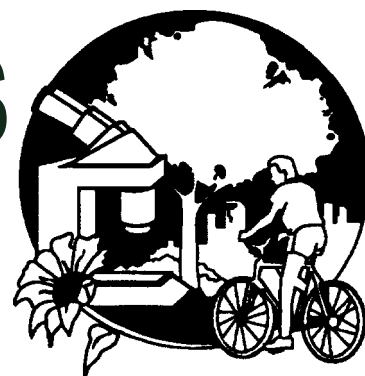


GROWING Points

Department of Environmental Horticulture • University of California, Davis



Ornamental Horticulture in California The industry grows and changes

Coastal California’s unique climate—cool and often foggy in summer, relatively warm and sunny in winter—combined with a ready supply of agricultural labor, has long provided an advantage for the production of ornamental crops. The ornamentals industry started with the production of outdoor crops, but soon diversified into year-round production of cut flowers under cover. Because of the equitable climate of the major production districts, rudimentary shelters sufficed for carnations and greenhouse construction and energy costs were relatively low.

The small “local market” industry of the prewar years expanded enormously after the Second World War, as improved rail and air transportation (along with refrigeration) opened East Coast markets to ornamentals produced in California. Production of various crops was located in areas that provided optimal climates: carnations in rudimentary shelters north of San Diego, field chrysanthemums under shade cloth in South San Francisco, nursery production in Los Angeles and Orange Counties, rose propagation in the Central Valley, and production of lily bulbs in the northwest corner of the state. In addition to producing cut flowers, cut foliage, and potted plants, California growers began producing bedding plants, woody ornamentals, roses, flowering bulbs, flower seeds, Christmas trees and prepared turf. By 1994, the wholesale value of ornamental crops produced in California exceeded one billion dollars.

Challenge and Change

In recent years, California’s green

industry has been impacted by urban and suburban growth. Areas where the ornamentals industry was first established—South San Francisco, San Jose, Monterey, Santa Barbara, Los Angeles, and San Diego—have also been areas of rapid population growth.

Because of increased land values, many growers have relocated to outlying areas. The shade cloth chrysanthemum growers of the San Jose area, for example, have moved south to largely agricultural areas such as the Salinas Valley. Greenhouses have been constructed in the desert east of Palm Springs (where geothermal energy supplies heating), in the inland valleys east of San Diego, and even in the Central Valley, where fog is heavy during winter and temperatures are extreme during summer. By using more sophisticated growing structures and techniques, growers can establish operations in less favorable climates, while still benefiting from ample light and the state’s plentiful labor supply.

As in many other industries, global competition affects green industry growth



In addition to cut flowers, the state’s green industry produces and maintains ornamentals, turf and bedding plants.

and profit. In recent years, flower imports into the United States from other countries such as Colombia, Israel and Holland have increased exponentially. These imports have been largely of the traditional crops: carnations, chrysanthemums, and roses. Although the market has expanded to absorb these imported products, their availability has prevented even an inflation-linked increase in prices. Some California growers have responded to reduced profit in the major cut flower crops by growing new “specialty” crops or varieties, such as lisianthus, asters, and amaryllis, to name a

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few.

The bulk of California ornamental production is still marketed through wholesale shippers located in California who ship product to wholesalers and/or retailers



The department's classrooms and laboratories (equipped for a wide range of analytical techniques) are contiguous with 150 m² of greenhouses, 100 m² of controlled growth chambers, a nursery, experimental golf green and 2 ha. of field areas where many of the experimental plants are grown.

in other states. In recent years, however, there has been a return to servicing the local market. Sales through produce markets in San Francisco and Los Angeles have increased and there is now a "Dutch"-type auction in San Diego County.

This changing marketplace has affected the types of flowers that are produced. Production of traditional flowers, such as large disbud-ded chrysanthemums and standard gladiolus, primarily used in formal decorating at weddings, banquets and funerals, is declining in favor of spray chrysanthemums, miniature carnations and a variety of specialty crops that are more suited to arrangements for the home.

