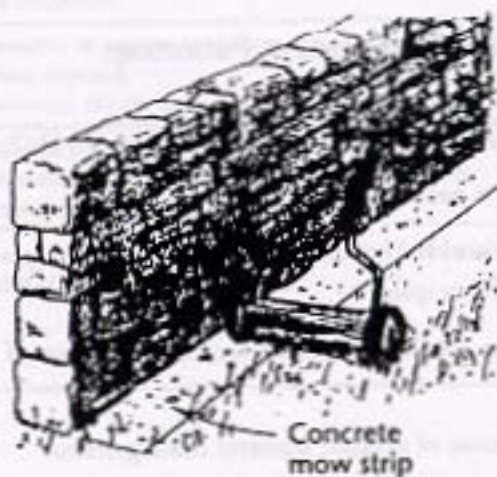


Figure 8 Construction of a concrete mow strip along retaining walls creates an easy weed control method.

- *Biological controls*, including: conservation of the pest's natural enemies through proper selection of material and timing and placing of treatments; augmentation through the introduction of the pest's natural enemies or commercially available pathogens; inoculation by reintroduction of effective natural enemies that will not survive over winter; and importation of host-specific natural enemies of exotic invaded pests.

- *Chemical controls*, including: pheromones and other attractants to lure and/or confuse the pest; juvenile hormones that arrest pest development (List from Daar 1983).

## 5. GROUND SQUIRREL MANAGEMENT

Rangeland pest control, particularly ground squirrels, has been a discussion of great debate on this campus. There have been various ground squirrel management proposals for control on campus:

- *Ground Squirrel Management: Controversy and Recommendation*, Roy Seidenstein, 1981
- *Ground Squirrel Management Plan, U.C. Santa Cruz Campus*, Terrell P. Salmon, 1982
- *UCSC Ground Squirrel Management Plan*, CLUPC Subcommittee on Ground Squirrel Management, 1983
- *Ground Squirrel Management Supplement*, Margaret Fusari, 1983
- *Ground Squirrel Control at UCSC*, Thomas Wittman, 1991

Tools for ground squirrel control suggested in the reports above are discussed in great detail in the reports. Please refer to flow charts for IMP plan to control ground squirrels, Figures 9, 10, and 11, and Figure 12 which show the yearly activities of the California ground squirrel in relation to control methods. The following is a general summary of the tools:

### • HABITAT MODIFICATION

Habitat should be less attractive to ground squirrels by removing rock outcrops, brush piles, fallen logs, and other natural debris that are structural supports for burrow systems and perches for predator detection (Salmon 1982). Vegetation recovery, by elimination of grazing and mowing, could potentially increase predator effectiveness. This management tool is labor intensive and time consuming and may pose certain fire prevention and safety concerns.

### • PREDATOR REGULATION

Increasing the number of raptors, cats, and dogs on campus would increase predation. This management tool is unlikely to work unless the campus decides to allow domesticated cats and dogs back on campus, and even if there were more predators there would not be a significant reduction in ground squirrels.

### • FENCING

There is discussion of squirrel-proof electric fencing in the *UCSC Ground Squirrel Management Plan* (please refer to that document for specifications). The fence would be expensive initially, but the long run savings may offset it. The report mentioned that the fencing could possibly be 100% effective in keeping ground squirrels out of areas of any size.

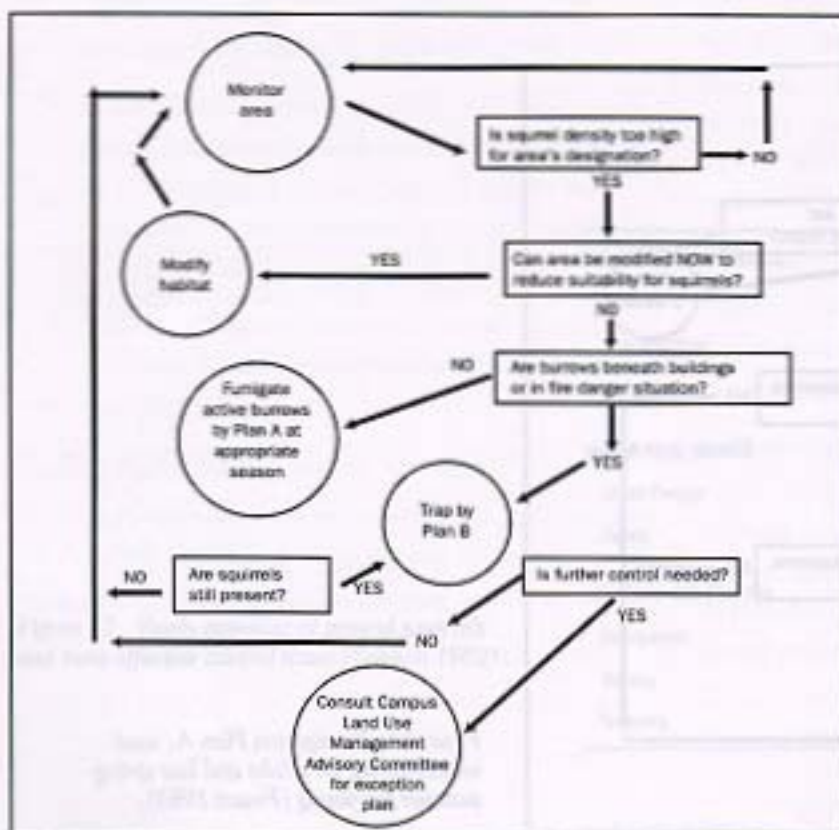


Figure 9 IPM plan for UCSC ground squirrel management and control (Fusari 1983).

#### • TOXIC FOOD BAITS

Toxic food bait consists of poisoning grains with anti-coagulants and leaving them out for the grounds squirrels to eat. To date this management technique has been considered a risk to burrowing owls, pets at the Faculty Housing, and small children, as well as predators.

#### • LIVE AND KILL TRAPS

Traps are practical devices for controlling ground squirrels in small areas where the number of squirrels are moderate. Live-catch traps as well as kill traps are effective in various situations, but present the problem of where to dispose the dead squirrels.

#### • SHOOTING

Shooting with an air rifle is an effective means of controlling small populations or populations in specific areas. The advantage to this is absolute selection of target species (Wittman 1991). But after the first shot there is an interim period of waiting for the squirrels to come out again.

#### • FUMIGATION

Ground squirrels can also be killed in their burrows by several types of toxic gases. Fumigation cannot

be used beneath buildings. It is only effective in the spring when gas is contained within the burrow system and does not diffuse through dry soil. Fumigation is not effective during periods of hibernation or aestivation because the squirrel plugs its burrow with soil. The plug is not obvious to a person examining the burrow entrance, because it is located far down in the system.

#### • PHEROMONAL/ENDOCRINE CONTROL

Pheromones with attractant properties might be used to improve trapping success by luring squirrels into traps or to bait squirrels into traps or to bait stations, or pheromones with repellent properties might be used to exclude squirrels from particular campus areas.

#### • NATURAL CONSTRAINTS

Natural constraints such as inadequate food and shelter, predators, disease, and bad weather limit ground squirrel populations. Experience has shown, however, that in most environments altered by humans, the point at which squirrel populations level off naturally is intolerably high (Salmon 1984).

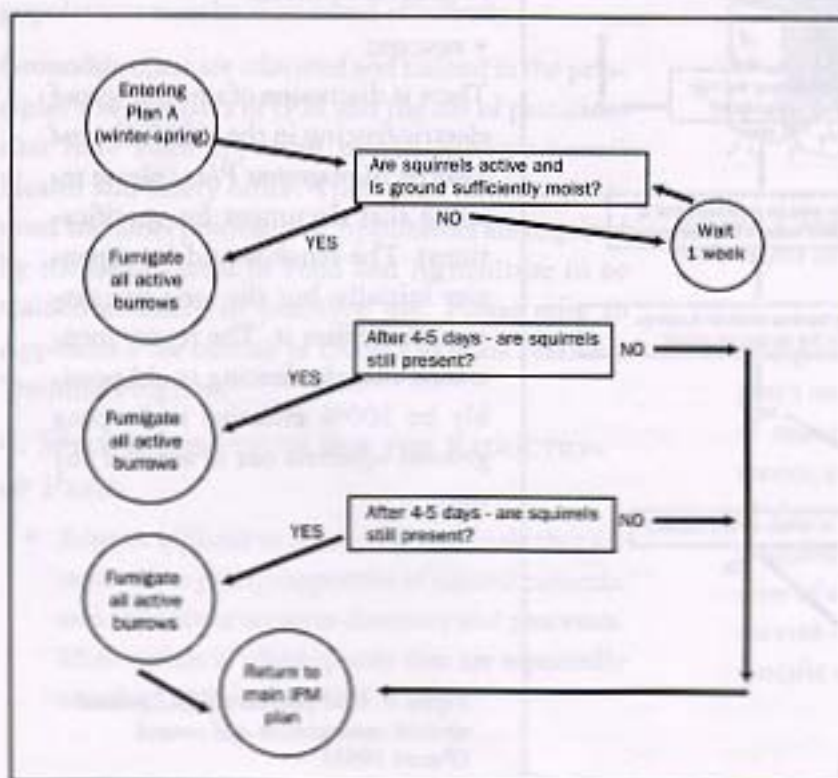
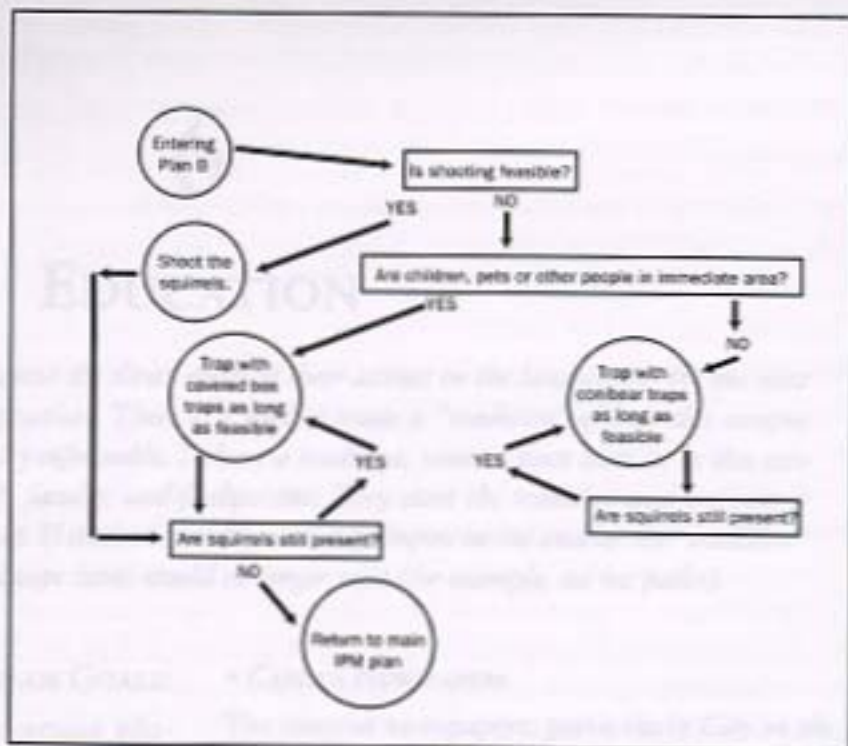


Figure 10. Fumigation Plan A: used winter-spring for adults and late spring-summer for young (Fusari 1983).

