Serpentine and Its Plant Life in California

First, a multiple definition: Serpentine vegetation grows on serpentine soils that weather from serpentine (serpentine) rock that contains serpentine minerals (chrysolite, antigorite, lizardite, etc.). The minerals are composed of iron magnesium silicate. Serpentine rock is a metamorphic member of the ultramafic family of rocks, derived from the earth’s mantle, surfacing where oceanic and continental plates collide.

Although serpentine soils occupy only one percent of California’s land area, where they do occur, the “serpentine syndrome” (soil scientist Hans Jenny’s term for the complex interaction of plants, soils and rocks), makes a striking impact on living landscapes. Dramatic contrasts of a sere serpentine chaparral or serpentine barren with dense mixed evergreen forest or typical chaparral on adjacent normal soils are clear evidence of the adverse effects of serpentine on vegetation. The word “serpentine” has been used to describe rock, soil, vegetation and flora; yet for the geologist, serpentine is a mineral class, the constituents of serpentine rock. They are composed mainly of iron magnesium silicate, with “impurities” of chromium, nickel and other toxic metallic elements. Because of this unusual chemical makeup, the soils weathering from serpentine and other ultramafic rocks (peridotite, dunite) are infertile (high magnesium to calcium ratio) or even toxic to most plants. But nature meets such a challenge with evolutionary opportunism. Plants have become adapted to serpentines everywhere these rocks reach the surface on our planet. The nature of the adaptation to serpentine ranges from strict serpentine endemics, narrowly confined to serpentine (like Quercus durata, Streptanthus polygaloides and Phacelia egena), to indicator species that occur on serpentines beyond their normal ranges (like Pinus jeffreyi and Calocedrus decurrens on granites, etc. in the Sierras but largely on serpentine in the North Coast Ranges). Still other native species may range widely on and off serpentine, but often take the form of genetically fixed serpentine-tolerant races when they encounter the demanding serpentine soil. The extreme adaptation for some endemics is not only to tolerate the toxic nickel, but to accumulate it; the Sierran Jewel Flower, Streptanthus polygaloides, is one such hyperaccumulator species.

California has the largest exposure of serpentine in North America. The major serpentine rock outcrops are mainly in the North Coast Ranges (especially in Del Norte,
Trinity and Siskiyou Counties). Yet other major exposures occur in the inner and outer Coast Ranges all the way to Santa Barbara County. The most spectacular serpentine barrns (treeless expanses nearly devoid of any plant cover) in the South Coast Ranges are in San Benito County (New Idria and San Carlos Peak); major exposures in the Bay Area include Mt. Tamalpais, Tiburon Peninsula and the Peninsula south to San Jose and Morgan Hill. Extensive outcrops occur in the North Bay counties (Napa, Sonoma and Lake) and increase in area northward to the Oregon border. The western Sierra Nevada also has major outcrops, extending from Tulare County north to Plumas County. In the Sierra the serpentine are arrayed in narrow parallel bands roughly in a south-to-north direction. The Red Hills area of Tuolumne County (near Chinese Camp) is an outstanding Sierran display of serpentine; its red soil and distinctive chaparral woodland vegetation (Ceanothus cuneatus and Pinus sabiniana) are trademarks.

Everywhere serpentine appears in California, its vegetation boldly contrasts with the surrounding non-serpentine plant cover. In the North Coast Ranges, stands of serpentine woodland with widely spaced Jeffrey pine and incense cedar may be surrounded by a lush hardwood-conifer forest. Further south, a distinctive serpentine chaparral dominates the outcrops with endemic Quercus durata, Ceanothus jepsonii and Garrya congdonii along with non-endemic chaparral shrubs. In the Bay Area (as on Tiburon Peninsula and Jasper Ridge near Palo Alto) a distinctive serpentine grassland is fostered by the inhospitable soil.

Plants restricted to serpentine contribute impressively to the list of California endemics. Over 200 species, subspecies and varieties are restricted wholly or in large part to serpentine. Two species of cypress (Cupressus sargentii and C. macnabiana) are serpentine endemics and three ferns are commonly found on serpentine (Polystichum lemmonii, Aspidotis densa and Adiantum aleuticum). Monocot genera (such as Allium, Calochortus and Fritillaria) have several serpentine endemics. Certain dicot families cater to endemism on serpentine (Cruciferae, especially Streptanthus and Arabis); Polygonaceae, Umbelliferae (mostly Lomatium and Perideridia); Linaceae (nearly all of Section Hesperolinon), Scrophulariaceae (Mimulus, Collinsia, Castilleja); Hydrophyllaceae (Phacelia) and several genera of the Compositae. For the most part, these endemics have close non-serpentine relatives, which suggests that evolution of a serpentine endemic is traceable to species of the nearby flora. A possible scenario for the origin of a serpentine endemic: (1) individuals of a non-serpentine species become genetically pre-adapted to serpentine (tolerating low calcium, high magnesium and overall low soil fertility; (2) next, the pre-adapted individuals multiply to form edaphic races; (3) further divergence in floral and vegetative features, as well as reproductive isolation, succeeds in making serpentine-endemic species. This scenario is illustrated in the genus Streptanthus where serpentine races are found in S. glandulosus, which may have served as ancestors to serpentine-endemics like S. insignis or S. niger.

Rarity and endangerment of serpentine endemics will be the most likely focus for preserving serpentine habitats. Even though many serpentines, especially the xeric barrens, have been disturbed by humans seeking minerals or geothermal power, no concerted attempt to preserve serpentine landscapes has been mounted. Only when a rare serpentine endemic is threatened does the habitat gain protection. Conservation of serpentine areas will need to go beyond saving rarities; the unique vegetation of serpentine—even on the barrens—merits protection.

