

Shields Oak Grove—Conserving an Extraordinary Tree Collection

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Although they may appreciate it as a picnic ground and peaceful spot for dog-walking, many visitors don't realize the scientific significance of the trees in Shields Oak Grove.

Shields Grove contains the largest collection of mature oaks in the southwestern United States, with 346 trees representing 89 types of oak species, varieties, and hybrids. This outstanding collection includes species from around the world but is particu-

and development of the Grove. By providing a stable source of funding, Dr. Tucker's generous gift has been an important step towards making our shared vision for the future of Shields Grove a reality.

We have two major goals for the future of Shields Grove. The first is to conserve the oak collection by improving horticultural care of the trees. Our second goal is to make the collection more physically and intellectually accessible to visitors with the addition of a trail system and interpretive signs. While academics and curators may already be able to appreciate the scientific value of the collection, a series of interpretive exhibits dedicated to engaging stories about the world's oaks will make the collection more meaningful to casual visitors and will bring them a greater understanding and appreciation of these remarkable trees.

We have already made great headway toward our first goal of improving horticultural care for the oak collection. Over the last three years we have received two prestigious federal grants from the Institute of Museum and Library Services for a combined total of \$106,000 for the conservation of



Shields Oak Grove.
 Photo by Debbie Aldridge.

larly strong in western North American and Mediterranean oaks. The oaks form a living library of plant diversity that is used by researchers, students, and oak enthusiasts for both scientific study and informal learning.

In 1999 I interviewed our curatorial, horticultural, and education staff as well as Dr. John Tucker, oak expert and professor emeritus of botany, to prepare a comprehensive collection analysis of Shields Oak Grove with recommendations for improvements. This document clarified the unique value of our oak collection, defined its potential for development as a major Arboretum destination, and helped motivate Dr. Tucker to establish an endowment for the maintenance

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EXCEPTIONAL TREES IN SHIELDS OAK GROVE

Brandegee oak (*Quercus brandegei*) is native to the lower slopes and canyons of the Cape Region of Baja California. It is classified as endangered by the World Conservation Union due to its highly restricted native range and declining number of mature trees. As far as we know, our two specimens in the Arboretum are the only ones in cultivation in the United States.



Island oak (*Quercus tomentella*) is restricted to the Channel Islands off the coast of California, making it the state's rarest oak. Our specimen in Shields Grove was started from an acorn collected from Santa Cruz Island in 1966. Over the last 39 years it has grown into an unusually dense and conical evergreen tree with shiny dark green leaves. Our nursery staff have undertaken research on the clonal propagation of oaks in order to propagate unique forms like this.



Tabor oak (*Quercus ithaburensis*) is a beautiful deciduous tree native to Israel and Jordan. Despite millennia of deforestation in this long-inhabited land, Tabor oak forests and woodlands can still be found in Israel. The oldest trees of this biblical species persist in graveyards, where they are considered sacred. Three of our specimens in Shields Grove started as acorns sent from Israel in 1964, and they have grown into attractive, broad-crowned trees.



Valley oak (*Quercus lobata*) is native to the Arboretum as well as fertile, lowland valleys throughout California. One of the largest of all oak species, it has been recorded to reach up to 178 feet in height and up to 13 ½ feet in trunk diameter. Once used as an indicator for good agricultural land, valley oak woodlands in the Central Valley have been largely eliminated. Valley oaks in the Arboretum support a variety of native fauna, ranging from magnificent Swainson's hawks to tiny oak gall wasps.



Photos: Emily Griswold

our oaks. These grants represent not only funding for needed improvements, but recognition at the national level for the significance of our collection. The UC Davis Grounds Division has pledged to match this funding with an additional \$45,000 for collections care improvements. The first grant funded a thorough assessment of the environmental conditions in the grove as well as health and structural stability ratings for each individual tree in the collection. Consulting arborist John Lichter led the assessment and made targeted management recommendations for improving the health of the trees. The second grant and its accompanying Grounds Division match funded the implementation of these recommendations. This major two-year project will be completed this spring and has included pruning for structural strength, construction of a new irrigation system, renovation of the existing lawn irrigation system, treatment of diseased trees, soil aeration in compacted areas, mulching, and professional arboriculture training for Arboretum and Grounds staff.