Figure 11 Trapping Plan B: Determination of suitable trap is dependent on specific site (Fusari 1983).

## 6. REFERENCES

Pest Control Principles on the campus are designed to be flexible, to act as a framework in which to solve a problem. As different pests appear, different strategies must be employed to combat them. Three excellent guides for determining a course of action are the *Pests of Landscape Trees and Shrubs*, Statewide Integrated Pest Management Project, University of California, 1994, *Insect Pest Management Guidelines for California Landscape Ornamentals*, Division of Agriculture and Natural Resources, 1987, and *Common-Sense Pest Control*, Olkowski, et al., 1991. These books outline general and species specific problem-solving guides, and act as an invaluable reference.



...major activities in the process: research, implementation, and evaluation in planning and building (U-1-5).

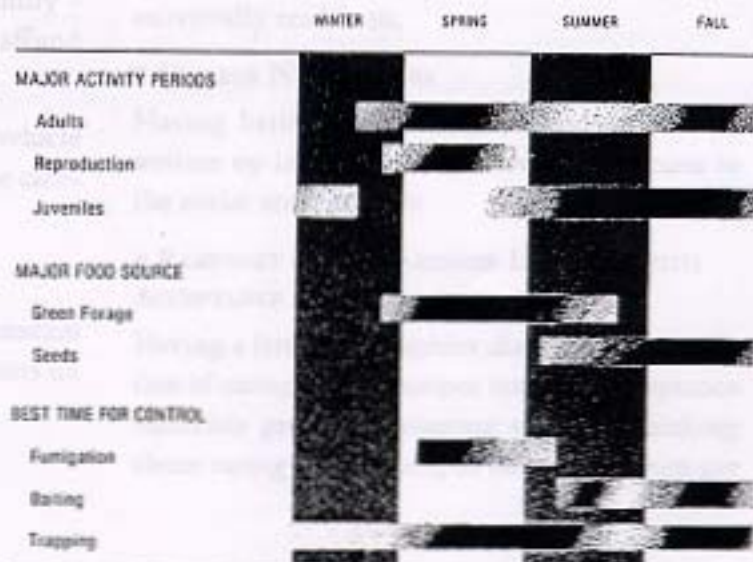
...A broad understanding of the campus's planning process and issues should be made clear to all segments of the campus community from professional associations through student groups to the student body (U-2-2).

...Campus college extension activities as a way to better connect with students about the campus (U-3-2).

## 2. EDUCATIONAL TOPICS

There are several ways to disseminate information to the staff, faculty, and incoming students. Some of the ways should be listed:

Figure 12 Yearly activities of ground squirrels and most effective control times (Salmon 1982).



# 6

## EDUCATION

*Educating the campus community about the direct effects of their actions on the landscape is the one most effective preventative maintenance practices. There is a need to create a "tradition" of how this campus should be treated that becomes socially enforceable. To have a tradition, someone must start it. In this case the most likely candidates are staff, faculty, and freshpersons. They start the tradition and continue it throughout their years at Santa Cruz. If students, faculty, and staff impose on one another the "tradition" of caring for the campus many landscape issues would no longer exist (for example, ad hoc paths).*

### LANDSCAPE MANAGEMENT PROGRAM GOALS:

1. Outline LRDPIP guidelines concerning education.
2. List of tools for educating.

### 1. LRDPIP GUIDELINES:

- Establish and develop mechanisms and traditions of broad campus education in the principles, processes, responsibilities, and issues involved in planning and building (9.1:3).
- A broad understanding of the campus's planning process and issues should be made clear to all segments of the campus community - from professional consultants through staff and faculty to the student body (9.2:d,e).
- Utilize college orientation activities as a vehicle to better inform new students about the campus (A.3:22).

### 2. EDUCATIONAL TOOLS

There are various ways to disseminate information to the staff, faculty, and incoming freshpersons on how the campus should be treated:

#### • CAMPUS NEWSPAPERS

The campus newspapers, particularly *City on the Hill*, are well read on the campus. The first few issues are more extensively read and a notice or article in one or a few would get information out. People would start talking about it and landscape issues would stay on people's minds. By having it at the first of the year and/or quarter, most incoming students (freshpersons and transfer), returning students, and some staff and faculty will be reached. Staff and faculty are much harder to reach because there are so many different departments, boards, and units. *Currents* is the closest thing to a universally read item.

#### • COLLEGE NEWSLETTERS

Having little reminders about landscape issues written up in college newsletters allows access to the entire student body.

#### • PAMPHLET ON STEWARDSHIP INCLUDED WITH ACCEPTANCE MATERIALS

Having a letter or pamphlet discussing the tradition of caring for the campus sent with acceptance materials gets the incoming students thinking about caring for the campus before they even get



## EDUCATION

here. Plus they are more likely to read materials they receive before they get to the campus. Please refer to Stewardship section.

### • ORIENTATION

At the beginning of the year for freshpersons and transfer students and Winter quarter for transfer students there is a college orientation. At this time groundskeepers should be introduced to students, so that they know who the groundskeepers are and what they do. There has been discussion that orientation is a time of information overload. Yes, there is information overload, but at least people will recognize the groundskeeper and some people will hear the message; even one is important. The request for the groundskeeper to speak should come from the Grounds Department directly so that the college is more likely to schedule time for the groundskeeper. The colleges also have college newsletters that usually go out once a quarter to all students. In these newsletters the groundskeeper should write a little note or comment or article. This allows the groundskeeper to encourage pride in the college landscape and appearance, and voice concerns and praise.

### • RESIDENTIAL PROGRAMMING

The other avenue to inform people is the residential/community/neighbor assistants. These residential life people must come up with programming for their students. One program per quarter must be educational. To fulfill this requirement they could have an environmental program and have a groundskeeper talk

to students as part of it; this allows for the groundskeeper to get to know the students.

### • A CAMPUS WIDE EVENT

In addition to disseminating written information and role modeling, a campus sponsored event to encourage environmental awareness, like Earth Day, would be an enjoyable way to educate the campus community. One example would be to sponsor an event to have students win free admission to a movie for collecting a certain amount of cigarette butts, cans, or bottles. Various college activities offices or administrative funds could co-sponsor such an event with one of the movie theaters downtown. The college would be responsible for collecting and disposing of the collected materials and handing out the passes. There are endless possibilities that only need be explored.

If a large campus wide event, educational programs given by residential staff, and articles in college and campus wide newspapers can put forth the idea that the campus landscape can be preserved with a simple consideration for the land itself and the people who tend to it, this will alleviate many landscaping problems. In this manner, caring for the landscape will become a tradition, enforced by the "society on the hill."

### • THE ROLE OF GROUNDSKEEPERS

Another idea is to have the groundskeeper attend monthly house/dorm/apartment/residential hall meetings and make a few remarks. A note similar to the following could be written to students by the campus's groundskeepers (please refer to Figure 13).

## Nurturing (the college's name) Environment

Hello! My name is (name of groundskeeper), your groundskeeper at (name of college) College. Welcome to our special community and environment. We are indeed fortunate to live, study, and work in an area that offers splendid panoramic views of the ocean with rolling hills and majestic redwoods nestled around us. Kindled with a sense of responsibility and nurturance, we can have a direct influence upon our sensitive ecological destiny. Our actions do affect plant and animal life, as well as the aesthetics of classroom and living areas. Being conscious of trash, cigarette butts, recyclable materials, and not walking through landscaped areas are ways of improving the grounds of our college and campus.

### TRASH

Litter is an immediate visible blight of the landscape. Aesthetically speaking, a beautiful natural setting or planted area can quickly be made unappealing to our eyes and dangerous for small animals (i.e., six-pack plastic rings) by litter strewn about. It takes a lot of human energy to collect litter. Thirty to forty percent of my time is spent picking up after others. The best thing one can do for our local environment is to dispose of all trash in containers and also to speak up when observing another littering. Please speak to me if you feel more receptacles are needed and tell me where they could be placed.

### CIGARETTE BUTTS

One of the numerous sources of litter are the unsmoked filters and ends of cigarettes. I recently read that these discarded butts take *seven years* to completely decompose. Many people take care not to throw trash on the ground and then leave their cigarette butts everywhere. If you smoke, smoke in designated areas only and please use provided urns and trash bins.

### RECYCLE

Many of us recycle at the college and more awareness of what is appropriate to reuse is increasing. Bottles and cans are still found on the ground. Please place materials in appropriate recycling areas. By doing so, you double our efforts by recycling and keeping our environment clean.

### WALKING THOROUGH LANDSCAPED AREAS

A number of plants (especially in newly-landscaped areas) are sensitive to foot traffic. An unintentional, well-placed footstep can kill or damage plants and also compact the soil which makes the ground hard and unable to breathe. By staying on designated paths, roads, and sidewalks we can all observe plants flourishing.

I am committed to creating beautiful landscapes for your enjoyment and use. Please feel free to introduce yourself and offer suggestions, questions, and ideas. Remember, we can all contribute toward the beautification of our immediate environment. Smile!

Figure 13 Outline for a college groundskeeper's note to students (Hendrickson undated).

# 7

## STEWARDSHIP

*The Site Stewardship Program consists of teams of volunteers taking on the ecological restoration and guardianship of sensitive natural areas within the UC Santa Cruz campus. Many areas of the campus have been impacted by historical natural resource extraction and University activities. The Site Stewardship Program is modeled after the successful Golden Gate National Park Association Model.\* The program's purpose is to educate the campus community, assist the campus with restoration efforts in high priority sites, and empower students, faculty, and staff to become actively involved with their environment.*

### LANDSCAPE MANAGEMENT PROGRAM GOALS:

1. Outline LRDPIP guidelines concerning stewardship.
2. Discussion of stewardship.
3. Scope of program.
4. Outline of Site Stewardship Program.
5. Description of positions.
6. Outline for development of sites.
7. Discussion of implementation timeline.

### 1. LRDPIP GUIDELINES:

- Establish a Campus Stewardship Program for students, faculty, and staff (A.3:21).
- Integrate campus ecology into the undergraduate curriculum and college orientation activities and create a lower-division course concerned with the campus ecology within the Environmental Studies program (A.3:22).

### 2. STEWARDSHIP

To the casual observer, the lands of the UC Santa Cruz campus must seem relatively pristine and untouched by human encroachment. The trees and grasslands hug the sides of buildings. A closer look,

however, reveals the extent to which human activity has changed the natural environment. Landscape disturbances, which include the displacement of native plant communities by exotics, degraded soil through compaction and widening erosion gullies, obstruct normal functioning of ecosystems throughout the campus.