Colorful prose on behalf of serpentine landscapes began with botanist William Brewer's 1861 account of
Most of the serpentine plantings for the new section were field-collected by horticulturist Roger Raiche, shown here next to the talus bed.

the New Idria barrens (pp 139-140 in Up and Down California). And in our own century, David Raines Wallace in his fine book The Klamath Knot gives this vivid description:

“The red-rock forest may seem hellish to us, but it is a refuge to its flora...it is the obdurate physical adversity of things such as peridotite [serpentine] bedrock which often drives life to its most surprising transformations.”

—Arthur Kruckeberg

Again, the new Serpentine Section of the Botanical Garden is unveiled to the public on April 25, 1993. Come see the beds and use our new self-guided interpretive brochure! Arthur Kruckeberg is a renowned authority on the serpentine plants of California and the author of the book California Serpentine (UC Press). We are grateful to Dr. Kruckeberg, Dr. Phyllis Faber, and Fremontia for permission to reprint this article.
**Gardening Tips**

Certainly spring makes the gardening fingers “itch,” and one of the first things on the list is to spade the soil and loosen it. Right? Wrong! Soil scientists tell us that every time we till the soil we destroy the soil structure. Soil structure is the arrangement of the soil particles and all soils structure themselves. Spading upsets the structure resulting in poor aeration and drainage until natural structure is attained again. There are, however, valid reasons for tilling soil, included are such things as: incorporating soil amendments such as organic matter, removing weeds (though this usually does not require very deep tilling), breaking of compacted soils resulting from walking on them or from the pounding of raindrops on the soil surface, and making seed beds where the soil particles should be small so the seeds can germinate easily. Sometimes tilling is necessary to remove, at least temporarily, invasive roots of trees, shrubs or even grasses. In large scale operations, tilling also is used to break plough or clay pans and to remove large roots in clearing land.

Structure in soils can be improved by the addition of organic matter. Clay soils have a very compact structure resulting in good water retention but limiting air movement. Sandy soils have an open structure and hold very little water. Organic matter will improve greatly both such soils.

Before spading clay soils, dig a shovelful and inspect the cut surface. If it is shiny, the soil is still too wet to work and will end up with terrible clods. Wait until the cut surface no longer is shiny.

Another soil characteristic is soil texture. This refers to the relative amounts of sand, silt and clay in a given soil. Soil texture cannot be changed so don’t add sand or silt to clay soils or clay to sandy soils with the idea of improving them. It would take massive amounts of materials to change the texture. Though organic matter should be added to all soils to improve them, organic matter will not affect the soil texture.

At this time of year, the beautiful but invasive *Oxalis pes-caprae* is still in flower. Some consider this plant a weed and feel control measures are necessary. Pulling off the tops as soon as they emerge eventually will deplete the food supply and the plants will die. *Roundup* also will give control, but do not spray unless air temperatures are at least 70 degrees Fahrenheit. Because *Roundup* is a contact spray, make sure that only *Oxalis* or other undesirable plants are sprayed. It is said this does not kill the bulbs, but it can be successful.

Information regarding removing the tops of *Oxalis* plants to prevent them from producing seeds is not correct. *O. pes-caprae* is a sterile plant and does not produce seeds. It propagates by producing bulbs and is very prolific. Do not put the bulbs in any compost pile, for they will survive even the rapid composting process. Do not remove the leaves of tulips, daffodils, hyacinths or other early spring flowering bulbous plants until they have died. They are necessary to manufacture food for next year’s plants and flowers. Tying the leaves in knots makes them look neater but does limit them from manufacturing as much food as possible.

—Robert Raabe

Would you like information about diseased plants, garden insect or weed problems? The Plant Clinic is held at the Botanical Garden the first Saturday of every month from 9 a.m. to noon. Bring your plant problems there and someone will help.
BOOK REVIEWS

We who live in the greater San Francisco Bay Area are a part of a minicenter of publishing and authorship which has developed because of our unique historical concerns about our environment and the beauty of our state. These concerns have led to a wonderful group of quality books for children about plants and nature, conservation and ecology. To bring a few of these fine books to your attention, the following four titles, written by authors in the Bay Area, are briefly reviewed.

- **Tomato soup**

  The modern adventures of Baby Mouse and his parents on Farmer Clem’s farm are a gentle reminder of the earlier adventures of Peter Rabbit with Mr. McGregor. Thatcher Hurd lives in Berkeley with his wife and two sons, where they are a part of the Bay Area book community.

- **John Muir, Wilderness Protector**
  Ginger Wadsworth. Lerner Pub. Co., Minneapolis, 1992. $22.95. and

- **Rachel Carson, Voice for the Earth**

  John Muir and Rachel Carson are so much a part of our understanding of the conservation movement in the United States, that we forget that our children should know the story of their lives as we do. These two clear, readable biographies for junior readers were written by another of our Bay Area authors. Ms. Wadsworth lives with her family in Orinda and has had a lifelong interest in the environment and conservation.

- **Kids Gardening**

  Klutz Press has published a large number of humorous ‘how-to’ books for children—magic tricks, knot tying, marble games—and this great one on gardening. Using their second-grade classroom and the Hidden Villa garden on the peninsula as resources, the authors have written a thorough, amusingly illustrated reference on growing seeds, transplanting plants, kitchen gardening, raising earthworms and practical garden lore.

  —Elly Bade

Botanical Seed Sales Project

1992 brought the beginning of a new enterprise for the Botanical Garden. Given the nod by then acting director Margaret Race, the Botanical Garden Seed Sales Project was off the ground. Staff members Martin Grantham and Peter Klement, and volunteer Francine Henderson compiled a list of seeds suggested and made available by the Botanical Garden horticulturists. The criteria for selection included: storage characteristics, uniqueness, ease of propagation, showiness, and quantities available.

The first year was very successful, with twenty selections. Six hundred packets were sold, and the Garden grossed $1500. *Alstroemeria* remain the stars, thanks to an article that ran in *Sunset* magazine a full ten years ago.

A plan to triple the amount of *Alstroemeria* seed for 1993 is in progress.