The Arboretum has been honored with an invitation to join the North American Plant Collections Consortium (NAPCC) by taking responsibility for holding one of the national oak collections. To become national collection-holders we must commit to maintain our collection at the highest curatorial and horticultural standards. In addition to contributing to a nationwide effort to preserve plant diversity, membership in the consortium will also bring more attention to the collection and attract more use by scholars, researchers, and the commercial horticulture industry.

A NEW CHALLENGE: EXPANDING HERON COLONY

Over the past five years, as we have worked hard to conserve this important collection, we have watched in amazement as a small breeding colony of black-crowned night-herons occupying a few trees in a corner of the Grove has grown into one of the largest heron rookeries in Yolo County. With over 1,000 egrets and night-herons nesting or roosting in Shields Grove between March and September, the area has become a fascinating local attraction for visitors and bird-watchers. Unfortunately, the birds have also started to take a toll on the health of the oak trees where they've built their nests. The remarkable growth of this breeding colony has presented us with a new challenge and has forced us to consider how we can balance protecting our trees

from harm, conserving our native wildlife, and guarding the health and safety of our employees and visitors.

Many botanic gardens struggle to balance the needs of their collections with the needs of local wildlife, but few have had to grapple with such a dramatic dilemma. On one hand, we have a responsibility as a living museum of plants to protect our most valuable collection of trees, some of which are rare or endangered. On the other, as stewards of the environment we have an obligation to protect these beautiful wild birds that have lost most of their natural habitat. In order to make the best informed management decisions, we have been working with experts from the UC Davis department of Wildlife, Fisheries, and Conservation Biology as well as a prominent local arboriculture expert. We are doing our best to come up with a carefully considered plan for managing this difficult situation and hope that our approach may provide a model for other botanical gardens.

With generous funding support from the Glide Foundation and the campus Grounds Division, wildlife biologists Melanie Truan and Amanda Castaneda have spent the past year and a half monitoring the size, extent, behavior, and reproductive success of the rookery in Shields Grove. Meanwhile, consulting arborist John Lichter has helped guide a study of the effects of bird activity on oak tree health. All of this information will be used to craft a plan of action for protecting our tree collection without harming the birds. Although our plan is not complete, we are ready to report on some of our preliminary results.

THE REMARKABLE ROOKERY

The rookery in Shields Grove is currently used by four species of birds in the heron family: black-crowned night-herons, snowy egrets, cattle egrets, and great egrets. Large, multi-species breeding colonies like this are typical of egrets and herons. However, it is somewhat unusual to find such a large, dense colony so close to human activity.

When selecting breeding sites, the birds are attracted to trees with a structure suitable for supporting nests in an area that is close to food resources. The wetlands, agricultural fields, livestock operations, and irrigation ditches in our region are rich with food resources for the herons, which include invertebrates, fish, amphibians, reptiles, birds, and small mammals.

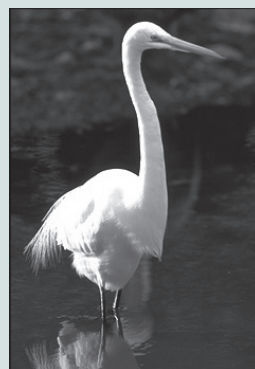
HERON SPECIES NESTING IN SHIELDS OAK GROVE

Black-crowned night heron (*Nycticorax nycticorax*) is found on every continent except Australia and Antarctica. This species is considered to be of moderate conservation concern in North America. There were 326 active nests in Shields Grove in 2005.



Snowy egret (*Egretta thula*) is found throughout the western hemisphere. In 1910, hunting egrets for their plumes was prohibited, and the species recovered from near-extinction. They are still declining in some areas due to pollution, pesticide contamination, and competition, and remain of high conservation concern in North America. There were 63 active snowy egret nests in Shields Grove in 2005.

Cattle egret (*Bubulcus ibis*) is native to Africa, Spain, tropical Asia and northern Australia. This species' range has expanded over the last 50 years and it is now found worldwide, except in extremely cold or dry climates. They forage in groups, especially around grazing livestock. There were 49 active cattle egret nests in Shields Grove in 2005.



Great egret (*Ardea alba*) breeds throughout the world. Like the snowy egret, these birds were once harvested for their lacy plumage used in the fashion industry. Their populations have recovered since the Migratory Bird Treaty was enacted. There were 11 active great egret nests in Shields Grove in 2005.