It appears likely that the California ornamentals industry will continue to change. While urbanization results in relocation of floriculture production, it also provides a vast new market for all kinds of ornamental plants. Enterprising horticulturists are already concentrating on servicing this rapidly increasing clientele by selling plants to mass marketers and supermarkets.

New opportunities continue to arise in landscaping and maintenance of domestic and public landscapes and sports areas. The need to conserve water will change these urban landscapes to more xerophytic (drought-tolerant) ones, with a consequent need for horticulturists to develop suitable crops and techniques. Californians are increasingly interested in using plants native



to the state, not only because they are generally better adapted to California's Mediterranean climate and diverse soils, but also because carefully selected native plants generally require less water. It's not difficult

handling, landscape horticulture and turf management. The current teaching, research, and extension goals of the Department of Environmental Horticulture are to:

- develop production methods that conserve our natural resources
- develop strategies for the revegetation and remediation of disturbed sites
- develop strategies for the maintenance of wildlands and forests

The department offers an undergraduate degree in Environmental Horticulture and Urban Forestry. (See next page.) It is also

the administrative home of the Graduate Group in Horticulture and Agronomy, which prepares students for professional roles in the private or public sector.

Graduates from the Department of Environmental Horticulture are now leaders in landscape management, urban forestry, turfgrass management, horticultural analysis and consultation,

flower breeding, flower production, and retail and production nursery management. We plan to increase the number of students preparing to meet the challenges of the ever-increasing urbanization of California.

We also participate in Ph.D. programs in plant biology, genetics and ecology and most major departments across the U.S. now have our former graduate students on their faculties. In addition, we attract a large number of post-doctoral students and visiting scholars to study in our laboratories. Our major challenge for the future of our graduate program is to find additional extramural funding needed for graduate student support.

The first of its kind, the Department continues to maintain a strong international reputation for research and teaching programs that place horticulture in an environmental context. These programs support the large and diverse green industries of California.

to imagine landscapes of the future comprised entirely of plants that require very little water, or landscapes that are 'wired' with the latest state-of-the-art equipment to monitor water availability and control water applications through irrigation systems.

California ornamental horticulture will continue to evolve as producers respond to these pressures and develop new means of maintaining profitability. Despite change, and perhaps because of it, production of ornamental crops will continue to be important to the agricultural economy in California.

Responding to Industry Needs

Established in 1966, the Department of Environmental Horticulture resulted from a merger of the Dept. of Landscape Horticulture at UC Davis and the Dept. of Floriculture and Ornamental Horticulture at UCLA. Its traditional strengths are in floriculture and nursery production, postharvest

Environmental Horticulture and Urban Forestry

Undergraduate major offers diverse opportunities

Now in its fourth year, the department's Environmental Horticulture and Urban Forestry (EHUF) major offers students the opportunity to learn how plants improve the environment and the quality of our lives. The focus of the EHUF major is on the biological and physical concepts and horticultural principles of plant production, management of plants and plant ecosystems in landscape settings, and sociological aspects of plant/people interactions in the urban environment.

Plants are used to revegetate and restore disturbed landscapes, control erosion, and reduce energy and water consumption. The ornamental use of plants to improve the aesthetic quality of urban and rural land-

Biodiversity/Restoration.

Environmental Horticulture and Urban Forestry is a diverse field including ornamental horticulture, landscape horticulture, floriculture, nursery management, plant biodiversity, and urban forestry. Students can study greenhouse and nursery crop production, postharvest handling of cut flowers and foliage plants, landscape tree maintenance, turf management and plant propagation.

Courses are also offered in other departments on campus (Landscape Architecture, Plant Pathology and Entomology) to complete and broaden the student's education. The field offers career opportunities for students who have sophisticated training in the development and management of landscape resources that range from production nurseries to arboreta, private resorts, and public parks. Graduates from this program are considered to be highly qualified and are valued in the industry for their broad background and flexibility in adapting to a changing environment.