Highlights for the 1993 seed list include California natives such as *Allium unifolium*, *Allium haematociton*, *Bloomeria crocea*, *Clarkia amoena huntsiana*, *Clarkia amoena ssp. whitneyi*, *Clarkia concinna*, *Delphinium cardinale*, *Helianthus bolanderi*, *Lewisia rediviva*, *Mimulus puctus*, and *Triteleia peduncularis*. *Stylomecon heterophylla* ‘White Satin’ (wind poppy) is a UCBG exclusive introduction, developed by Roger Raiche and Kurt Zadnik. Special thanks to R. Raiche and K. Zadnik for these seeds.

Francine put in 85 volunteer hours on the project last year. “The accomplishment of this project held a great deal of satisfaction and I was thrilled to be one of the driving forces that got it completed,” she said. And Norm Smith, volunteer propagator, is helping out this year; he has contributed cactus and other succulent seeds to the 1993 list.

Come and browse last year’s seeds for bargains, and get your 1993 seeds for spring.
SPRING PLANT SALE

Friday, May 7
Members’ Preview 5-7:30pm
Saturday, May 8
Public Sale 10am-3pm

The Spring Plant Sale sponsored by the Friends of the Botanical Garden will take place on Mother’s Day weekend, Friday-Saturday, May 7-8th. This sale is the most extensive of the year, offering a wide variety of California natives, roses, rhododendrons, perennials, rock garden/alpines, vines, ferns, grasses, orchids and bromeliads. Please note that many plants will be available at the Visitor Center before the sale, especially those that flower early, so come by frequently and see what we have!

Cacti/Succulents: A variety of cacti and succulents will be available, including Aeonium, Agave salmiana, A. victoriae-reginae, A. zebra, Aloe arborescens, A. mobilis, A. vera, A. victoriae-reginae, Astrophytum spp., Crassula argentea, C. corymbulosa, C. ovata, C. rosularis, Chamaecereus and others in small quantities, Echeveria macdougallii, E. spectabilis, Euphorbia spp., Ferocactus, Gasteria, Graptopetalum amethystinum, Haworthia, Hechtia marnier-lapostollei, Notocactus magnificus, Opuntia, Pachyphytum hookeri, Sempervivum arachnoideum, Senecio articulatus, and mixed planters suitable as gifts.


Orchids: Cattleya, Coelogyne, Cymbidium, Dendrobium, Oncidium, Paphiopedilum and reedstem epidendrums.

Bromeliads: Aechmea, Billbergia, Cryptanthus, Guzmania, Puya, Tillandsia, Vriesea, and a special collection featuring Cryptanthus hybrids.


Palms: Primarily Rhapis.

Vines: Vines will include the following propagated from the UCDBG collection: Asparagus africanus, Bomarea spp., Campsia valdivianum, Clematis argenticula, C. ciriiflora, C. sibirica, Eustrephus latifolius, Salvia dombyi, Schizophragma hydrangeoides, Trachelospermum asiaticum var. oblanceolatum, Vitis ficifolia.


Grasses: Ornamentals, natives, ground covers.

Fuchsias: Species from the University of California Botanical Garden.
Perennials: A large, choice collection of plants suitable for sun or shade, damp places or dry. Includes: *Achillea*, *Campanula*, *Centaurea*, *Digitalis*, Shasta Daisy 'Cobham Gold', *Eryngium ciliatum*, *Iris* (bearded and non bearded), *Lysimachia ciliata* 'Atropurpurea', *Lilium*, *Penstemon*, *Phlomis*, *Primula*, *Salvia*...

Rock Garden: In addition to perennials includes: *Aquilegia*, *Campanula*, *Centaurea bella*, *Dianthus*, *Erigeron*, *Geranium*, *Geum*, *Helianthemum*, *Lychnis*, *Phyteuma*, *Pulsatilla*, *Silene*...


House Plants: *Alocasia*, miniature *Begonia*, *Coffee*, *Colocasia*, *Episcia*, *Ficus*, *Kohleria*, *Philodendron*, *Sanseveria*, and more.

Roses: *Rosa brunonii*. The following heritage roses will be available: Bourbon: 'Mme. Isaac Pereire' (1881); Floribunda: 'Mountbatten' (1982); Gallica: 'D'Aguessseau' (1837); Hybrid Musk: 'Ballerina' (1937); Hybrid Perpetual: 'Mme. Victor Verdier' (1863), 'Marquise Boccella' (1842), 'Ulrich Brunner Fils' (1881); Hybrid Rugosa: 'Thérèse Bagnet' (1950); Moss: 'Adeline', 'James Mitchell' (1861); Noisette: 'Crépuscule' (1904), 'Fellenberg' (1835); Polyantha: 'Perle d'Or' (1884); Rambler: 'Baltimore Bell' (1898), 'Félicité et Perpétue' (1828), 'May Queen' (1898).

### TREES AND SHRUBS

These plants will be on sale at the Spring Plant Sale or otherwise at the Visitor Center.