Photos: Great egret, Gerald and Buff Corsi © California Academy of Sciences. Others, Clyde Elmore.

However, the loss of native forests in this area through conversion to agriculture and housing has reduced nesting options. This has made marginal habitat areas, like our cultivated oak grove, more attractive as a breeding site despite its proximity to a bustling urban campus.

It is difficult to relate to the size and density of the breeding colony without visiting the grove in mid-spring, when the canopies are filled with fluttering white and gray forms and cacophonous sounds and acrid smells permeate the air. During the height of the breeding season in mid-May of this year there were 430 active nests in 105 of the 346 trees in the Oak Grove. Several hundred birds, especially juveniles, also roosted in the grove without breeding between March and October. In the late summer, up to 650 cattle egrets alone have been observed returning to the Oak Grove in a single evening after foraging all day in surrounding areas. The birds vacate the grove for the cold fall and winter months and do not reappear until the early spring.

THREATS TO OAK HEALTH

Heron rookeries are known to threaten the health of the trees in which they nest. There are several documented examples of herons damaging or destroying their nesting site vegetation through guano accumulation on the foliage and soil. In one particularly dramatic case, a colony killed 85% of the mature post oaks (*Quercus stellata*) on an island in a mere three years. It is typical for heron colonies to damage their nest site vegetation and then move on. Where their forest habitat is extensive,

this doesn't pose much of a problem. The former breeding site undergoes ecological succession, which adds to the structural diversity of the vegetation in the region. However, where forest habitat has been lost or fragmented, herons may increasingly nest in cultivated trees in urban areas.

In Shields Grove, damage appears to be directly related to the concentration of nesting and roosting. Foliage loss is particularly apparent in the most densely occupied areas of the grove, where up to 28 active nests, each up to two feet in diameter, have been sighted in a single tree. Guano coats the foliage under nests, causing leaf drop and canopy thinning. The thinning is visible looking up at the canopies from the ground and in aerial photos of the site.



Oak leaves covered with bird droppings are unable to photosynthesize, depriving the tree of energy. Photo by Holly Crosson.

Laboratory tests indicate that guano deposits in heavily occupied areas have also changed the soil chemistry, lowering the pH and greatly raising the nitrate, ammonium, phosphorous, and potassium levels.

All four bird species are protected from harm by the Migratory Bird Treaty Act, which prohibits disruptions during the breeding cycle. Because loud noises and regular human activity can lead to nest abandonment by adults or increase the risk of chicks falling from nests, construction projects associated with our conservation work in Shields Grove have been postponed until the end of the breeding season. Protection of the breeding birds has delayed our grant-funded irrigation installation, soil grading, soil aeration, and mulching projects. Unfortunately, winter construction is less desirable because wet soils are more subject to compaction, which is further detrimental to tree health.

HUMAN HEALTH CONCERNS

More worrisome than construction delays are the potential health risks the heron rookery might pose to our employees and visitors. The guano which coats anything under the trees in the most popular nesting areas has the potential to contain disease-causing bacteria such as, *E. coli*, *Salmonella* spp., and *Chlamydia psittaci*. Bacteria can be spread to humans by inhalation or hand to mouth contact after touching an infected surface. As a precaution, employees working in the grove are requested to wear a respirator, eye protection, a Tyvek suit, and rubber gloves for protection. We advise that visitors stay away from areas where birds and guano are present and that they not touch sick, injured, or dead birds.

Our long-term vision for the Oak Grove is to create a visitor-centered tree exhibit with walking trails, similar to what we've done in the Redwood Grove. Unfortunately, at this point, we are not comfortable encouraging visitors to get too close to the trees and their avian inhabitants. Plans for developing permanent interpretive signs and hiring a landscape architect to design a path system and understory plantings for Shields Grove have been delayed until we have a better sense of how we can balance tree care and human safety with the presence of wildlife.

We encourage you to visit the grove this winter—after the big storms have washed much of the guano away—to check out the new signs and contemplate the challenge we face. Please join me and wildlife biologist Melanie Truan on Sunday, March 26 for a special tour of the Oak Grove to further discuss these issues. We look forward to hearing your feedback on our work so far and your opinions about our potential management options. We are doing our best to gather informed recommendations from UC Davis experts that will help us fulfill our dual roles as collection caretakers and environmental stewards.