STRAWBERRY CREEK II

RESTORING THE CREEK, 1987–1989
A PERSONAL PERSPECTIVE

Robert Charbonneau

This is a personal account of the urban stream restoration project on Strawberry Creek that I coordinated in the late 1980s. It summarizes the major activities and the key people responsible for the project's ultimate success, highlighted by the reintroduction of native fisheries in the creek following a century's absence. For a more technical discussion of the project, please refer to the scientific journal article on the subject.[1]

BY THE 1980S, STRAWBERRY CREEK HAD BECOME a typically neglected urban stream. Its troubled waters were polluted with street runoff, chemicals, and raw sewage. Many aquatic organisms and native plants had nearly disappeared from the creek and along its riparian corridor. Recurrent winter flood waters undercut stream banks; cement banks and dams, built to fight erosion, detracted from the creek's natural beauty. As the creek's ecological and aesthetic qualities continued to deteriorate slowly, the campus displayed a dismaying lack of knowledge or concern.

In May 1985, a concerned group of faculty representing the natural and environmental sciences complained in a memo to Professor Calvin Moore about the degraded condition of the creek. They stated that the creek was polluted, partly by campus discharges, and called for a comprehensive study of the entire watershed to identify all sources of pollution. The group offered the research assistance of students and faculty, and noted that "if we ignore the pollution in Strawberry Creek, the University may find itself in an embarrassing and costly situation. A great University should not have running sores on its land."[2]

Professor Moore recommended to the Campus Planning Office that an advisory committee be formed to deal with creek environmental quality issues. In September 1985, the Environmental Health and Safety Office (EH&S) followed up on the faculty memo, concluding that dogs were responsible for the high fecal bacteria counts in the creek, and that trace heavy metals were originating from street runoff. EH&S reviewed its own files and reported that a comprehensive sanitary survey to locate and reroute sewer lines draining from campus buildings into the creek was successfully completed in the early 1970s, leaving only storm drains to empty into the creek.[3] The administration's conclusion that unleashed dogs were responsible for bacterial contamination of the creek outraged even the most conservative natural sciences faculty and galvanized their support for the restoration of Strawberry Creek.

In fall 1985, EH&S committed to "examining some long-range solutions" to the polluted creek because of the potential "significant health hazard."[4] In March 1986 Luna Leopold, chair of the geology department, complained of the creek's condition to the campus Hazardous Waste Management Committee, stating that "in the last decade, all studies with which I am familiar have shown that the stream is polluted to the point that no insect life grows on the bed of the channel." Leopold recommended that EH&S perform water quality sampling and sanitary engineering investigations to identify specific point-sources of pollution on campus.[5] Finally, in

June 1986 the EH&S associate director reviewed Strawberry Creek files and recommended the development of a master plan and various sanitary engineering remedies.[6]

Around the same time, I packed my bags in Massachusetts and headed for Berkeley to work towards my master's degree in environmental planning in the College of Environmental Design. I had received my B.S. degree in environmental sciences with a concentration in water pollution biology from the University of Massachusetts at Amherst and since 1980 had gained valuable experience working on dozens of stream and lake water quality studies and projects.

Restoration Project Inception

Near the end of the fall 1986 semester, I went to the campus EH&S office to try to find gainful employment, because I had previously worked for EH&S at the University of Massachusetts. As my savings dwindled, I was motivated to accept the only student work-study position available in the industrial hygiene program. Over the next several months, I visited every campus laboratory and in the process got to know the campus buildings and grounds in excruciating detail.

Early in the spring 1987 semester, I spoke with EH&S Associate Director Ben Gonzales about potential topics for my master's professional report (an applied version of a thesis). Ben told me about several hazardous-materials-related options but mentioned as an afterthought, "Then there's always Strawberry Creek." So inadvertently I began a project that would consume much of my life over the next two and one-half years.