- **Abutilon nabob** Large maroon flowers cover this plant for most of the year
- **Acer griseum** Paperbark Maple; red and scarlet fall color, peeling bark
- **Acer palmatum** Atropurpurea Medium tree, older stems and trunk green with conspicuous white striations
- **Acer tataricum** ssp. albizamece Japan
- **Acer tataricum** ssp. semenovii Turkistan shrub from dry regions in the mountains; related to ginnala but small deeply lobed leaves
- **Ararcaria bidwillii** A large erect evergreen tree 30-50 meters; lanceolate leaves dark green, prickly; female cones 20-30 cm x 15-20 cm
- **Berberis darwinii** Compact shrub, small dark green, 3-pointed leaves; dark yellow flowers followed by blue berries
- **Berberis Xirwinii** shrub to 3' with long arching branches and yellow flowers
- **Carpinus sp.** Mexico
- **Castanospermum australe** Moreton Bay Chestnut; tree to 10-30 meters; racemes 5-15 cm long, arising from old leafless wood, pea shaped, red; seedling can be grown indoors
- **Chimonanthus praecox** Winter Sweet; winter flowering, sweetly scented yellow flowers on leafless branches
- **Cistus spp.** Drought tolerant, small or medium shrubs.
- **Coriaria sp.** Peru; fond like stems with pinnate leaves; reddish; winter color
- **Cornus capitata** In mild areas, evergreen small tree with attractive sulphur yellow bracts
- **Cornus kousa** The numerous white bracts cover the spreading branches in June; rich bronze and crimson colors
- **Daphne spp.** Fragrant, evergreen, small to medium shrubs
- **Drimys winteri** Handsome, tall shrub or small tree with leathery leaves and white, fragrant flowers in May
- **Ephedra andina** Curious shrubs with rush-like green or blue-green stems; good for dry areas
- **Ephedra tweediana**
- **Eucryphia cordifolia** Large, evergreen shrub or columnar tree; flowers white with conspicuous stamens
- **Hymenosporum flavum** Honey scented flowers of soft yellow; evergreen, must have sunny sheltered position
- **Leptospermum arachnoidea** Hardy, low-spreading evergreen shrub with small white flowers
- **Michelia doltsopa** A magnificent small to medium tree, leathery leaves, and heavily scented white flowers
- **Michelia figo** Medium to large shrub; leaves small, dark glossy green; flowers small brown-purple and strongly scented
- **Osmanthus delavayi** Beautiful evergreen slow growing shrub to 6' small dark green leaves, fragrant small white flowers
- **Tecoma stans** Shrub or small tree to 20', flowers bright yellow; will only stand a few degrees of frost
- **Tecoma garrocha** Shrub to 5'; flowers 2" long, corolla yellow or salmon, tube scarlet
The Mesoamerican Section: Part Two

Many characteristics of the Mesoamerican flora make it particularly attractive to feature at UCBG. Floristic linkages to our already well established California and Eastern North America collections allow all three sections to be interrelated via biogeographical themes. The horticultural potential of Mesoamerican plants for our region makes our outdoor plantings of great interest to the gardening public and the nursery industry as they represent initial tests of plant performance and provide raw material for future horticultural selections. The climate here in Berkeley’s Strawberry Canyon is generally so mild (except for certain notorious Winters like 1972 and 1990) that an exceptionally broad range of Mesoamerican plants can be cultivated outdoors, allowing complex and diverse plantings that can actually give the Garden visitor a feeling for natural plant communities as they exist in the region.

The high levels of endemism and diversity for the Mesoamerican region, with its accelerating rates of habitat destruction, make it a prime vehicle for a strong conservation message. Although conservation of plants in their natural habitats (in situ conservation) is the real goal, most of the countries in this part of the world have neither well developed strategies for conservation nor the economic means to implement them. Given the situation, our collection can serve the important function of conserving many threatened Mesoamerican plants outside of their imperiled habitats (ex situ conservation).

The Mesoamerican collection is an important resource for researchers working on the plants of the region. Plant material is frequently requested for botanical and horticultural investigations. Locally, several researchers working on Mesoamerican plants are available to help with development of our collection. Just across the Bay at the California Academy of Sciences both Dr. Dennis Breedlove, working on plants of southern Mexico, and Dr. Frank Almeda, with extensive knowledge of the Costa Rican flora, are frequently of help. They would like to see interesting and desirable Mesoamerican plants enter cultivation. UC Berkeley’s Dr. Brent Berlin heads an ethnobotanical research project in southern Mexico. In a way this work may be recapturing a bit of the pre-Columbian ethnobotanical knowledge lost during the Spanish conquest. Ethnobotany can eventually provide major themes for development of our Mesoamerican collection.

In the works

While talking with a researcher who visited the Garden last year, I began developing the idea of a pollination walk for the Mesoamerican section. Dr. James Cane of Auburn University, Alabama, began telling me about his work with solitary bees and how they pollinated several plants I was growing in our Cloud Forest beds. We already have a bed emphasizing plants adapted to hummingbird pollination and I had been noting any other pollination...
mechanisms or relationships for plants under my care with future development in mind. When Dr. Cane explained how certain bumble bees and solitary bees “sonicate” flowers of *Vaccinium*, *Solanum*, and *Saurauia*, the vibrations of their flight muscles causing the anthers to spew pollen over their bodies, which they then collect by grooming and, furthermore, how the anthers can be fooled by a tuning fork of the proper frequency, I immediately saw this as a favorite docent-led tour activity. The idea of “sonicating docents” caught on and the pollination walk project was born.

This project focuses on the geologically stable beds at the top of the Mesoamerican slope with their dramatic view corridors to the Bay and the lush borrowed scenery of wooded slopes to the southwest. Current plantings can quite easily be modified to illustrate a wealth of pollination biology. We will increase the diversity of plants that illustrate pollination by hummingbirds. These plants will be scattered throughout several beds according to the type of growing conditions particular plants prefer. Currently a species of *Bomaerea* collected in Costa Rica can be seen climbing up into the Coast Live Oaks and producing its clusters of *Alstroemeria*-like flowers (it is a close relative.) These flowers, which should be dangling overhead by next season, illustrate beautifully many of the morphological correlates for hummingbird pollination: inflorescence a tight cluster, corollas long, tubular and red, heavy nectar production, lack of scent, etc.

Certain Mesoamerican species of the large and taxonomically messy genus *Salvia* have diverged from their bee-pollinated brethren making themselves extremely attractive to hummingbirds. In the sunny open beds below the grove of live oaks, *Salvia* species representing both of these common pollination syndromes will be juxtaposed so that their features may be easily compared.

Illustrating Beetle and Bat Pollination

Mesoamerica is home to several very rare and beautiful *Magnolia* species related to our own *Magnolia grandiflora* (Southern Magnolia). These, along with the very hardy Mexican subspecies of the Big-leaved Magnolia (*M. macrophylla ssp. dealbata*) which flowers heavily in May and June, can be used to illustrate pollination by beetles.