California contains more natural diversity than any other state in the nation. The Santa Cruz campus in particular is an extremely rich biological region with a remarkable number of ecological communities. These include chaparral, mixed evergreen forest, redwood forest, grassland, coastal prairie, Northern coastal scrub and riparian (Buck 1987). With the University's imminent growth in student population and construction, the campus's unique ecosystems are threatened by poorly mitigated and managed development and other incompatible land uses. Already more than 70 percent of California's land has been stripped of its native plants. The importance of preserving what remains of California's biological diversity is widely acknowledged. A fair percentage of the state is in fact already under some sort of protected status. The problem for biological diversity, however, is that official protection does not assure long-term preservation of the protected resources.

\* The entire Stewardship section has been adapted from Golden Gate National Park Association materials written by Sue Gardner, undated.

### 3. PROGRAM SCOPE

The program is being designed as a part of the Landscape Management Program and is a collaboration between the Grounds Department, the Campus Land Use Management Advisory Committee, the Environmental Internship Office, and the campus community. Organizationally, the program will be fully integrated into the Grounds Department with the Grounds Superintendent acting as the official liaison to the Site Stewardship program. The program coordinator intern will facilitate the program and provide ongoing support to the Site Stewardship volunteers with the Grounds Department. The Environmental Studies Board and Biology Board will be encouraged to give academic credit or extra credit points to students that volunteer for work parties. A tradition must be started on this campus that supports student, faculty, and staff involvement in the preservation of the University's plant and animal communities.

As part of cooperation toward protecting and preserving our natural resources, the aim of the program is to create a stewardship program which acts to integrate the community, restore proper ecosystem function, and serve as a model which other universities, parks, and agencies can emulate to address their own resource management challenges.

### 4. PROGRAM OUTLINE

Negative impacts on the campus's natural resources include those associated with historical logging and mining, invasion by non-native plant species, suppression of natural fires, widespread erosion, and use by students, faculty, and staff. At present there are over 50 species of rare or uncommon plants that reside on the campus (Buck 1987).

Unfortunately, conditions like these are common in remnant natural areas still found across the United States. Ecologists, biologists, and other specialists have documented the processes and a new discipline — restoration ecology — has sprung up to deal with degraded natural areas. One of the main lessons learned is that active long-term stewardship of disturbed ecosystems is essential. Quick fixes and in-

termittent efforts do not work. What is needed is baseline data on key ecosystem elements, long-term monitoring systems, and carefully designed management plans. These are the activities that, over time, induce positive change.

Public land managing agencies have the responsibility to address ecosystem degradation because they hold title to the land and establish policy for its management. But they rarely have the funds or staff to carry out the detailed, consistently attentive work of long-term stewardship.

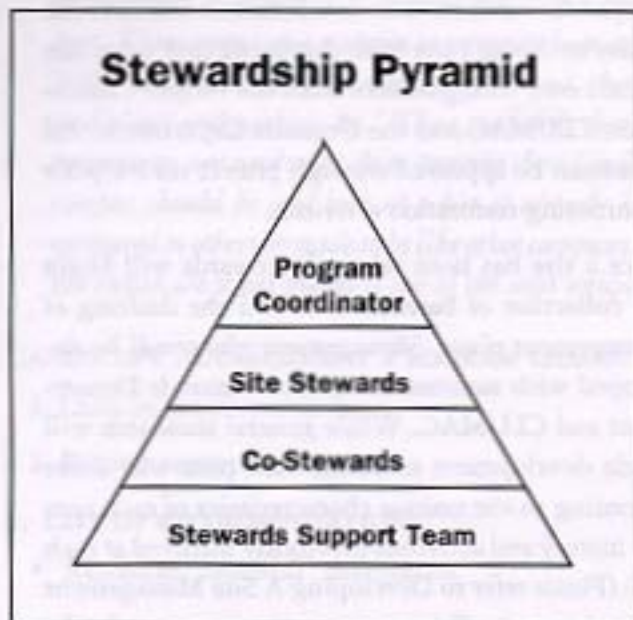
A solution lies in the creation of a dependable work force that will endure as long as the land. The way to develop such a force is by building community tradition. Citizens actively involved in caring for the land can do the job in cooperation with public land managing agencies. A very effective program has been developed between the Golden Gate National Park Association and San Francisco City College Biology Department. The following is a proposed course of action. It must be flexible during further development to accommodate issues that may arise.

The Site Stewardship Program will have dedicated teams of interns and volunteers under the leadership of a Site Steward. Through repeated reconnaissance, monitoring and field work, these teams will become expert stewards of a particular place.

The purpose of this program will be to provide students with expanded opportunities to combine classroom studies with field experience. The program will be structured to accommodate all levels of volunteer interest and involvement. Those individuals interested in receiving course credit would become interns through the Environmental Studies Board. There will be various types of internships. It will also allow for faculty and staff to become directly involved with care of the campus through volunteering for the various positions.

The Program Coordinator will make a one- to two-year commitment to act in that capacity. These individuals will be responsible for coordinating and designing activities and plans to maintain the entire program. The Site Steward, with a year-long

commitment, will be responsible for developing a management plan for the site, recruiting additional Co-Stewards and volunteers, and managing volunteer field work at the site. Co-Stewards, in turn, with at least a quarter's commitment, will assist the Site Steward by assuming one or more of the activities outlined in the management plan. Examples of Co-Steward tasks include baseline-data collection, vegetative mapping, tool maintenance, and public out-



reach. Crucial to the success of the program are those volunteers who offer their assistance at work days on the site. These people provide the hands-on work necessary to accomplish those goals and objectives set forth in a campus approved management plan.

## 5. POSITION DESCRIPTIONS

All positions are volunteer and could be filled by students, staff or faculty. The position descriptions are as follows:

### PROGRAM COORDINATOR

Students will be the primary liaison between the Grounds Department and Site Stewards, with a three-quarter commitment, 12-15 hours a week (average), to implement the Site Stewardship Program. Time will be divided as follows (dependent on weather): Fall Quarter 70% organization, 30% on

restoration sites; Winter Quarter 60% organization, 40% on restoration site; Spring Quarter 50% organization and 50% on site restoration. Student must be in good academic standing, have undergraduate course work in Environmental Studies or Biology or have related experience (i.e., intern at the arboretum or farm) or human relations experience.

Duties may involve: recruitment and management of Site Stewards, Co-Stewards, and steward support team; development and maintenance of natural resource inventory and monitoring systems; planning and implementation of restoration activities. Restoration activities may include, but are not limited to: preparation of restoration action plans; removal of non-native invasive plant species; revegetation of site with native species; mitigation or erosion problems; and assistance with trail repairs and improvements.

### SITE STEWARD

The Site Steward will act as the primary liaison between the stewardship site and the Program Coordinator. In this position, Site Stewards will work closely with the Grounds Staff and the Program Coordinator in organizing and managing all stewardship activities at the restoration site, with a minimum one-quarter commitment, 5-15 hours a week. The Site Steward will spend 50% of time on organization and 50% working outside on restoration sites. Students must be in good academic standing, have undergraduate course work in Environmental Studies or Biology or have related experience (i.e., intern at the arboretum or farm) or human relations experience.

Duties may involve: research and collection of baseline data; development and maintenance of natural resource inventory and monitoring systems; planning and implementation of restoration activities; and assistance with the recruitment and management of community volunteers at the site. Restoration activities may include, but are not limited to: preparation of restoration action plans; removal of non-native invasive plant species; revegetation of site with native species; mitigation of erosion problems; and assistance with trail repairs and improvements.

### CO-STEWARD

Co-Stewards will assist Site Stewards in executing restoration activities. While Site Stewards assume responsibility for more general oversight, Co-Stewards will engage in one or more specific tasks related to site restoration. Position descriptions will be designed individually, based on the restoration needs of each site and the Co-Stewards' individual needs, interests, and experience. Examples of Co-Steward activities include: planning and organization of site revegetation; creation and drafting of stewardship newsletter; liaison and volunteer to nursery; organization of seed collection regime; coordination of tool and material inventory; and coordination of a community outreach program.

### STEWARD SUPPORT TEAM

The Steward Support Team will provide weekend and intermittent assistance to Site and Co-Stewards at a stewardship site. Once management goals and objectives have been identified and approved, Support Team members will assist in implementation by attending work days and other events organized by the Site and Co-Stewards on a particular site. Individuals interested in becoming Support Team members will communicate with the Program Coordinator, Site Steward, Co-Steward, or Grounds Department. Steward Support Team members are crucial in assuring that restoration goals are executed and realized.

For all positions, routine activities may involve strenuous physical exertion, contact with poison oak, and exposure to harsh weather elements.

To assist Site Stewards in their restoration goals, the Site Stewardship Program will provide stewards with the training and tools necessary to ensure that restoration activities are performed with competence and skill. Each Site Steward will be required to attend several workshops which include on-site training in restoration concepts and techniques as well as seminars on campus rules, regulations, procedures and policies. (Please refer to the *A Revegetation Intensive*, available from the Grounds Department.)

## 6. SITE DEVELOPMENT

Many areas within the campus will be available for selection by program participants. Stewardship sites within the campus will be identified using an objective ranking system with input from the Campus Land Use Management Advisory Committee (CLUMAC) and Physical Plant, Grounds Department. A list of these sites, as well as short narratives and maps outlining site characteristics, will be developed for stewards to review. Stewards will have the ability to choose a site from this list or to develop one of their own with guidance from the Project Coordinator, CLUMAC and the Grounds Department. All sites must be approved through project review prior to initiating restoration activities.

Once a site has been selected, stewards will begin the collection of baseline data and the drafting of management plans. Management plans will be developed with assistance from the Grounds Department and CLUMAC. While general standards will guide development of plans, each plan will differ according to the unique characteristics of each site, site history and activities previously initiated at each site. (Please refer to *Developing A Site Management Plan*, Appendix G.)

After management plans have been approved by project review, the Site Stewards will begin restoration activities. Routine projects will include the establishment of monitoring systems, the collection of baseline data, the removal of invasive, non-native plant species, plant propagation and revegetation, mitigation of erosion damage, and other related activities.

## 7. IMPLEMENTATION

The Site Stewardship Program needs to be phased in over time. This can be accomplished in a number of ways, including initially having an individual college or board sponsor a site. The plan could be phased in over a period of 3-4 years, starting small and building on accomplishments.