In March 1987, EH&S management applied for a $15,000 Business and Administrative Services (BAS) opportunity grant to work on Strawberry Creek. Ben Gonzales and Director Elaine Bild's unwavering administrative and political support would be essential throughout the project. Dan Boggan, the administrative vice chancellor, soon approved the BAS grant, although I had already commenced initial research on the project.

During the spring of 1987, I met several staff and faculty who would prove instrumental in the future success of the restoration project. No one would be more essential or supportive than Sonja Biorn-Hansen, the facilities department engineer who oversaw all underground utilities systems and associated deferred maintenance projects. Sonja would become a trusted colleague and formidable ally over the next few years. I also soon met Vince Resh, an enthusiastic entomology professor with a passion for the creek, who became my closest academic advisor and strongest faculty supporter.

Sanitary Engineering and Water Quality Studies, Spring 1987

I spent most of spring 1987 reviewing and compiling existing information and gaining an understanding of the creek and its canyon watershed area. The storm drain system map was quite outdated; because many parts of the campus utility infrastructure were over fifty years old, anything was possible in terms of how drainpipes had been connected and what eventually emptied into the creek. Over one hundred drainpipes were located on the banks of Strawberry Creek on the central campus. It would take over a year to determine where all these pipes originated. Both the storm drain and sanitary sewer system maps had to be completely updated and revised. Sometimes this would require crawling through large culverts with a flashlight and map, armed with a baseball bat to ward off unhappy rodents.

After much time-consuming and laborious sanitary engineering work, Sonja and I determined that there were multiple problems with both the storm and sanitary sewer systems due to their age and condition. Acting on a faculty complaint about sewage contamination from the stadium, we dye-tested the bathrooms and sampled the South Fork of Strawberry Creek before, during, and after football games. We found massive bacterial contamination in the creek during

half time and immediately after games, as stadium toilets were flushed thousands of times. A broken sewer line beneath the stadium was flowing into an adjacent broken storm drain line, sending raw sewage spewing out into the creek. Sonja soon undertook an extensive sewer system rehabilitation project to fix the stadium infrastructure damaged by movement along the Hayward fault zone.

We discovered several other sewer leaks, none more puzzling than one contaminating a storm drain coming from Harmon Gymnasium. We dye-tested all of the drains and bathrooms in the gym but uncovered no problems. Following the storm drain line up from the gym, we traced the source to the Bear's Lair pub bathrooms, which had been retrofitted into the student union building several years earlier. The plumber had incorrectly tied the pipes into a storm drain line coming down from the roof drains, instead of into the adjacent sanitary sewer line, allowing raw sewage to drain directly to the creek. This certainly validated Murphy's Law and reinforced the need to be thorough and vigilant in our investigations.

Evaluating the campus sewer system for breaks and cross-connections sometimes resulted in surreal experiences. We often used fluorescein, a non-toxic fluorescent green dye, for tracer and flow tests. On more than one occasion, the creek turned day-glo green as a result of our dye tests. One day, a facilities worker inadvertently added too much dye to a sewer manhole, not only turning the creek fluorescent green, but a significant portion of the bay as well. The coast guard was alerted and responded, but by then the plume had spread out over such a wide area that they were unable to find its source.

During the summer of 1987, I conducted comprehensive ambient water quality sampling of both the north and south forks, covering the headwaters in Strawberry and Blackberry Canyons as well as the upper and lower ends of the creek on the central campus. Ben Tamplin, director of the state's sanitation lab in Berkeley and a Cal alumnus, agreed to analyze all of the creek samples for a wide range of water quality parameters on a pro bono basis, saving a significant amount of money as well as assuring quality control on the analytical results. These cost savings allowed us to contract with a commercial environmental laboratory to sample and analyze all campus point-source discharges (effluent from continuously flowing drainpipes).