The Monkey Hand Tree (*Chiranthodendron pentadactylon*) related to our own *Fremontodendron*, produces highly unusual flowers like orange-red chalices out of which a startlingly handlike structure reaches. The hand is formed by fusion of the five stamens at their bases with anthers in the position of fingernails. These flowers show features related to bat pollination such as copious nectar, musky odor and very sturdy structural parts that can withstand the onslaught of enthusiastic bats.

There are many oaks (*Quercus* species) in Mesoamerica. Their adaptations to wind pollination are very clear: flowers small, without attractive color, scent or nectar rewards, male flowers clustered in pendant inflorescences or catkins. There is already a new generation of Mesoamerican Oaks planted among the Coast Live Oaks at the top of the Mesoamerican slope. Until they begin flowering, the mature Coast Live Oaks do a superlative job each Spring, illustrating the features of wind pollination with copious catkin production.

There are, of course, other pollination syndromes and related reproductive mechanisms that we will be researching for inclusion in the interpretive program for the Mesoamerican area. There are plants in the collection to illustrate hawkmoth pollination, dioecy (plants with individuals producing only male or female flowers) and heterostyly (variations on style and anther length ensuring cross-pollination).

—I Martin Grantham

I'd like to thank the Elvenia J. Slosson Endowment Fund for Ornamental Horticulture for its support of this project. Thanks, too, to all of those people (of whom I can name only a few) who over the years have contributed to the Mesoamerican Section with their time, labor and generous gifts. A special thank you to Susan and Michael Addison whose generous gifts in 1986 and 1988 helped improve the new site and to obtain wild collected seed from Mexico, and to Martha and Manuel Coronado for their continued support.
PROGRAM HIGHLIGHTS

Chocolate bugs and prune trees
Over 60 persons enjoyed one of the most imaginative and taste-full programs ever offered at the Garden, the Chocolate event on Valentine’s Day. Participants were first shown the story of the cacao plant and development of plantations in the Americas, Africa and Indonesia; then they were treated to a lively discussion of how chocolate and cocoa are derived from the plant, and what are the criteria for quality production. FINALLY, they engaged in a delightful tasting of many different dark, milk and white chocolates, foreign and domestic.

Once again our annual BUG DAYS event was a smashing success. Over 800 people (big and little) attended the three day event, which featured LIVE insects and spiders from the San Francisco Insect Zoo, exhibits on pollination, plant defenses and carnivorous plants and bug-oriented games and activities.

Curiously, roles flip-flopped as children instructed parents in the nuances of entomology and botany.

At BUG DAYS kids of all ages petted the giant walking stick, held the huge millipede and cautiously approached the tarantula, Rosie.

Microscopes saw heavy duty use at BUG DAYS as kids focused in on plant parts and insects mouthparts; even toddlers became entranced. And everyone loved playing with the suspended housefly, as they took party blower in hand and became a frog whose tongue lanced outward at the fly. Most people were having just as much fun at the “Compost Detective Game” wheelbarrow, where they sifted for bugs and worms that compost our garbage, or at gift tables set up by the Visitor Center (Elly Bade, Francine Henderson, Kate Heckman, Nancy Markell and Nancy Swearingen).

BUG DAYS is a collaborative event that could not occur without the very generous support of the San Francisco Insect Zoo, which is known around the nation for being one of the finest displays of its kind. Some of the traveling insect displays from the Zoo were loaned to us for the weekend, as well as several huge “oh, my” displays of pinned insects, mostly from the tropics, and the staff (many indefatigable insect-lovers) to handle and provide instruction about the exhibits. Even Leslie Saul, the Director of the Insect Zoo and Curator of Insects, made time to attend our event and, as is typical of Leslie, enjoyed it so much she rolled up her sleeves and joined in as an instructor.

For Gardeners
The Rose Pruning workshop attracted many rose fanciers. Peter Klement (in charge of the Garden’s Rose collection) reviewed a series of handouts that described pruning and then took the group up to the Old-Fashioned Rose collection to demonstrate the various techniques. The workshop is one of our most popular annual events, and, with the assistance of Lizzie Lee and Deborah Darnell, Peter never fails to please his audience.
Many little people constructed colorful six-legged creatures.

There was a tremendous amount of interest in the new Trees series. As always, Dr. Raabe and his associates in Cooperative Extension brought a great deal of experience and practical knowledge to their presentations and tailored them for people trying to grow trees in the Bay Area, with its unique climatological and pest peculiarities.

And Martin Grantham, with help from Elly Bade and Iris Gaddis, keeps coming up with new twists in his Propagation series: recently, the participants worked on hardwood cuttings, chip budding, and fern propagation.

Special Celebrations

The long-awaited publication of the revised The Jepson Manual: Higher Plants of California was celebrated at the UC Botanical Garden with a few remarks by the Principal Investigator, Lincoln Constance, the Project Manager, Dieter Wilken, and the Director of The University of California Press, Jim Clark, followed by a book signing at the Oak Knoll.

Almost one-fourth of California’s huge number of endemic plants grow on serpentine soils. The Garden’s new serpentine bed, completely redesigned with native serpentine soils and rock, features many of these plants. To celebrate the completion of the project, Professor Arthur R. Kruckeberg, of the University of Washington and author of the classic UC Press book on serpentine plants, California Serpentes: Flora, Vegetation, Geology, Soils and Management Problems, presented an address on Earth Day here at the Garden, on the “Saga of Serpentine: Plants and People,” that underscored the significance of these plants to the California flora.

Spring Classes

There are several well-tested courses returning to the Garden this Spring: our Wildflower Identification course, with Glenn Keator, Art in the Garden, and the Environmental Gardening series. Subscription to the former two courses is on a series basis only, but the latter course, Environmental Gardening, can be attended on a class by class basis. The coordinator, Cindy Nelson, has assembled an impressive group of skilled instructors, who all are sensitive to the environmental impact of gardening techniques. Cindy leads the kickoff class on developing healthy and beautiful soil for your plants. She is followed by Dr. Nick Mills (UC Division of Biocontrol), Sarah Wikander (Irrigation Equipment Company), and Wendy Johnson (Head Gardener, Green Gulch Farm); the series culminates in a delightful presentation by Sibella Kraus, who is a garden writer for the San Francisco Chronicle and author of Greens, on the many varieties of food plants available to the home gardener. A tasting will follow the presentation!