# 8

## RECOMMENDATIONS FOR THE FUTURE

*The campus's landscape and natural features are an integral part of what makes UCSC what it is. If that environment is damaged it destroys not only a physical component of the campus but also an intangible part. This campus was a vision to integrate humans into a natural setting. As Thomas Church said in the 1963 LRDP, "Instead of remaking the land, the land must remake our standard conceptions of building and plaza and parking lot." These are words that we should plan by. There are many things this campus community can and must do to preserve these lands for future use. We must revise our thoughts of what a campus should be and look at what it already is. This University is like no other and should not be compared to others or made to be like other campuses. This campus's differences and ability to stand out from the crowd are what makes it one of the most unique places in the world to study.*

### LANDSCAPE MANAGEMENT PROGRAM GOALS:

1. Outline recommendations.
2. Discuss recommendations.

### 1. LIST OF RECOMMENDATIONS:

- formalize "hand-off" procedures
- land manager
- create Master Gardener position
- institutionalize stewardship
- create plant material tracking system/data base compatible with GIS
- complexity of the campus landscape
- centralization of decision making

### 2. DISCUSSION OF RECOMMENDATIONS:

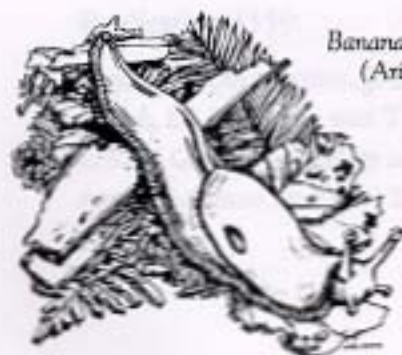
#### • FORMALIZE "HAND-OFF" PROCEDURES

Landscapes should not be an afterthought but a forethought. Adequate funding needs to be set aside for the planning, development, and future care of the landscape. It would be ideal for the "hand-off" procedures of construction projects, between Physical Planning and Construction and Physical Plant, to become more formalized. There have been many positive steps in this direction, but there is still much that could be done. One step would involve having an individual from the Grounds Department inspect all landscape materials.

#### • LAND MANAGER

The campus has an immense landscape that needs to be cared for. The Physical Plant Grounds Service personnel are essentially the campus's land managers. Each individual cares for a portion of the campus. These individuals should be empowered by recognition from the campus community for the service they provide.

In addition to recognition of the Grounds Department personnel, a decision may be made to hire an "official" land manager. It would be ideal to have a land manager/landscape architect on staff to aid in decisions on natural and exotic landscapes on cam-



Banana Slug  
(*Ariolimax columbianus*)

#### RECOMMENDATIONS FOR THE FUTURE

pus. This individual would be an important bridge between Physical Plant and Physical Planning and Construction and with the other units. S/he could act as a campus consultant, answer questions about dying landscape that needs to be replaced, review future building sites to eliminate landscape maintenance nightmares, and act as a bridge for ideas and information between the staff and administration. This position would solve many communication problems and create a clear place for decisions to be made about the campus landscape.

##### • CREATE MASTER GARDENER POSITION

Currently the groundskeepers act as gardeners/maintenance workers. It would be productive to see a division of the present groundskeeper job description into two separate positions, a full time Master Gardener and part time maintenance job. In this way there would be a way for people to advance. All the groundskeepers have an extensive knowledge of horticulture from formal education, experience and/or college degrees in horticulture. It would be a better use of our resources to encompass their knowledge more extensively into the care of the campus. The University of California Cooperative Extension Program offers a Master Gardener Program as part of its curriculum. Creation of the Master Gardener position would reinforce the idea of the Grounds personnel as land managers.

##### • INSTITUTIONALIZE STEWARDSHIP

Education and stewardship must become a tradition that is passed along to every class. The Stewardship Program Coordinator will be sponsored by the

Grounds Department and will be the student representative on the Campus Land Use Management Committee (CLUMAC).

##### • CREATE PLANT MATERIAL TRACKING SYSTEM/ DATA BASE COMPATIBLE WITH GIS

The campus is working towards integration of GIS systems; having the plant materials entered in the database as they were planted would add to the depth of the system.

##### • COMPLEXITY OF THE CAMPUS LANDSCAPE

The campus landscape is an incredibly complex system with its own fluidity and fluxes. Human disturbances impact the landscape greatly. This complexity needs to be taken into consideration when making decisions about building sites, new landscaping projects and renovation projects.

##### • CENTRALIZATION OF DECISION MAKING

The ecosystems on campus are susceptible to human damage and therefore there needs to be strict regulation of who uses the campus lands, what purpose they are used for, and who is responsible for any damage incurred. There needs to be a central place where decisions are made concerning what groups use the campus and if there is any damage, who is to pay for it. If a group comes to campus and uses the fire roads for a race and thereby creates erosion problems, who is to pay for it? There either needs to be a charge for groups who do damage to the landscape to return it to its previous condition or the individual or unit that gives permission to the group must be held accountable for the actions of the group.



## REFERENCES CITED

- Allaby, Michael. (1983) *A Dictionary of the Environment*. New York University Press: New York.
- Begon, Michael, John L. Harper, and Colin R. Townsend. (1990) *Ecology - Individuals, Populations and Communities*. Blackwell Scientific Publications: Boston, MA.
- Botkin, Daniel and Keller, Edward A. (1987) *Environmental Studies: earth as a living planet*. Merrill Publishing Company: Columbus, OH.
- Buck, Roy. (1987) *Botanical Survey for UCSC Long Range Development Plan: Project, Actions, Impacts and Mitigation Measures*.
- California Department of Transportation. (1981) *Standard Specifications*. Sacramento, CA.
- Chengrian, Dan. (1995) "Analyze landscape sites." *Grounds Maintenance*. March, p. 50- 56.
- Church, Thomas D. (1962) Memorandum to J.E. Wagstaff, 29 October.
- Daar, Sheila. (1983) "What is IPM?" In: *Ground Squirrel Sampling Report*, ed. Margaret Fusari, 1993.
- Daar, Sheila, Helga Olkowski, and William Olkowski. (1992) *IPM Training Manual for Landscape Gardeners*. The Bio-Integral Resource Center: Berkeley, CA.
- Dreistadt, Steve H. (1994) *Pests of Landscape Trees and Shrubs*. Division of Agriculture and Natural Resources, University of California, Publication 3359.
- Duffey, E., M. G. Morris, J. Sheila, Lean K. Ward, D. A. Wells, and T. C. E. Wells. (1974) *Grassland Ecology and Wildlife Management*. Chapman and Hall Ltd.: London.
- Environmental Protection Agency (EPA), Office of Pesticide Programs. (1993) *Pest Control in the School Environment: Adopting Integrated Pest Management*. US Government Publication EPA/354-93-012.
- Forman, Richard T. T. and Michel Godron. (1986) *Landscape Ecology*. John Wiley & Sons: New York.
- Fusari, Margaret. (1983) *Ground Squirrel Management Supplement*.
- Gardner, Sue. (undated) *Developing a Site Management Plan*.
- \_\_\_\_\_ (undated) *Stewardship*.
- Grounds Department Procedure Manual*. (1992) UCSC Grounds Department, Santa Cruz.
- Harris, Richard W. (1992) *Arboriculture*, Second Edition. Prentice Hall: Englewood, NJ.
- Hendrickson, Steven. (undated) *Nurturing Oaks Environments* (pamphlet).
- Implementation Program, Long Range Development Plan, University of California, Santa Cruz (LRDPIP)*. (1993) Ed. Richard Bender. EDAW/Skidmore, Owings and Merrill.
- Jepson, Willis. (1993) *The Jepson Manual: The Higher Plants of California*. James C. Hickman, editor. University of California Press: Berkeley, CA.
- Kliwer, Gary. (1988) *The Campus Guide* (pamphlet). Bay Tree Bookstore, University of California: Santa Cruz, CA.
- Koehler, C. S. (1987) *Insect Pest Management Guidelines for California Landscape Ornamentals*. Cooperative Extension University of California, Division of Agriculture and Natural Resources, Publication 3317: Oakland, CA.

#### REFERENCES CITED

- Macheny, N. P. (1989) "Preserving Trees Affected by Development." In *Technical Guide to Community and Urban Forestry in Washington, Oregon, and California*, ed. R. Morgan. World Forestry Center: Portland, OR, pp. 34-41.
- Olkowski, William, Sheila Daar, and Helga Olkowski. (1991) *Common-Sense Pest Control*. The Taunton Press: Newton, CT.
- Pedigo, Larry. (1989) *Entomology and Pest Management*. Macmillan: New York.
- Perry, E. J., ed. (1988) *Pruning Standards*. Western Chapter of the International Society of Arborists: St. Helena, CA.
- Salmon, Terrell P. (1982) *Ground Squirrel Management Plan, UCSC Campus*.
- Salmon, Terrell P. and Robert E. Lickliter. (1984) *Wildlife Pest Control Around Gardens and Homes*. Cooperative Extension University of California, Division of Agriculture and Natural Resources, Publication 21385: Oakland, CA.
- Staub, Stephen R. (1995) *Land Management Study for Fire Prevention, UCSC*.
- Long Range Development Plan, University of California, Santa Cruz*. (1963) UCSC Office of Campus Facilities.
- Long Range Development Plan, University of California, Santa Cruz*. (1971) UCSC Office of Campus Facilities.
- Long Range Development Plan, University of California, Santa Cruz*. (1978) UCSC Office of Campus Facilities.
- Long Range Development Plan, University of California, Santa Cruz*. (1988) UCSC Office of Campus Facilities.
- UCSC Campus Standards Handbook*. (1993) Physical Planning and Construction.
- UCSC Ground Squirrel Management Plan*. (1983) CLUPC Subcommittee on Ground Squirrel Management.
- Warrick, Sheridan E., ed. (1982) *The Natural History of the UC Santa Cruz Campus*. Environmental Field Program, University of California, Publication No. 11.
- Webster's Seventh New Collegiate Dictionary*. (1972) G.&C. Merriam Company, Publishers: Springfield, MA.
- Wittman, Thomas. (1991) *Ground Squirrel Control at UCSC*. Consultant report, UCSC.

## GLOSSARY

**abiotic:** Non-biological (Allaby 1983). *See* biotic factors.

**ad hoc:** For the particular end or case at hand without consideration of wider application (Webster 1972).

**aeration:** Any process where a substance becomes permeated with air or another gas (Allaby 1983).

**aestivation:** The dormancy of certain animals during the dry season, the summer, etc. (Allaby 1983). *See* hibernation.

**anthropogenic:** Produced as a result of human activities (Allaby 1983).

**biotic factors:** Influences on the environment which are the result of the activities of living organisms (Allaby 1983).

**corridors:** Narrow strips of land which differ from the matrix on either side. Corridors may be isolated strips, but they are usually attached to a patch of somewhat similar vegetation and are often create connections of similar vegetation (Forman and Godron 1986).

**diversity:** Having various forms or qualities (Webster 1972).

**ecology:** The science of the study of the relationship between living things and their environment (Botkin and Keller 1987).

**ecological functioning:** The ability to perform its regular or natural processes (Webster 1972).

**ecotone:** A transitional zone between two habitats (e.g., a woodland edge bordering grassland) (Allaby 1983).

**erosion:** The breakdown of solid rock into smaller particles and its removal by wind, water, or ice (Allaby 1983).

**exotic species:** Species introduced into a new area by human action (Botkin and Keller 1987).

**hibernation:** Dormancy of animals in winter, during which metabolic rate is much reduced and the body temperature of the species drops to that of the surroundings (Allaby 1983).