These ongoing sanitary engineering and water quality investigations continued to uncover problems. Over the next two years, various sewer leaks were repaired and discharges rerouted to the sanitary sewer. Today, the campus facilities department continues to fix sewer leaks as soon as they are discovered, and diverts minor drains to the sanitary sewer system whenever possible. We also worked with the facilities department to improve street sweeping and catch basin cleaning in an attempt to mitigate urban storm-runoff pollution. The water quality of the creek improved dramatically. Macroinvertebrate (aquatic insect) surveys, a widely used biological indicator of environmental quality, showed the creek improved from "poor" to "good" condition.

The Creek Committee

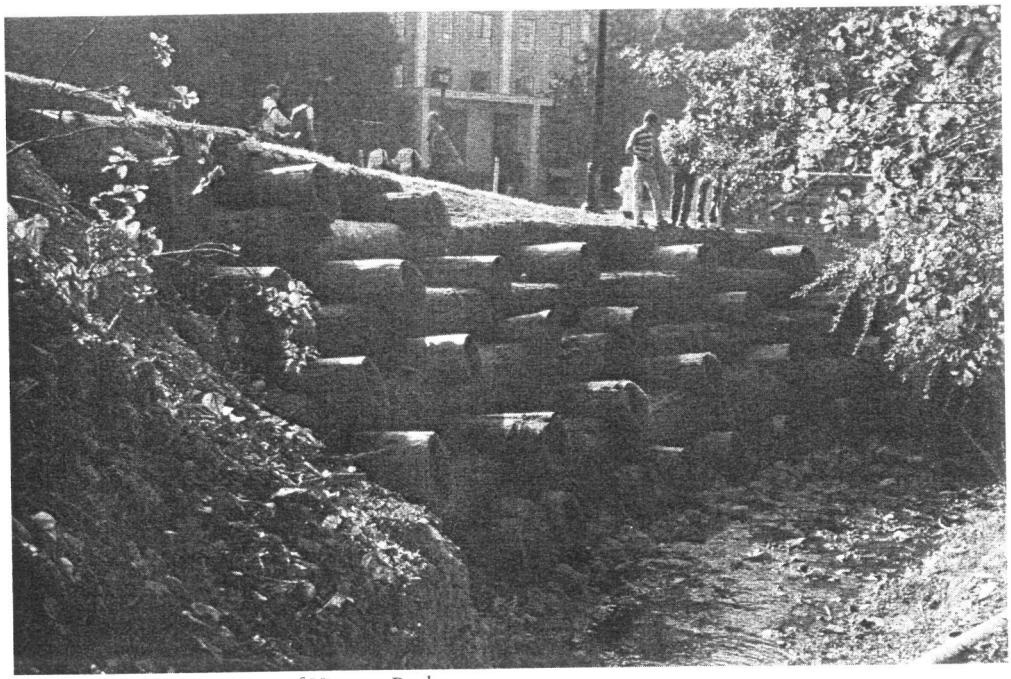
In October 1987, Sonja Biorn-Hansen and I made a presentation to Vice Chancellor Boggan and his BAS directors, discussing the results of the initial creek study and recommendations for restoration, with an emphasis on the value of the creek to the campus. Boggan enthusiastically received the presentation and committed his support for restoration of the creek. In November 1987, the vice chancellor officially established the Strawberry Creek Environmental Quality Committee, a chancellor's advisory group composed of faculty, staff, and students.

Joe McBride, chair of the Department of Forestry and a respected campus environmental advocate, was the first committee chair. Other faculty originally included Vince Resh (entomology) and Bob Twiss (landscape architecture). Campus staff included Sonja, EH&S personnel, the campus landscape architect, and me as the student representative. Soon after, the campus grounds

manager, a campus environmental planner, and a botanical garden staff member were added. Eventually, liaison representatives from the city of Berkeley (director of Parks and Recreation) and the Lawrence Berkeley Laboratory (EH&S director) joined the committee because both the city and the laboratory controlled portions of the upper watershed, mainly along the North Fork.