The department has excellent facilities for teaching and research. In addition to providing students with access to our research laboratories, our teaching facilities include a herbarium, a computer laboratory, computer-controlled greenhouses, an outdoor nursery, and extensive landscape plantings. We also have close ties to the UC Davis Arboretum, which serves as an outdoor laboratory for plant identification and landscape usage of ornamental plants.

The EHUF Bachelor of Science degree provides students with the necessary background to understand and apply the concepts, principles, and methods of plant biology, ecology, and genetics. The "principles" approach to our courses prepares students to understand, investigate and solve challenging problems.



"What I like about this major is that the classes are small and the students are a close-knit group. There's plenty of opportunity for hands-on experience with plants and that's a good way to learn."

--James Cook, EHUF student specializing in Plant Biodiversity/Restoration

scapes, recreational areas, interiorscapes and commercial sites is an important aspect of this major. Students in the EHUF major can select from four areas of specialization: Urban Forestry, Floriculture/Nursery, Landscape Management/Turf and Plant

Careers in Environmental Horticulture and Urban Forestry

- Floriculturist
 - Greenhouse Grower
 - Greenhouse Manager
 - Field Flower Grower
 - Custom Plant Propagator
 - Greenhouse Consultant
 - Pest Control Advisor
- Production Horticulturist
 - Nursery Manager
 - Nursery Marketing
 - Nursery Consultant
 - Horticultural Advisor
 - Garden Center Operator
- Landscape Horticulturist
 - Revegetation Consultant
 - Site Analyst
 - Park Supervisor
 - Park Planner
 - Golf Course Manager
 - Landscape Designer
 - Landscape Contractor
 - Urban Ecologist
 - Arborist
 - Tree Damage Assessor
 - Landscape Inspector
 - Irrigation Specialist
- Flower Seed Producer
- Plant Breeder
- Turf Sod Producer
- Curator of Botanic Garden
- Arboretum Director
- Land Appraiser
- Land Development
 - Consultant
- Community College
 - Instructor
- Expert Witness
- Graduate Studies

Restoration Ecology Programs Take Root

By Truman Young

The current expansion of restoration activity in the private and public sectors is paralleled by a growing interest in restoration ecology as an academic discipline. The establishment of specific academic programs, however, has lagged behind demand. The Department of Environmental Horticulture is aggressively addressing this shortfall on three fronts.

First, I have been hired as a new assistant professor under the title, *Restoration Ecologist*. Although I am the first faculty member at UC Davis with this title, there are several other members of the UC Davis academic community who have been active in developing the graduate program here: Kevin Rice of Agronomy and Range Science (ARS), Mark Schwartz and Eliska Rejmankova of Environmental Science and Policy (ESP), and Debbie Elliott-Fisk of Wildlife, Fish, and Conservation Biology (WFCB). They have overseen the birth of the Restoration Area of Emphasis in the Ecology Graduate Group, and seen it become the fastest growing and most academically competitive area of emphasis in ecology.

Second, we have recently added a new option in the Environmental Horticulture and Urban Forestry Major called *Plant Biodiversity and Restoration*. This option is specifically designed for horticulture majors who want to increase their ecological background and restoration experience. It combines course work in both horticulture and ecology with hands-on internships in restoration.

Third, we have proposed a new minor called *Landscape Restoration*, designed for majors in other departments such as WFCB, ESP and Evolution and Ecology (EVE). These students may have solid backgrounds in ecology and conservation, but less training in actual plant management, which we provide with courses in Environmental Horticulture.

Together, these actions represent a serious commitment on the part of the Department of Environmental Horticulture to the future of ecological restoration in California.

Restoration and Biodiversity Management at UC Davis

Restoration represents a major shift in environmental management and biodiversity



Students and volunteers from the Davis community plant valley oak, white alder, and willow saplings at the Putah Creek Riparian Reserve. The California Dept. of Fish and Game donated 2,000 saplings for this restoration project.

conservation from preservation and damage control to active rehabilitation. Because it re-establishes plant populations, communities, and entire ecosystems in areas in which they have been destroyed or degraded, its role is critical.