**integrated pest management (IPM):** The coordinated use of several techniques of pest control done in an ecologically and economically sound manner (Botkin and Keller 1987).

**native species:** For the purposes of this document, native plants will be defined as those plants that are indigeneous to California, present in the state prior to the influence of Europeans (Jepson 1993).

**ornamental:** A plant cultivated for its beauty rather than for use (Webster 1972).

**reforestation:** Recovery of a forest area to a former state.

**restoration:** Activities to bring back to or put back an area into its former or original state (Webster 1972).

**succession:** The non-seasonal, directional and continuous pattern of colonization and extinction on a site by species populations (Begon *et al.* 1990).

# APPENDIX A

## CAMPUS STANDARDS ON LANDSCAPING ISSUES

The UCSC Campus Standards Handbook outlines required products and mandatory design constraints for all construction on the campus. Standards are complementary to specific project program requirements. The Handbook includes various construction components ranging from general building requirements to documentation standards. The guidelines are periodically revised by appropriate members of the campus community. There are many standards that deal with landscaping issues. The titles of these landscaping standards are listed below. (Please refer to the Handbook to see the sections in their entirety.)

- Landscape (Site Requirements)
- Landscaping Standards - Section 02900
- Tree Protection - Section 01530
- Plant List: Redwood Forests and Associated Native Plants
- Plant List: Mixed Evergreen Forest and Associated Native Plants
- Plant List: Chaparral/Baccharis Scrub and Plants in Chaparral for Fire Safety
- Plant List: Grasslands
- Plant List: Native Plants with Ornamental Characteristics of Interior Complexes
- Plant List: Recommended Non-Native Plants, Vines and Ground Covers
- Plant List: Turf Grass Seed
- Erosion Control (Site Requirements)
- Drainage (Site Requirements)
- Erosion Control Standards (Appendix)
- Campus Drainage Plan for UCSC (Appendix)
- Erosion and Sediment Control - Section 01560
- Storm Sewage System Standards - Section 02720
- Irrigation Standards - Section 02810
- Trash Collection (Site Requirements)
- Paving and Surfacing Standards - Section 02500

# APPENDIX B

## EXCERPTS FROM THE LAND MANAGEMENT STUDY FOR FIRE PREVENTION

- *Land Management Study for Fire Prevention, UCSC* written by Stephen R. Staub, Forester and Environmental Consultant, April 1995
- The purpose of this study is to define possible fire hazards and management opportunities within the lower and central campus areas as part of a complete urban forest plan for the campus in relation to current and future vegetation management.
- Table of Contents
  - I. Background
  - II. Methodology
    - A. Recent Fire History
    - B. Past and Current Maintenance Activities
    - C. Fuels and Fire Hazard Analysis
      1. Fuel
      2. Topography-Slope
      3. Dwelling Density
      4. Weather
    - D. Determination of Hazard Assessment Units
  - III. Description of Fuel Treatment Techniques
    - A. Lopping
    - B. Piling
    - C. Mowing
    - D. Discing
    - E. Grazing
    - F. Prescribed Burning
    - G. Thinning
    - H. Pruning
    - I. Fire Resistant Plantings
    - J. Shaded Fuelbreak
    - K. Maintenance
  - IV. Hazard Assessment Unit Analysis
    - A. Unit A - Family Student Housing
    - B. Unit B - Kresge and Porter Colleges
    - C. Unit C - Campus Trailer Park
    - D. Unit D - Applied Sciences, Central Heating
    - E. Unit E - Crown and Merrill Colleges
    - F. Unit F - Cowell and Stevenson Colleges, East Fieldhouse
    - G. Unit G - Natural Sciences, Student Facilities
    - H. Unit H - Social Sciences, Visual Arts, Student Center
    - I. Unit I - College Eight
    - J. Unit J - Oakes College
    - K. Unit L - Lower Campus Open Space
  - V. Estimated Maintenance Costs
  - VI. Summary
  - VII. References Cited
  - VIII. Hazard Assessment Unit Maps
  - IX. Appendices
    - A. Assembly 337, "Bates Bill" Text
    - B. State Park Guidelines for Thinning
- Four factors, fuel, topography-slope, dwelling density, and weather, were combined with local knowledge of fire behavior, access for fire fighting equipment, and available water sources to arrive at a numerical rating of relative fire hazard.
- The central and lower campus areas were broken into units for the purpose of the study. Hazard units were defined by logical boundaries around campus facilities (which roughly correspond to the various colleges). Units were analyzed for vegetative fire hazard both within and outside their boundaries.

- A variety of fuel treatment techniques were suggested to create fuelbreaks within the various units. Selection of the appropriate techniques will be the responsibility of the Grounds Department based on cost, staff, availability, campus policy, and other factors. These treatments include: lopping; piling; mowing; discing; grazing; prescribed burning; thinning; pruning; fire resistant plantings; shaded fuelbreak; and frequency of maintenance

- **SUMMARY:**

Past and present grounds management activities in conjunction with moderate climate, structure sit-

ing and materials, and an extensive road network have created a generally "firesafe" pattern of vegetative growth in the developed campus areas. Indeed, campus grounds receive an overall level of maintenance far in excess of the minimum necessary to comply with presuppression fire standards. Recommended maintenance activities can be scheduled on a priority basis within the suggested 3- to 7-year monitoring and maintenance cycle.

- Copy of complete study is on file with the Grounds Department.

# APPENDIX C

## TREE EVALUATION REPORT

61-94-1

Prepared by: Tom Peterson  
Tree Supervisor  
Certified Arborist #WC-0693

Report date: October 10, 1994  
Site visit date: October 3, 1994

Location: Southeast of Hahn Art/Stevenson College UCSC Campus Sector 61  
Refer to Bruce Hoffman report dated 1/3/94, ADA project

### Narrative

This identifies 3 Coast Redwoods (*Sequoia sempervirens*) located at the southeast corner of the Hahn Art Facility building. They range in diameter at Breast Height (DBH) from 14" to 28" and average 50 to 60 feet tall.

General health of the trees is good to excellent. Several trees near the pathway have had the lower limbs removed. These trees are young, the foliage color is normal, and are in good general condition. Any decline from existing pathway construction appears to be minimal.

Three trees have been identified as being impacted by pending construction activities. They are **Tree A: 14" DBH, Tree B: 20" DBH and Tree C: 28" DBH** and 3'-4" respectfully away from the existing asphalt pathway which is connected to the Stevenson service road. Trees A, B and C are single trees in part of a large tree cluster.

### Recommendations

Due to new construction, the trees dripline will only be effected by 30% on one side of the trunk. This minimal impact would be mitigated by constructing a retaining wall parallel to and about 20" from the soil embankment. The retaining wall will prevent excessive soil build up around the trees root crowns. Several trees remain in the area and the remaining Coast Redwoods should receive minimal impacts from this project, provided tree protection standards are exercised.

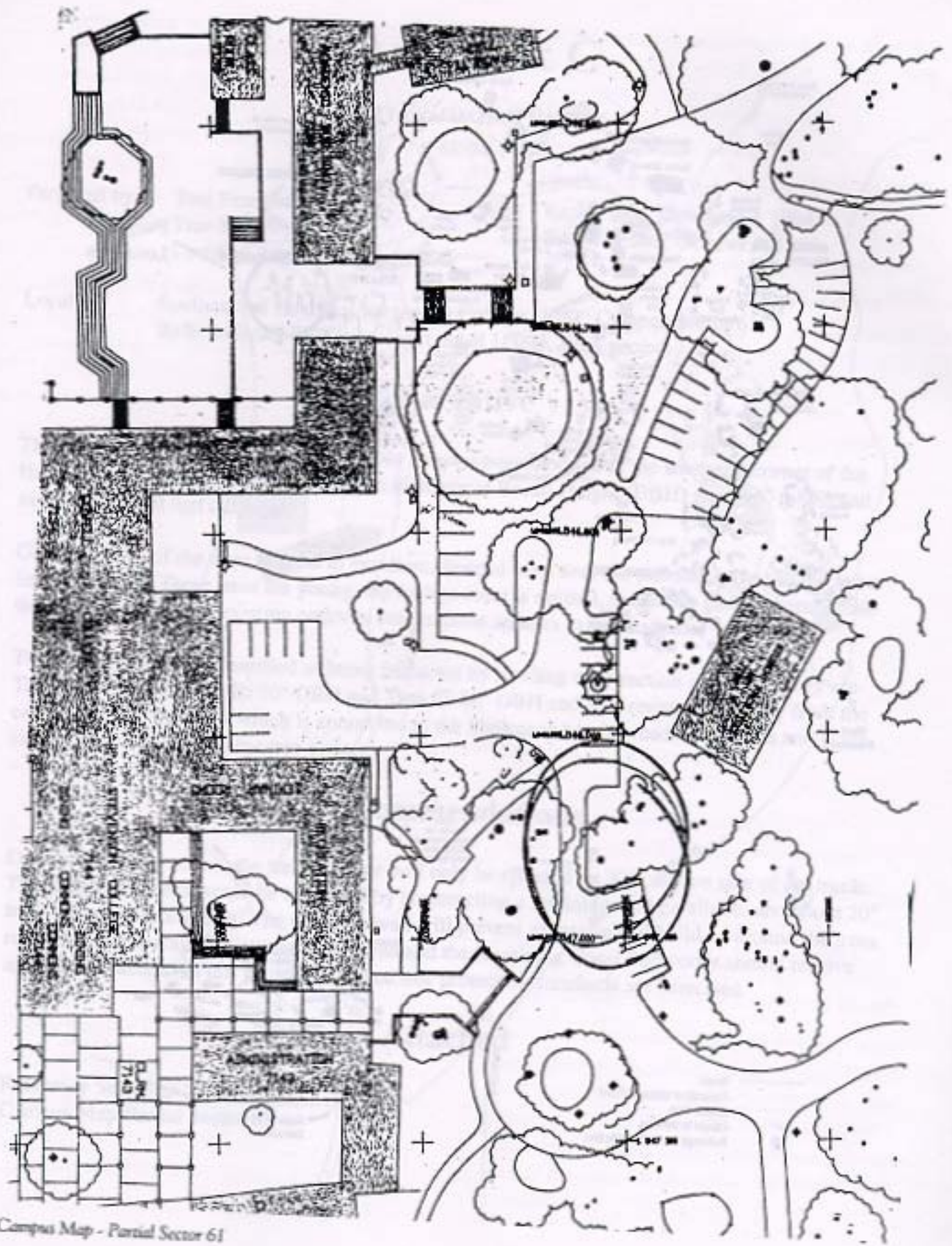
### Attached

Reference Site Map  
Campus Map-Partial Sector 61



Reference Site Map





Campus Map - Partial Sector 61

# APPENDIX D

## PRUNING GUIDELINES FOR TREES IN LANDSCAPED AREAS

(FROM HARRIS 1992 AND ADAPTED FROM PERRY 1988)

The following guidelines consist of mature tree pruning types. Standards are reviewed and updated periodically by the International Society of Arboriculture. Updated guidelines and an arborist should be consultant for more information concerning pruning.