Back by popular demand are two classes in June: Barbara Wilt’s Chinese Medicinal Herbs and Travis Columbus and his workshop on that highly desirable but not well known group, the Grasses.

Horticulturist Peter Klement deftly demonstrates Rose Pruning.
**GARDEN NOTES**

**AABGA Award of Merit:** Congratulations are due Dr. Robert Ornduff, former Director of the Garden, our current Curator and Emeritus Professor of Integrative Biology, who will receive the AABGA Award of Merit for his contributions to the field of public horticulture. The award will be given by the American Association of Botanical Gardens and Arboreta in recognition of Dr. Ornduff's efforts during his tenure to bridge the gap between academia and the general public, at the annual meeting in July.

**Staff activities:** Two Garden volunteers, Lizzie Lee and Elly Bade, along with a UCBG horticulturist, Peter Klement, organized logistical support for the annual Winter Study Weekend of the American Rock Garden Society held in nearby San Mateo. Following the meetings, another speaker, Alberto Castillo, who is a world renowned bulb specialist from Buenos Aires, Argentina, visited the Garden and provided invaluable information on cultural requirements of many of our living bulbs in the collection.

The Garden's Education Director, Dr. Carol Baird is currently teaching a UC Berkeley undergraduate seminar on California biodiversity. And once again, horticulturist Martin Grantham is teaching his course, Advanced Propagation, at Merritt College. Along with Peter Klement, who is in charge of the South American section, Martin presented a lively slide show on their Chilean tour for the New Members of the Friends. Peter will miss the Garden's Plant Sale, as he is organizing displays for the annual Heritage Rose Show, also on Mother's Day Weekend.

In mid-April Elaine Sedlack, the horticulturist in charge of the Asian section, presented a talk to the San Francisco Home Economists in Business, that outlined a short history of the Chinese Medicinal Herb garden here at UCBG and focused on the Chinese cultural sensibility of the healing basis of herbs when incorporated into the diet.

**AutoCAD:** At the end of January Assistant Curator Holly Forbes participated in a four-day introduction to the AutoCAD system, that will allow her to make more efficient use of the bed map system. The workshop was sponsored by San Francisco State Extended Education, and involved hands-on computer work.

**New Permanent Director Announced**

On Friday April 2, 1993 the Dean of the College of Natural Resources, Wilford R. Gardner, announced the appointment of Dr. George Rogers, at the time Director of Clark Botanic Garden in New York, to the position of Director of the University of California Botanical Garden. Dr. Rogers will assume the position on May 1, 1993.
Planning Your Gift

Though this century-old Garden has outlasted many already, and will outlast me, I can wander through it and capture a sense of how the improvements accomplished in recent years will resound well beyond my own lifetime. This vision is sustained most effectively by the Friends of the Botanical Garden, who have provided much of the financial support that makes the Garden a more enjoyable and educationally rewarding place to visit. Your gifts, and the swelling ranks of Friends' memberships, supply the momentum through which the Garden will survive the current recession. Many of you may not be aware, however, that there are funding opportunities that exist for the Garden that focus on securing it for future generations.

The manner in which you choose to support the Garden is, of course, a matter of personal choice. Following, I have outlined a number of planned giving options that may be mutually beneficial for you and the Garden. Some may offer particular tax or estate planning advantages. Should you decide to give to the Garden, please discuss any of these options with your financial advisor prior to making your gift.

Planning Your Gift By Will

Probably the simplest and best-known mechanism for making a long-term gift is through a personal will. Charitable bequests to the Garden allow you to extend your support beyond your lifetime. This provides a tax advantage to the donor since the gift qualifies as a full estate tax charitable deduction, which, in turn, reduces the size of the taxable estate. In addition to general bequests, you may also consider a residual bequest. This type of bequest enables you to provide first for your survivors, and then, if circumstances permit, for the Botanical Garden. While unrestricted gifts allow the Garden maximum flexibility in meeting changing needs and unanticipated opportunities, any bequest can be restricted to a specific purpose. It is important, however, to include language that enables the bequest purpose to be modified as the future needs of the Garden change.

Planning A Life Income Gift

A variety of ways exist to provide you with life income while making the Garden the long term beneficiary of a gift. Each plan has a different investment and management philosophy designed to appeal to a variety of charitable and financial goals.

The most popular of these options is the pooled income fund. It works much like a mutual fund, in that it is a transfer of money or securities to a merged fund which consists of other similar gifts invested together. The beneficiary of each gift is entitled to a proportional amount of the fund income. Payments are made quarterly for the lifetime of the beneficiary (or beneficiaries). Pooled income fund gifts require only a $5,000 minimum, with additions accepted at any time.

For those interested in fixed income, the gift annuity provides fixed, guaranteed payments for life in exchange for a transfer of cash, securities or other property to the Garden through the University. The payments are based on the age(s) of the recipient(s). An attractive feature of this plan is that a portion of each payment is considered tax free, boosting the effective yield considerably. Another favorable aspect of this plan is that it permits the option of either receiving income immediately or deferring annuity payments until later. This arrangement can be very attractive to a younger donor in a high tax bracket who wants to take a deduction now and receive supplemental income after retirement. A charitable gift annuity may be established for the Garden with a minimum $100,000 gift.

Charitable remainder trusts offer individual management and investment for those who require considerable flexibility in their financial planning. There are two kinds—unitrusts and annuity trusts. These are legal arrangements that pay income to the donor (or any beneficiary the donor names) for life or a set number of years. At the end of the trust term, the Garden would receive the remaining principal. Both the unitrust and the annuity trust provide income tax deductions in the year of the gift, and may provide the beneficiary with tax exempt income if funded with cash or tax exempt securities. Unitrusts pay variable income based on a donor-selected percentage of the trust's annual value. Annuity trusts provide the donor with fixed payments during the beneficiary's lifetime regardless of trust performance. Charitable remainder trusts may be established for the Garden with a minimum gift of $100,000.