Public recognition and support of restoration's role in recovering degraded biodiversity is increasing. The state, the nation, and the international community have begun supporting its goals through legislative mandates and financial commitments. In addition, a new scholarly society (*Society of Ecological Restoration*) and new international peer-reviewed journals (*Restoration Ecology*, *Restoration and Management Notes*) have been established in the last decade to address this burgeoning growth.

UC Davis is uniquely positioned to be an academic leader in this field because its programs apply both ecological principles and plant management expertise to the management and restoration of native biodiversity. By offering studies and applications relating to soils, climate, plant

physiology, population and community ecology, and plant-animal-mutualist interactions, UC Davis offers the multi-disciplinary expertise that is needed to meet the challenge of ecological restoration in the 21st Century.

Looking to the Future

Ecological restoration promises to be one of the most important areas of applied environmental science in the coming century (millennium!). The *Plant Biodiversity and Restoration* option and *Landscape Restoration* minor will prepare students for careers in restoration/mitigation biology, environmental consulting, and reserve management, to name a few. In addition, these programs will prepare students for graduate studies in environment, conservation, and land management.

We have already been in contact with employers who want to know how soon these students will be on the job market. The future looks bright for ecological restoration!

Departmental Research Briefs

A fresh look at cut flower behavior

Lobelia, asters and amaryllis are a few of the speciality crops that are gaining popularity in the cut flower market. But once harvested, how long do they remain fresh? In cooperation with a researcher at the University of Florida, Michael Reid and Linda Dodge are looking at the postharvest behavior of these crops to see how they respond to various preservation techniques currently used in the industry.

Where elephants and cattle co-exist

On arid and semi-arid rangelands worldwide, livestock shares the landscape with native plants and animals. While a considerable amount of research has been focused on the effects of domestic herbivore grazing on range ecosystems, little attention has been given to how wild and domestic herbivores impact each other and the ranges where they reside.

Truman Young has established a long-term experimental study of these relationships in the Laikipia ecosystem of Kenya. He believes that as the value of biodiversity climbs and the profitability of livestock production declines, it will be important to find successful ways to both manage and restore these degraded landscapes.

To graze or not to graze

How can range management be used as a tool in restoration? Truman Young and other scientists are attempting to answer this question by gathering data that will help them understand the causal links between livestock grazing and biodiversity. The Bureau of Land Management has established several large-scale experimental plots for this purpose in Kern County. By allowing cattle grazing on some plots and not on others, the research group is able to monitor the effects of grazing on endangered and threatened plant and animal species. They hope this information will allow them to assess how range

management can be used as a tool in habitat management and restoration.

Recycled water solutions

The use of recycled water for irrigation poses a challenge for landscape managers. Because some plants commonly used in urban landscapes will not tolerate the high levels of salt found in recycled water, landscapers must replace salt-sensitive plants with salt-tolerant ones.

Through ongoing research that looks at the effects of recycled water on landscape plants, Lin Wu and Ali Harivandi are compiling a list of about 30 popular woody plants and native grasses that tolerate high salt levels.

Aquatic plant filters?

What can sago pondweed and widgeongrass do for San Joaquin farmers? Lin Wu thinks they may remove water-polluting selenium that exists in high concentrations in irrigation water in this California agricultural region. Already thriving in San Joaquin Valley irrigation canals, both species tolerate the salt and selenium concentrations found there. Lin believes that they may convert selenium to its gaseous form, thus removing it from the water.

How much fertilizer is too much?

Application of chemical fertilizers contributes to salt build-up in the soil. When build-up occurs, water movement is reduced and leaf burn can result.

One way to measure the soil salt level is to take a soil sample from the root zone, add water, and measure the solution's ability to conduct electricity. Although widely used, this method can be inaccurate. Heiner Lieth is working on a simpler method that uses a sensor. He believes the sensor will provide more accurate information because it will measure salt concentration directly in the root zone.

Computer simulation in the greenhouse

You can build a mathematical model that describes the growth process of a

greenhouse rose crop. You can also build a model that describes greenhouse climate changes over time. Bring these two together, says Heiner Lieth, and you can simulate the effects on greenhouse rose growth of temperature, humidity and CO₂ concentration changes over time. The end product of his multi-part project will be a tool for growers that improves control of greenhouse production environments.