### TYPES OF MATURE TREE PRUNING:

#### A. CROWN CLEANING

Crown cleaning or cleaning out is the removal of dead, dying, diseased, crowded, weakly attached, and low-vigor branches and watersprouts from a tree crown.

#### B. CROWN THINNING

1. Crown thinning includes crown cleaning and the selective removal of branches to increase light penetration and air movement through the crown. Increased light and air maintain and stimulate interior foliage, which in turn improves branch taper and strength. Thinning reduces the wind-sail effect of the crown and the weight of limbs. Thinning the crown can emphasize the structural beauty of trunk and branches as well as improve the growth of plants beneath the tree by increasing light penetration. When the crowns of mature trees are thinned, seldom should more than one-third of the live foliage be removed.

2. After pruning, at least one-half of the foliage should be on branches that arise in the lower two-thirds of the tree. Likewise, when laterals are thinned from a limb, an effort should be made to retain inner lateral branches, that is, one-half of the foliage on laterals along the inner two-thirds of the branch. Trees and branches so pruned will have stress evenly distributed throughout the tree and along the branches.

3. An effect known as lion tailing results from pruning out (stripping) the inside lateral branches. Lion's tailing, by removing most of the inner foliage, displaces the weight to the ends of the branches and may result in weakened branch structure, limb breakage, sunburned branches, and watersprouts.

#### C. CROWN REDUCTION

Crown reduction is used to reduce the height and/or spread of a tree. Thinning cuts are most effective in maintaining the structural integrity and natural form of a tree and in delaying the time it will need to be pruned again, thereby reducing maintenance costs. The lateral to which a branch or trunk is cut should be at least one-half the diameter of the cut being made.

#### D. CROWN RESTORATION (RENEWAL)

Crown restoration can improve the structure and appearance of a tree that has been topped or severely pruned using heading cuts. One to three sprouts on main branch stubs should be selected to reform a more natural appearing crown; all except one will be headed to one or two buds to speed wound closure. Selected vigorous sprouts may need to be thinned to a lateral or even headed to control length growth in order to ensure adequate attachment for the size of the sprout. Restoration will require several prunings over a number of years.

#### E. CROWN RAISING

Crown raising removes the lower branches of a tree in order to provide clearance for buildings, vehicles, pedestrians, and vistas. It is important that a tree have at least one-half of its foliage on branches that originate in the lower two-thirds of its crown to ensure a well formed, tapered

## APPENDIX D

structure and to uniformly distribute stresses within a tree.

### F. UTILITY-LINE CLEARING

1. Utility-line clearing can combine all five types of pruning just described to direct tree growth away from utility lines. Detailed studies of pruning techniques, tree responses, and costs have shown that the previously recommended pruning techniques can be used in utility-line pruning techniques. To achieve clearance, make thinning cuts primarily back to medium-size branches within the crown. Remove

the entire branch if more than 50 percent of live foliage needs to be removed from it.

2. Severe height reduction (including heading) occasionally may be the only alternative when a tree is directly under lines; it may be best to replace the tree.

### G. VIEW RESTORATION

Crown thinning, reduction, and raising can be used to enhance or restore a scenic view or light penetration to the property. Views can be attractive when seen through sparsely-leaved branches. Care must be taken to not overprune.

# APPENDIX E

## SPECIFICATIONS FOR ACCEPTANCE OF NURSERY TREES AT TIME OF DELIVERY (ADAPTED FROM CALIFORNIA DEPARTMENT OF TRANSPORTATION 1981 AND HARRIS 1992)

**Purpose:** To obtain vigorous, healthy trees which can be easily trained into attractive trees with structurally strong roots and crowns.

**Specifications:** The buyer should choose and/or modify the appropriate sections depending on the species, the landscape site, and the intended function of the tree.

**I. The Buyer.** The buyer shall be notified when plants are to be shipped at least ten days prior to the actual shipment date, and Grounds staff should be on site to inspect shipment.

**II. Correct Type.** All trees shall be true to type or name as ordered or shown on the plans and shall be individually tagged or tagged in groups by species and cultivar (variety).

**III. Health.** All trees shall be healthy, have a form typical for the species or cultivar, be well-rooted, with proper stem taper (diameter at base should be larger than crown), and be appropriately trained. These characteristics are described in sections IV through VIII.

**IV. Diseases and Pests.** All trees shall comply with Federal and State laws requiring inspection for plant diseases and pest infestations. Inspection certificates required by law shall accompany each shipment of plants. Stems and trunks are free of cankers or discoloration. Foliage density and color are normal.

**V. Root Ball.** The root ball of all trees shall be moist throughout and the root crown shall show no signs of moisture stress.

**VI. Tree's Structure - Decurrent:** (round headed) broad-leaved, decurrent trees (a tree that has lateral branches with apical dominance)

A. Crown has a single trunk that has not been headed or pruned to be a leader.

B. The minimum acceptable length of the most recent season's shoots should be specified, for example, shoots of small-growing trees (that is, red maple, red oak, ginkgo) might be 300 mm (12 in.); for large growing trees the minimum acceptable length might be 450 mm (18 in.) and preferably 0.6 to 1.0 m (24-36 in.).

C. It would be desirable to have:

1. The tree stand upright without support
2. Small (< 1/4 diameter of trunk) temporary branches along the trunk below the limbs

**VII. Tree Structure - Excurent:** broad-leaved or coniferous, excurrent (a tree with a central trunk, and lateral branch with apical control) trees

A. Crown has a single, straight trunk with no double leaders (co-dominate stems) or vigorous, upright branches competing with the leader.

B. Radially and vertically distributed branches form a symmetrical crown.

## APPENDIX E

### VIII. Roots: container, boxed, or balled and burlapped trees regardless of species or mature size

A. Check that the tree is free of roots visibly circling the trunk, and free of "knees" (roots protruding above the soil).

B. If in a tapered container, slip the root ball out; the root-ball periphery should be free of circling roots larger than 6 mm (1/4 in.) in diameter and a bottom mat of roots 6 mm (1/4 in.) or larger (the acceptable diameter of circling peripheral roots depends on species and size of the root ball).

C. Untie the tree trunk from the stake; the trunk should not touch the top rim of the container.

D. Tip the root ball or container on its side and with a small jet of water expose the roots within 50 mm (2 in.) of the trunk to a depth of 65 mm (2.5 in.) below the topmost root attached to the

trunk. The trunk and main root(s) should be free of circling roots and kinks. Replace soil washed from around the trunk with a similar soil mix (less than ten percent of the total root-ball volume should need to be added).

E. If the trees pass the above inspections, further inspect the roots by removing the soil from the roots of no less than two tree species/variety. The trunk and main roots shall be free of circling and kinked roots.

**IX. Defective Trees:** In case the sample trees inspected are found to be defective, the buyer reserves the right to reject the entire lot or lots of trees represented by the defective samples. Any plants rendered unsuitable for planting because of this inspection will be considered as samples and will not be paid for.

# APPENDIX F

## UCSC GROUNDS PESTICIDE TRAINING PROGRAM OUTLINE

The following information must be covered with all employees who will engage in the application of pesticides. No employee will be allowed to apply pesticides until this information has been covered in its entirety. This training is required at least annually as per worker safety regulations of the Department of Food and Agriculture.

### I. Acknowledgment Of Pesticide Safety Training

The following information must be reviewed and understood for each pesticide to be used.

- A. Immediate and long term hazards
- B. Safety procedures to be followed
- C. Procedures for handling emergency situations including common poisoning symptoms and decontamination procedures
- D. Applicable laws, regulations, M.S.D.S. and label requirements

### II. Information Safety Series

Review and discuss information safety series A-1, A-2, A-4, A-6, and A-8. All employees should have a copy of this series. Post Safety Series A-8 in prominent area of workplace.

### III. Loading, Mixing, and Rinsing Procedures for Pesticide Application

Discuss and review the procedures.

### IV. Pesticide Safety Video

View and discuss.

### V. Material Safety Data Sheets

Review the M.S.D.S. for each pesticide applied. All employees should have a copy of these.

### VI. Employee Right to Know

Discuss the Hazard Communication Program (i.e. Safety Series A-8).

- A. Purpose of Hazard Communication
- B. Worker rights
- C. Hazard identification
- D. Training and education
- E. Label and warning information
- E. Location of pesticide application records
- G. Location of telephone number and address for emergency medical care

# APPENDIX G

## DEVELOPING A SITE MANAGEMENT PLAN

(ADAPTED FROM GARDNER UNDATED)

The first step in developing a site management plan is collection of baseline data. The collection data and process will serve to introduce and familiarize the stewardship team with the site. Through the process of researching and collecting the data, the stewardship team will learn about the ecological features and processes which shape the site and give it a unique functional and visual character. Baseline data will provide information necessary to the formation of site management and restoration action plans. It may provide clues to the nature of a disturbance or to the ecology the stewardship team hopes to restore.

Some of the baseline data on the site has already been collected by other surveys or studies. Fire management crew, the Reserve's Steward, Environmental and Biological faculty, and other specialists may have already collected data that the stewardship team can utilize. Likewise, the information compiled by the stewardship team will be of great interest to those working on projects on or near the site. The Steward Program Coordinator can advise the stewardship team as to projects and persons the stewardship team may want to contact as the stewardship team begins compiling baseline data.

Much of the data that is needed has already been collected; it is the job of the stewardship team to fill in the gaps. Site specific floral and fauna reports and/or detailed vegetative maps may have already been written. These reports may exist or it may take several seasons or years to collect the needed data. This should not delay the writing and enacting of the site management or restoration action plans. Assemble as much information as possible now, noting long term data collecting needs and projects in the site management plan.

The following pages provide recommendations on the types of information that will help the team

understand and manage the site. Also provided are suggestions concerning how and where to acquire this information. Feel free to expand or delete information, but focus on data that will be critical to the management planning. Remember to document sources as the stewardship team goes along. Everything the stewardship team learns will add to the knowledge of resources on the campus.

The collection of baseline data may at first seem an overwhelming task. Begin slowly and enlist the help of other people, the Grounds Department, and various campus resources. The process will serve to orient the stewardship team to the site and to the entire campus. It is not necessary to learn everything about a topic; focus on the information the stewardship team needs now to complete a site management plan. Remember that the site management plan is itself a general statement of the site's features, problems, and management objectives. Details can be filled in later as part of the plan's implementation.

As the stewardship team assembles the baseline data, look for connections. How do the abiotic elements such as geology and hydrology influence the flora and fauna of the site? What human actions have caused disturbances or continue to do so? What cultural and natural resources require special attention? How will all this information translate into the goals and objectives of the site management plan?