Life Estate Gifts

You may opt, instead, to donate your personal residence to the Botanical Garden and retain lifetime use of the property. After your death, the residence will either be sold or used by the University for the purpose you specified. Advantages of life estate gifts are income tax deductions in the year of the gift, and possible reductions in estate taxes and probate costs.

Through the University, the Garden has investment management professionals and legal counsel available to consult with you on these giving options. If you wish to explore the possibility of making a planned gift, please call me at 642-3012, or leave word with the Friends' Office at 643-7265.

—Bobbie Ohs
New Members

The Friends of the Botanical Garden welcome the following new members:

<table>
<thead>
<tr>
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<tr>
<td>Julia Avramides</td>
<td>Diana Chua</td>
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<td>Mr. &amp; Mrs. Hugh Barton</td>
<td>Joan Chyan</td>
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<td>C. Ritchie Bell</td>
<td>Claire Colvin</td>
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<td>Mr. &amp; Mrs. Jay Berkman</td>
<td>Evelyn Cranston</td>
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<td>Larry Biando</td>
<td>Katherine C. Creighton</td>
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<td>Ava Blum</td>
<td>Charlice &amp; John Danielsen</td>
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<td>Jan Brougher</td>
<td>Alice M. Dimalanta</td>
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<td>Diane G. Burgess</td>
<td>Rex Dieterich</td>
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<td>Jack F. Bussio</td>
<td>Robert Drake</td>
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<td>William &amp; Timothea Campbell</td>
<td>Alan Stanley Dyck</td>
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<td>Betsy Jo Carleton</td>
<td>Don &amp; Hazel Faries</td>
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<td>Barbara M. Champion</td>
<td>Toni Fauver</td>
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<td>Cecilia Christensen</td>
<td>Jennifer L. Flint</td>
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- Robert Riddell, President
- Dr. William Weeden, Vice President
- Ramona Davis, Treasurer
- Thomas Shaw, Secretary

Staff:
- Dr. Sidney Zelaya-Aragon, Acting Managing Director
- Dr. Robert Raabe, Associate Director
- Daniel Campbell, Manager
- Judith Finn, Assistant Manager
- Dr. Carol Baird, Education Coordinator
- Dr. Robert Ornduff, Curator
- Holly Forbes, Assistant Curator
- Toni Kaffon, Administrative Assistant
- Bobbie Ohls, Development Coordinator
- Nancy Swearengen, Education Assistant
- Deborah Darnell, Friends’ Assistant
- Jay Shipley, Security

Horticulturists:
- John Domzalski
- Sean Hogan
- Roger Raithe
- Gerald Ford
- Peter Klement
- Elaine Sedlack
- Martin Grantham
- Jerry Parsons
- Kurt Zadnik

Newsletter:
- Carol Baird, Editor
- Academic Arts, Production
- Printed by TechniPrint

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643-8040 Curation • 642-3352 Education
643-7265 Friends • 642-3012 Development
FAX • (510) 642-5045

Grateful Thanks

The Friends wish to thank these donors who have made a substantial gift over and above membership:

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- Nancy McLaughlin
- Cal McRae
- Mr. & Mrs. R. Sheldon Milligan
- Joan Rock Mirov
- Tim & Nancy Muller
In Memory
The Friends offer appreciation and thanks for gifts from these donors in memory of:
Sally Constance, from
Jane McKenzie
June Foote
Katharine Swearingen & Kurt Kirchoff, from Helen Wadman
Jim Jones, from "happy friends who received help in repotting their cymbidiums"

Special Projects
The Friends offer appreciation and thanks for gifts from these donors to support the special projects noted.
Meeting Room Renovation, from
*AETNA Foundation
Fred Coe
Ramona Davis
Gladys Eaton
Joan Rock Mirov
Jim & Irma Uren
Dr. & Mrs. William Weeden
Bernard & Alba Witkin
*Matching Corporate Gift
Aquatic Plant Display, from Dr. Robert Ornduff
Rhododendrons for the Garden, from Iris Gaddis
California Alive! educational program, from
Mary & Philip Pierpont

MEMBERSHIP
The Friends of the Botanical Garden offers public education programs and provides independent funding to support the many needs of the Garden. You can enjoy and support the Botanical Garden year-round by becoming a member of the Friends of the Botanical Garden.

Membership benefits include:
• Newsletter
• Workshops, lectures, and tours
• Discount on Visitor Center purchases
• Discount on educational classes
• Early admission to Spring Plant Sale
• Volunteer opportunities

Friends of the Botanical Garden Membership Application
Yes, I would like to support the U.C. Botanical Garden at Berkeley as a member:

☐ Student* ...................... $10  ☐ Sponsor ...................... $250
☐ Individual ................... $25  ☐ Patron ...................... $500
☐ Family ......................... $35  ☐ Benefactor ................... $1000
☐ Contributing ................ $50
☐ Supporting ................... $100  ☐ New  ☐ Renewal

Name ________________________
Address _______________________
City/State/Zip __________________
Telephone _______________________

☐ My employer has a matching gifts program. I have enclosed the appropriate forms.

Contributions are tax deductible. Please make checks payable to Friends of the U.C. Botanical Garden and mail to:
Friends of the Botanical Garden, U.C. Botanical Garden, Berkeley, CA 94720

*Full-time only.
Calendar of Events

APRIL

WILDFLOWER IDENTIFICATION Thurs eves, APRIL 15-JUNE 10
Dr. Glenn Keator, celebrated botanist and author of The Complete Garden Guide to Native Perennials of California, presents an eight-week evening course on identification of California wildflowers. Registrations recommended. Meeting Room, 7-9pm. Members $60, non-members $70 for the series.