Plants in outer space

Do known horticultural principles apply to the culture of plants in extreme environments? A project developed by Don Durzan and other scientists associated with NASA to produce a cancer-fighting drug are geared to provide answers to this question.

Currently, they are studying the effects of microgravity on the production of taxol--a chemical produced by certain plants that is used to treat some types of cancer. In this study, taxol extracted from several species of ornamental yew is "over-produced" in a bioreactor that approximates the outer space environment. Through the use of gravitational forces, they hope to develop a means of producing this important drug that is currently in short supply.

Beyond their immediate goal, these studies will contribute to advances in modeling horticultural principles for extreme environments and to aging in microgravity.

Native oak species on trial

The establishment of native oak trees is a component of many current restoration projects. Although greenhouse propagation is common practice in restoration, cultured seedlings may encounter problems. Both container growth and drip irrigation can affect root development in ways that may be detrimental to long-term establishment in low-maintenance restoration sites.

Truman Young and Richard Evans are conducting trials to examine the effects of these and other horticultural practices on these species

How do you spell *Cymbidium*?

Many of you routinely seek answers to horticulture questions from your local county advisors and Master Gardeners. Perhaps you're wondering whether to water your backyard oak or how to properly cut back some mums. Or maybe you're intrigued by an unexpected flower color or shape and wish to pass the information along. A call to your local UC Extension office gives you access to practical advice based on both research and hands-on experience. And if they don't have the information you're looking for, they know where to find it.

Some county advisors conduct research or collaborate on projects with specialists and faculty members from various UC campuses. Much of the research-based information available, however, is obtained through projects and studies done here in the department. Our Extension specialists and many of our faculty members provide information to advisors who in turn educate Master Gardeners to work with the public. This avenue of information, broadened by the collective hands-on experience of researchers, staff and trained volunteers, is vital to the success of Cooperative Extension.

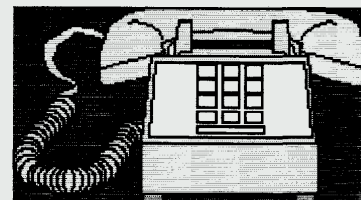
The department—often referred to by callers as the “horse’s mouth”—routinely receives a wide assortment of questions. Some questions, such as “How can I keep my loquat tree from bearing fruit?” are referred to the appropriate campus department (pomology, in this case). Others can be answered by staff.

Our office staff, some of whom have received Master Gardener training, keep abreast of horticulture resources via Internet websites and newsgroups. Often,

in response to a call, they take the time to consult reference materials or pull up a bit of information gleaned from a website.

Sometimes, they refer callers to one of our Extension specialists. Inquiries about soil mixes, for example, may be referred to Richard Evans, who conducts soils research. Heiner Lieth responds to questions about greenhouse production as does Michael Reid, who also answers inquiries about postharvest care of cut flowers. And Linda Dodge, our staff research associate who writes *News From The Ex Files* responds to a variety of floriculture and ornamental inquiries. Often, however, callers are referred to their local County Extension office, where experience with local growing conditions and problems is most likely to be found.

The list below provides a sample of the range of horticulture questions (with responses given) that our Extension specialists and staff are asked to answer, or at least obtain information about—everything from how to select a shade tree to how to spell *Cymbidium*.



Campus Resources

Agronomy & Range Science	(530) 752-1703
Calif. Vet. Diagnostic Toxicology Lab	(530)752-6322
Biological & Ag Engineering	(530) 752-0102
DANR Pubs	(510) 642-2431 1-800-994-8849
Entomology	(530)752-0475
Environmental Horticulture	(530)752-0130
Landscape Architecture	(530)752-3907
Ornamental Hort. Research/Info. Cntr.	(530)752-8419
Plant Biology	(530)752-0617
Plant Pathology	(530)752-0300
Postharvest Outreach	(530)752-6941
Weed Research & Info. Center	(530)752-0612



I have two black oak trees that are on a hillside on the edge of a lawn that are suffering a large amount of leaf drop. Water drains away from the trunk. Herbicide was sprayed only on nearby blackberry vines. What is causing this?