The Stewardship Program Coordinator and Grounds Department can help the stewardship team interpret and integrate the baseline data.

### SITE MANAGEMENT PLAN OUTLINE

- I. Site Name
- II. Site Description - *Briefly describe the site.*
- III. Location - *Provide a detailed description of site*

location, and outline the watershed on a topography map. Estimate the size of the site in acres.

The first map the stewardship team will need is a map showing the topography and boundaries of the site, a site map. This can be located in the Physical Planning and Construction Office or the Environmental Assessment Group Office. This map will probably be oversized and encompass more than the site. By playing with a photocopy machine, create a smaller map the stewardship team can carry easily in the field. Remember to include the scale, legend and compass directions on the field map. Finally, locate a 10 scale map and the Roy Buck 1986 map which contains the stewardship team site.

**IV. Site History and Cultural Resources - Provide a brief sketch of any historical and cultural uses of this area (i.e., grazing, ranching, agricultural or Native American land uses).**

Historical maps and aerial photos can provide invaluable information such as major changes in vegetation patterns, alterations in the natural topography and hydrology, and the past existence of structurally significant structures. As such maps and photos can be found in any number of places, it is best to start with the Physical Planning and Construction map archives and Special Collections at McHenry Library.

An understanding of the human history of the site will guide many of the management decisions. Past activities such as grazing, mining, construction, and lumbering may have impacted the ecological processes by altering vegetation patterns, removing top soil, diverting streams, and changing topography. Knowledge of human activities may provide the stewardship team with clues as to the cause and extent of the ecological imbalance on the site. It will also direct the revegetation efforts by providing clues to native impact on the site.

In addition to the ecological impacts of the site's human elements, historical context must be considered. A eucalyptus stand may be historically significant as well as ecologically damaging; the stewardship team may need to preserve some trees while minimizing their negative impact on the site.

The following questions need to be addressed:

- When did the site enter the campus/reserve system and what was its prior use?
- Who were the past owners of the site and how did they impact it? Was the site grazed, mined or farmed?
- What ornamental or agricultural species may have been introduced to the site and are they "historically significant"?
- Did Native Americans utilize this site and if so how?
- What human activities may have changed the topography and hydrology of or near the site (i.e., road construction or mining)?
- Are there historical documents, photos or maps of the site in the campus archives?
- What is the "historically significant" period of concern for the campus on this site (i.e., Native American vs. logging vs. mining)?
- What are the concerns of the campus community in relation to this site and to ecological restoration efforts there?
- Where can I find more information?

Information on the history of the campus can be obtained from various faculty, staff, students, *The Natural History of the UC Santa Cruz Campus*, edited by Sheridan F. Warrick, and similar books.

**V. Site Analysis - Provide a description of the following elements on the site:**

#### 1. Geology

Locate geological survey maps in the campus archives. These maps will show the stewardship team the bedrock covering the site, as well as the slope, aspect, and elevation. Note all relevant information.

#### 2. Soils

Locate the site on campus soil survey maps, observing boundary lines between soil types as the stewardship team may later find a correspond-



ing boundary in plant communities. Take the time to look at the maps and note any pertinent facts. Testing the pH and moisture of the soil with a testing kit is also important.

Some questions that need to be addressed are:

- What and where are the main soil types in the site, and what are their characteristics?
- Describe the color and texture of the soil the stewardship team find on site (if the site is large, describe samples from representative areas).
- What is the soil depth and depth to the bedrock?
- What is the effective rooting depth?
- Describe some limitations and/or appropriate uses of the soil type on the site.
- How does the soil relate to hydrology? How permeable is it?
- What is the available water capacity and intensity of runoff?
- What is the potential for erosion?
- What are the characteristic plant communities or the soils? Are those plants all present?
- What wildlife habitats are generally associated with the soils?
- Does this match what the stewardship team actually has?
- How deep is the organic layer and the rooting system?
- Are there measurable chemical changes in or near certain plant communities (ex. pH levels near eucalyptus)?

### 3. Climate

When thinking about climate, the primary concern is how it will affect the restoration efforts. Some invasives will not resprout if mowed or cut at a time of maximum drought stress. Many native plant seedlings show a much higher survival rate if planted out when there is adequate

rainfall to sustain them until mature root systems have developed. Thus it is important to know the cycle of the wet and dry seasons on the site. Consider setting up a simple station at the site to measure wind speed, precipitation and temperature. For more information please contact Sue Gardner at (415) 776-1607 ext.250.

### 4. Vegetation

Obtain a copy of Roy Buck's report, *Botanical Survey for University of California, Santa Cruz*, and obtain a list of flora on the site. Begin checking those plants initially found in Buck's report against those which now exist in the field. Make notes as to their location, seasons and prevalence. Also indicate whether plants are native or non-native, invasive or endangered. Walk the site several times with the Reserve Steward, botanist faculty, or other members of the Grounds staff who can help the stewardship team identify the plants. Members of the California Native Plant Society will also come out upon request. Plus field guides and plant keys may be checked out of the campus libraries. Once the team is familiar with the plant distribution of the site cross reference the findings with the community classifications in the Roy Buck Report. Keep a list of invasive exotics, their locations, and the seasons in which they are dormant or in seed. The observations will be added to the Grounds Department plant database. Note which control techniques would be appropriate to the site and situation.

Note: The study of the site's flora will be an ongoing process and play a major role in enacting the management and restoration action plans. If the stewardship team is not able to include a complete flora in the management plan, a partial list will be sufficient. Ongoing data collection will be an objective of the site management plan.

### 5. Hydrology

Begin by marking the watershed boundaries of the site on the enlarged topographical map. What water feeds into the site and where does

the water go? Also record any known streams, ponds, seeps and springs on the map, and indicate whether they are permanent or intermittent. Walk the stewardship team site to confirm their existence and record any discrepancies.

Due to seasonal cycles in the area, the stewardship team will need to visit the site many times, monitoring seasonal changes in water flow and soil moisture. Do not be overly concerned with quantitative measurements; relative statements such as "moist" or "dry" are sufficient at this stage. Watch for streams and standing water that appear only with the rainy season and dry up during the summer, making note of when and where they appear as well as their depth, velocity and slope. The topography and vegetation of the site can provide clues as to where to look.

Describe the morphology of the wet features:

- Is a stream straight, braided or ponded? What kinds of debris are in it?
- Also describe any man-made structures that are affecting the hydrology of the site (i.e., culverts, pipeline, storm drains, silt catchers, irrigation, and artificial ponds).
- Cross reference these with any historical information the stewardship team may have gathered.
- List all species the stewardship team finds in the wet areas, making note of the season in which the stewardship team finds them. The stewardship team will have to explore the life of the seeps and streams throughout the year in order to catch seasonal appearances of salamanders and *Mimulus*.
- Are any of these species endangered? Are they non-native? Are there any indicators of wetlands?
- Also watch for signs of wildlife that may utilize a stream or pond. Look for footprints and animal trails along stream banks.

After the stewardship team has become familiar with the hydrological features of the site, make an appointment to walk it with a member of the faculty or campus staff that is knowledgeable about hydrology.

#### 6. Fauna

Contact Brian Walton of the Predatory Research Group to obtain a list of raptors and other birds that may be on the site. Walk the site with an experienced avian specialist and look for both birds and nesting sites, paying particular attention to areas the stewardship team may want to disturb in the future. Begin a list of sightings, noting species, location, date, time, weather conditions and behavior.

Keep a similar list for animal sightings. Also record signs such as trails, scat, carcasses, and tracks. As the stewardship team compiles the fauna list, make note of any rare or endangered species. The presence of an endangered species will greatly affect the management and restoration efforts as their preservation is a federally mandated priority.

Note: Ongoing studies of the fauna of the site may be the stewardship team goals or the objectives of the site management plan.

#### 7. Land Use

An analysis of the current use of the site.

VI. **Problem Statement** - *What are the threats to the integrity of this site (in general)?*

VII. **Management Goals** - *What are the end goals for the project — what would the stewardship team like to accomplish?*

VIII. **Implementation Plan** - *In general terms, how does the stewardship team plan to meet the management goals listed above?*

IX. **Special Considerations** - *Are there any endangered species, potential conflicts, historical or cultural resources, or unusual circumstances which may affect restoration activities?*

# APPENDIX H

## ANNOTATED BIBLIOGRAPHY

The following list consists of a *partial* listing of materials read and reviewed for creation of the Landscape Management Program.

- Adams, Christine M. and Julia Graham. (1992) *Senior Thesis The Relationship of Disturbances to the Native Grasses of the UCSC Campus.*  
Describes the history, ecological succession, disturbance of the grasslands, including descriptions of campus native grasses.
- Adams, Christine M., Arthur W. Gil, Julia Graham, and David E. Rothstein. (1992) *UCSC Campus Native Grass Survey for Environmental Studies 104B.*  
This study provides a detailed analysis of native grasses occurring in the lower meadows, their relative abundance, and their distribution. It also identifies the current status of native grasses on campus, identifies areas important for native grass restoration and enhancement, and provides a base for information for further studies.
- Adams, Ted and John Menke. (1992) "Perennial Grasses for Roadside Weed Control." *Grasslands*. September issue.  
Discussion of eight different grass species that were planted to determine possible weed control benefits.
- Ammes, David. (1992) "Grassland Restoration in California." *Grasslands*. October issue.  
Discussion of restoration through fire, grazing, technology, and monitoring as tools available for grassland restoration and management.
- Ammes, David and Ted Adams. (1992) "Seeding After Wildfires in California." *Grasslands*. May issue.  
Discussion of the need for seeding and seeding methodologies.
- Anderson, John. (1993) "Strategies for Establishing Native Grasses." *Grasslands*. 3:1.  
Discussion of herbicides, seed bed preparation, seeding techniques, and weed management to aid in the establishment of native grasses.
- Ball, Donald M., Jeffrey F. Pedersen and Garry D. Lacefield. (1993) "The Tall-Fescue Endophyte." *American Scientist*. 81:370-379.  
Evolution meets economics in this discussion of the nation's most popular planned grass, which owes many of its qualities to a fungus toxic to livestock.
- Buck, Roy E. (1986) *Botanical Survey for University of California, Santa Cruz, Long Range Development Plan: Base Line Study.*  
Describes the plant communities on campus and significant plant species, and suggests recommendations for mitigation of development impacts.
- *Campus Land Management Plan, The University of California at Santa Cruz.* (1981) The Ad Hoc Campus Land Management Committee and The Student Task Force to the Campus Land Management Committee.  
This report defines land management options for UCSC using three models of campus land management and defines specific land management issues including grassland management, pest control policies, viticulture, silviculture, fire management, and a campus reserve system.
- Cheater, Mark. (1992) "Alien Invasion." *Nature Conservancy*. September/October issue pp. 25-29.

Discussion of tall fescue and other weeds as invasive aliens, outlining weed history through methods to defend against the weeds.