JEPSON MANUAL BOOKSIGNING Sun, APR 18
The Garden joins with the Jepson Herbarium and UC Press to celebrate the publication of The Jepson Manual: Higher Plants of California. The Principal Investigator, Lincoln Constance, Project Manager, Dieter Wilken and the Director of UC Press will all speak, followed by a wine and cheese reception and book-signing on the Oak Knoll, 3-6pm. No charge. Registrations only.

ENVIRONMENTAL SERIES Tues eves, APRIL 20-MAY 18
This series provides you with the wherewithal to tie your environmental server to your everyday gardening activities. Meeting Room, each Thursday evening from 7pm-9pm. $5 members, $8 non-members, each session 1-4. $10 member, $15 non-members final session. (1) Healthy Soil for Healthy Gardens (4/20); (2) Natural Pest Control (4/27); (3) How to be Water-wise 5/4; (4) If Plants Could Talk 5/11; (5) Cooking from the Garden 5/18.

ART IN THE GARDEN Weds, APR 21-JUNE 9
The Friends offer their popular watercolor and drawing class, taught by Judith Corning. Individuals with all levels of experience are encouraged to participate. Meeting Room, 9:30am-noon, every Wednesday. $55 members, $65 non-members.

THE SERPENTINE: PLANTS AND PEOPLE Sun, APRIL 25
Professor Arthur R. Kruckeberg, University of Washington and author of California Serpentine, will talk about the significance of serpentine-adapted plants to the rich endemic flora of California. Meeting Room, 7pm. No charge. Arrive early to ensure seating!

ESTATE GARDENS OF NAPA VALLEY Thurs, APRIL 29
The tour will be joined by four experts: Jonathan Plant, designer of the Niebaum-Coppola Estate garden of Mr. & Mrs. Francis Ford Coppola and the Far Niente Garden of Mr. Gil Nickel; Katie Trefethen, recently profiled in Pacific Horticulture; Victor Vood, a horticulturist with extensive knowledge and a wit to match; and Dr. Robert Raabe, Associate Director of the UC Botanical Garden. 8am-5pm. $55 members, $70 non-members. FULL.

MAY

PLANT CLINIC Sat, MAY 1
Bring your ill plants to see Dr. Robert Raabe, UC Plant Pathologist. First Saturday of the month, 9am-12, Meeting Room.

SPRING PLANT SALE: MEMBERS PREVIEW Fri, MAY 7
The Annual Spring Plant Sale begins on Friday evening with a Members Preview Party. First choice of rare and beautiful species. 10% surcharge added to purchases. Food and refreshments will be served and author Pam Peirce will be present to sign her new book, Golden Gate Gardening. 5-7:30pm.

SPRING PLANT SALE Sat, MAY 8
This year the Sale will feature many plant species from the UCBG's collection. See inside, pages 6-7. Public Sale: Saturday 10am-3pm.

EXPLORING STRAWBERRY CANYON Sat, MAY 22
Environmental planner Bob Charbonneau, the guiding light behind the restoration of Strawberry Creek on the UC campus, will lead a creekside walk from the Garden down to campus (and ride the shuttle back). Meet at the Visitor Center, 1-4pm. Members $5, non-members $7.50, children FREE.

CHINESE MEDICINAL HERBS Sat, MAY 29
Principles of Chinese herbal medicine, with an special emphasis on anti-viral and immune-enhancing herbs, with Barbara Wilt, licensed acupuncturist. Includes tour of Chinese medicinal herb garden. 10am-noon. Meeting Room. $10 members, $15 non-members.

SOFTWOOD CUTTING Sun, MAY 23

JUNE

ROSE WEEKEND Sat, SUN JUNE 5-6
Tours: Free docent-led tours of the Rose Garden which features old-fashioned roses. Meet at 1:30 at the Tour Orientation Center on Saturday and Sunday.

PLANT CLINIC Sat, JUNE 5
Dr. Robert Raabe will answer questions on rose diseases and pests. 9am-12, Meeting Room.

ROSE BUDDING AND GRAFTING Sat, JUNE 5
This workshop will introduce the basic skills needed by all serious rose fanciers. Special tools, plant stock and written materials provided with registration and materials fees. Led by UCBG horticulturist Peter Klement and Dr. Robert Raabe. 1-3:30pm. Meeting Room. Members $20, non-members $30. Registrations required.

GROWING GREAT ROSES Sun, JUNE 6
Rose expert Rayford Reddell will lecture and show slides. Reddell is author of Growing Great Roses and is working on The Rose Bible, to be published next year. Meeting Room, 10-11:30am. Members $10, non-members $15. Reservations suggested.

GRASSES Sat, JUNE 12
Join grasses expert Travis Columbus in a wonderful grass identification workshop that concentrates on the important groups of California grasses. Ornamental grasses will also be discussed. Meeting Room. 9am-4pm. $35 members, $45 non-members.

GREEN STUFF DAY CAMP JULY 12-AUG 13
Week-long programs for children with instructors from the UC campus, on the wide world of plants, how people use plants, plant stories, art and games. Sessions I (7/12-16) & II (8/2-6) 5-7 years old, 9am-2pm M-F; Sessions II (7/19-23)& IV (8/9-13) for 8-11 years old, 9am-3pm M-F. $100 per session. Call 643-3352 for registration information.

COMING ATTRACTIONS GREVILLEAS, WITH WILLIAM GRANT Sat, JULY 10
For further information on classes and events, call the Visitor Center, 642-3343. To register for classes, send checks to UC Botanical Garden. Two weeks advanced notice is necessary to accommodate individuals with special needs. No refunds the week before the class date unless class is cancelled. Pre-registration is suggested, as classes fill early. The Garden is open every day of the year except Christmas from 9:00am to 4:45pm. Free public tours led by docents are given on Saturdays and Sundays at 1:30pm. Admission to the Garden is free.

Friends of the Botanical Garden
University of California
Berkeley, California 94720
Address Correction Requested