Herbicide drift may be responsible, but not too likely, since the oak tree foliage was probably too far away to be affected. Staff recommend the caller consult an ISA (International Society of Arboriculture) certified arborist or local County Extension office.

Our valley oak is dripping “brown water” from a cut on one of its branches. What is causing this?

Tree wounds that drip may be caused by bacterial canker. The Dept. of Plant Pathology here on campus does some disease diagnosis, so we suggested that the caller contact them about taking a sample in for diagnosis. Staff also recommended that the caller consult an ISA certified arborist. These trained professionals can be found locally and often do telephone consults at no charge.

Is oleander still toxic after it is composted?

For toxic plant questions (cherry pits in compost is another we have gotten), staff has a copy of the *AMA Handbook of Poisonous & Injurious Plants* that they consult for this kind of information. If they can't find it there, they refer callers to the California Veterinary Diagnostic Laboratory System toxicology lab.

My mother-in-law's tongue plant has mushrooms growing in its pot. Are they poisonous? How can we control them?

This caller was also referred to the CVDLS toxicology lab. For information about the toxicity of mushrooms (and an extensive list of toxic/safe plants), a new Cooperative Extension brochure titled *Know Your Plants...safe or poisonous?* can be obtained by calling (650) 726-9059 or contacting the UC Ornamental Horticulture Research and Information Center.

Our elm trees have new shoots coming up at the base of their trunks. One of the shoots is albino. What causes this to happen?

This caller was advised to contact an ISA certified arborist.

I would like information on how to operate a greenhouse.

Questions about greenhouse operation are referred to our greenhouse manager, Ron Lane, who responds to inquiries as time permits. Questions about building greenhouses are referred to the Dept. of Biological and Agricultural Engineering on campus.

How do you spell *Cymbidium*?

A staff member found this information in the *Sunset Western Garden Book*.

We would like to plant a deciduous shade tree next to our house that is fast-growing and low-maintenance. Any suggestions?

Many communities have a street tree program in place that maintains a list of recommended trees and their characteristics. It was suggested that the caller investigate to see if his community has one. He was also referred to his county Extension office.

My pine trees are infested with beetles. Is there a way to treat this problem?

This caller was referred to the Dept. of Entomology on campus.

We have some cardboard drums that were used to store garlic. We want to use them as receptacles for toy donations this Christmas. Is there a way to remove the garlic odor?

The Garlic Guru on the Internet was consulted on this one. She recommended rubbing the inside of the barrel with a handful of fresh rosemary and then leaving it in the bottom of the barrel.

Where can I get a soil analysis done?

This caller was referred to her local Extension office. She was also referred to the *Yellow Pages* for her area.

Can someone come and look at my sick redwood tree?

The caller was directed to contact her local Extension office to see if they provide this service. Another suggestion was to contact an ISA certified arborist.

My husband and I want to start a tree farm. Do you have information about growing Christmas trees?

The UC Division of Agriculture and Natural Resources offers publications on many topics, including this one. Since the caller didn't live in a county whose Extension office has an advisor who specializes in tree farming, staff sent her a DANR publications catalog. A free catalog may be obtained from the DANR publications office.

What are good plants for landscaping at a daycare center?

This question was referred to the Dept. of Landscape Architecture on campus.

We've just purchased a new home and want to plant a lawn. The water in our area is high in salinity. Are there some kinds of grass that are more salt-tolerant than others?

Quite a bit of research has been done on salt-tolerance of turfgrasses by various UC faculty and Extension people. One of our faculty members, Lin Wu, does work in this area and responds to inquiries on this topic.

Reader Survey

We are planning upcoming issues of Growing Points and would like to include topics that are of interest to you. Please give us your feedback by filling out and mailing this survey to the address shown below. Comments by e-mail are also welcome. Thanks!

The articles I have found most interesting/useful are:

I would like to read about: _____



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