- Curry, Bob. (1981) *UCSC Viticultural Plan*.

This report discusses the suitability of the campus for wine production, the probability of production capabilities for at least three premium wine grape varieties, suitable sites for such a venture, and estimates of possible revenue.

- *Denver Botanic Gardens Master Plan Report*. (1992)

This plan discusses the classification of individual site usage, how to define gardens that are consistent with their expected level of excellence, expansion of their education programs and community outreach, etc.

- Final Recommendations on Management of Campus Grasslands. (1981) *Student Task Force*.

This report identifies recommendations in monitoring of pasture conditions, restoration of native perennial grasses, investigation of the ground squirrel problem, grazing land for the Farm, and the maintenance of esthetic quality.

- Fusari, Margaret. (1983) *The Ground Squirrel Management Supplement*.

This report was written as a supplement to the 1983 *UCSC Ground Squirrel Management Plan*. It outlines the Integrated Pest Management (IPM) protocols for the campus.

- Grazing articles:

Blumler, Mark A. (1992) "Some Myths About California Grasslands and Grazers." *Fremontia*. 20:3, 22-34.

Dewald, Chester L., William A. Berg and Philip L. Sims. (1985) "New Seed Technology for Old Farmland." *Journal of Soil and Water Conservation*. 40:3, 277-278.

Edwards, Stephen W. (1992) "Observations on the Prehistory and Ecology of Grazing in California." *Fremontia*. 20:1, 3-11.

Menke, John W. "Grazing and Fire Management." (1991) *Grasslands*. October issue.

———"Grazing and Fire Management for Native Perennial Grass Restoration in California Grasslands." (1992) *Fremontia*. 20:2, 23-25.

Wood, Daniel B. "Soil-Management Lessons Help California Ranchers." (1993) *Christian Science Monitor*. 3 August issue, p.14.

- Greenlee, Jason M. (1978) *Fire Management Plan, UCSC*.

This document describes the management plan for the prescribed burning of 150 acres of upper campus lands to reduce fire hazards due to fuel load.

- Gunnoe, Bryan Andrew. (1981) *Senior thesis Toward the Development of a UCSC Campus Land Management Plan*.

This document outlines in great detail the business, laboratory, and park model approaches to land management and compares them, finding the laboratory model to be the most adequate model.

- Handweeding Festival Data. (1981)

These pieces of data included a flier for the festival, a budget, as well a newspaper article discussing the success of the event. Over 100 participants attended the Handweeding Festival at the UCSC West Playing Field, which included bluegrass music for entertainment and pizza as reward.

- Heath, Sacha, Andrea Joyce, Scott McBride, and James Ross. (1992) *Landscape as Place at UC Santa Cruz: Identification and Names of Valued Outdoor Spaces*.

This document formalizes the names and locations of valued places on campus, such as Elfland and the Porter Meadow, so that future planning and building site decisions can be made with the information.

- Houser, Kris. (1981) *2,4-D in UCSC Turf Management*.

This report contains a consortium of notes from various campus reports on Phenoxy Herbicide 2,4-D, contains estimated costs for maintenance, and various herbicidal and non-herbicidal weed control methods for turf.

- Karst Publications on file with North Jersey R C & D as of 7-15-94.

A bibliography of publications on the subject of review, planning, and design development in carbonate areas.

- Landscape Management Plans - National Parks List:

*Development, Concept Plan, and Environmental Assessment.* (1991) West District Pinnacles National Monument, California.

*Exotic Plant Management Plan.* (1989) Point Reyes National Park.

*Final General Management Plan, Development Concept Plans, and Environmental Impact Statement.* (1992) Great Basin National Park, Nevada.

*Final General Management Plan, Development Concept Plans, and Environmental Impact Statement.* (1992) Petrified Forest National Park, Arizona.

*General Management Plan, Visitor Use, Park Operations, and Development.* (1980) Yosemite National Park, California.

*Land Protection Plan.* (1989) Grand Canyon National Park, Arizona.

*Revegetation and Related Vegetation Management Guidelines Draft.* (1993) National Park Service Western Region.

*Statement for Management.* (1988) Petrified Forest National Park, Arizona.

*Statement for Management.* (1992) Redwood National Park, California.

- Landscape Management Plans - Other Campuses List:

*Campus: A Compendium Of Planning And Design.* (1988) State University of New York Campus Environmental Improvement Program.

*Draft, Campus Landscape Planning Study.* (1993) Campus Planning Office, UC San Diego.

*Landscape Design Guidelines.* (1989) Stanford University, Stanford Planning Office.

Peck, Sheila. (1993) *Landscape Conservation Planning: Preserving Ecosystems in Open Space Networks.* Integrated Hardwood Range Management Program, University of California Cooperative Extension.

*Resources Management System for Campus and Environs.* (1972) Ingmire-Patri Land Resource Planning.

- Leveton, Ruth. (1980) *Senior thesis The History and Future of Phenoxy Herbicide 2,4-D.*

This report discusses the history and intended uses of Phenoxy Herbicide 2,4-D, discussing the chemistry, human health effects, environmental effects, and alternatives of the herbicide.

- Lowry, Judith. (1991) "Notes on native grasses." *Grasslands*. 2:1.

Article discussing native bunchgrasses, management techniques, and recent research.

- Menke, John and G. Eric Bradford. (1992) "Rangelands." *Agriculture, Ecosystem and Environment*. 42:141-163.

Discusses the effective integration of three main goals of rangeland management: economic gain through livestock production, management of game animals for recreational use, and conservation of biological diversity.

- Monitoring California's Annual Rangeland Vegetation. (undated) *Cooperative Extension University of California, Division of Agriculture and Natural Resources, Leaflet 21486.*

Discusses herbaceous plant measurements, monitoring woody vegetation, monitoring tree overstory, and using photo points as a monitoring tool.

- Oak Tree information sources:

*A Planner's Guide for Oak Woodlands.* (1993) Published by the University of California Integrated Hardwood Range Management Program and California Department of Forestry and Fire Prevention.

Hagen, Bruce W., Barrie D. Coate, and Keith Oldham. (1991) *Compatible Plants Under and Around Oaks*. California Oak Foundation, CA.

McCreary, Douglas D. (undated) *How to Grow California Oaks* (pamphlet). University of California Cooperative Extension.

*oaks 'n' folks*. Published by the University of California Integrated Hardwood Range Management Program.

*Quercus*. Published by the University of California Integrated Hardwood Range Management Program.

- Passof, Peter C., W. James Clawson, and E. Lee Fitzhugh. (1985) *Preliminary Guidelines for Managing California's Hardwood Rangelands*. Cooperative Extension, University of California, Division of Agriculture and Natural Resources, publication 21413.

The focus of this manual gives guidelines for oak-grass woodland areas that have at least 10 percent tree canopy.

- Range Monitoring Handbook and Range Management Guidelines (1990) *Point Reyes National Seashore, National Park Service, U.S. Department of Interior*.

Both documents discuss the framework for monitoring rangelands in Point Reyes National Park.

- Salmon, Terrell P. (1982) *Ground Squirrel Management Plan, U.C. Santa Cruz Campus*.

This document discusses the biology, control, monitoring, and a management plan for the campus ground squirrel problem.

- Sample Costs to Establish and Produce Wine Grapes in the North Coast Counties. (1980) *Division of Agricultural Sciences, University of California, Special Publication 3086*.

This publication shows sample costs to establish a vineyard, to produce cane-pruned, trellised wine grapes with sprinkler protection, and to produce older, head-trained wine grapes.

- Seidenstein, Roy. (1981) *Ground Squirrel Management: Controversy and Recommendation*.

This document discusses the controversy surrounding control of the campus's ground squirrels and suggests management tools.

- Signage documents:

*Campus Furnishings and Signage.* (1993) University of Washington.

*Campus Signing Program.* (1978) University of California, Santa Cruz.

- Staub, Stephen R. (1995) *Land Management Study for Fire Prevention, UCSC*.

This report is summarized in the Land Management Study for Fire Prevention section and Appendix B.

- Stewart, Tom and Jean Marie Morelli. (1980) *Turfcape - An Integrated Pest Management Alternative for Parklands of California Central Coast Counties*.

This document discusses management techniques for turf that takes into account energy, water, soil as well as socio-political, human health and environmental considerations.

- *UCSC Campus Standards Handbook.* (1993) Physical Planning and Construction, UCSC.

This handbook contains the campus standards for planning and construction. A list of landscaping standards can be found in Appendix A.

- *UCSC Ground Squirrel Management Plan.* (1983) CLUPC Subcommittee on Ground Squirrel Management.

#### APPENDIX H

This report suggests several control methods, which are outlined in the Integrated Pest Management (IPM) section of this document.

- Wittman, Thomas. (1991) *Ground Squirrel Control at UCSC.*

This report outlines three major control methods: shooting, trapping, and fumigation, and also mentions that management of the meadow grasses may prove to be the most effective control program.

- Yellow Starthistle Control. (1991) *Range Science Report from the Department of Agronomy and Range Science, University of California, Davis, Number 30.*

Outline of the life cycle, plant description, control considerations, control methods, and preventive measures concerning yellow starthistle, *Centaurea solstitialis*.

# APPENDIX I

## DAB CORRESPONDENCE TO CHANCELLOR PISTER

SANTA CRUZ PHYSICAL PLANNING AND CONSTRUCTION

May 11, 1995

CHANCELLOR KARL S. PISTER

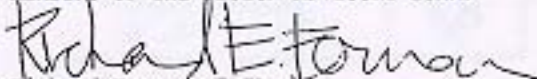
Re: Landscape Management Program and Plan

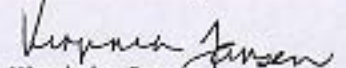
Dear Karl:

At its meeting of March 23, the Design Advisory Board reviewed the most recent draft of the Landscape Management Program and Plan, prepared by Chancellor's Undergraduate Intern Jeanine Scaramozzino, in conjunction with Dean Fitch and the UCSC Grounds Department. Members of the Board were enormously impressed with both the scope and the quality of their effort, and I am writing on the Board's behalf to convey our enthusiasm and wholehearted endorsement. While much remains to be done, both in completing the draft and in implementing it, the work to date represents an enormous jump forward in understanding, preserving, and enhancing UCSC's spectacular landscape. Ongoing support, both administrative and financial, will be essential for the plan to succeed. We suggest that securing funds for its implementation be included as one of the campus's fund-raising goals; perhaps alumni would be among the strongest potential sources of assistance.


The Board particularly appreciates your personal interest and support for this endeavor, and we hope that the plan is only the first step in the long range management of UCSC's most visible resource.

Sincerely,  
MEMBERS OF THE DESIGN ADVISORY BOARD

  
Richard Fernau, FAIA

  
Virginia Jansen  
Professor of Art History

  
Tito Patri, FASLA

  
David Rinehart, AIA

cc: G. Bice  
L. E. Coate  
D. Fitch  
J. Hagler  
J. Scaramozzino  
F. Zwart