This committee proved invaluable in cutting through the red tape associated with these three bureaucracies and allowed work to proceed relatively unhindered by political obstacles and squabbles. Sonja served a pivotal project management role while providing engineering expertise and access to deferred maintenance funding. The committee agreed upon an ambitious set of goals: enhance the teaching and research value of the creek; restore ecological integrity of the creek to the greatest extent possible; provide innovative examples of urban creek restoration techniques through demonstration projects; and preserve and enhance the creek as both a campus and city amenity.

By fall 1987, I had essentially completed the initial water quality study. However, in order to formulate a truly comprehensive creek management plan, the scope expanded into broader areas of watershed management, urban stream restoration, and environmental education. I finished the first draft of the Strawberry Creek Management Plan by January 1988. After graduating in the fall of 1988, I became a full-time EH&S staff member, responsible for implementing my plan.



Cribwall, 1988. *Courtesy of Vincent Resh.*

Erosion Control

In 1988, restoration activities began and continued in earnest for almost two years. Many stream banks and structures along the creek were near collapse from lack of maintenance and relentless erosion. Sedimentation threatened the health of the creek's biota and habitat. In the spring of 1988, Philip Williams and Associates, a local hydrology firm, analyzed erosion and bank stabilization options, prioritizing and recommending sites along the creek for repair and stabilization of stream banks, check dams, retaining walls, and utility overcrossings. Over the next

year, we used a combination of private contractors and the California Conservation Corps to do erosion control work on campus and in Strawberry Canyon.

Plantings in cribwall. *Courtesy of Vincent Resh.*

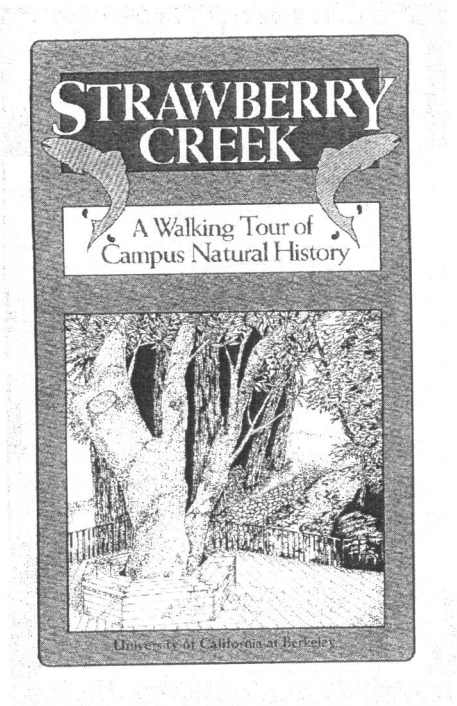
During the summer of 1988, we worked on a major project opposite Stephens Hall, where the creek was eroding a high vertical creek bank, collapsing the lawn and undercutting the bridge supports. Instead of installing a conventional concrete retaining wall, we decided to try a biotechnical approach—a redwood cribwall. The cribwall combined native vegetation and redwood logs, forming an integrated structure more durable, cost-effective, and environmentally compatible than a concrete wall.

The designing engineer specified redwood logs at least twelve inches in diameter. We specified this minimum size in our bid specifications to Bay Area lumber companies, envisioning telephone-pole size logs. When the over-sized big rig from the Santa Cruz mountains rumbled onto campus with our load of logs, we were shocked. The logs were a foot thick at the top and some were nearly three feet at the base! Luckily, our contractor was able to conceal the large ends by burying them about 15 feet into the bank as tieback logs. The cribwall was backfilled with soil to provide strength, weight, and a place for plants to grow. Later planted with a wide variety of native vegetation by faculty and student volunteers, today the cribwall appears quite natural and aesthetically pleasing. Due to extensive plant roots, this bank will remain stable after the cribwall logs rot out.

Further downstream, adjacent to the 1935 Student Glade just east of Sather Gate, we modified the inlet to a high-flow bypass structure, restoring a natural stream channel meander that had been cut off and left dry since the bypass was constructed in the 1960s.

Environmental Education

Environmental education was a major focus of the restoration project; raising awareness of the creek and changing campus attitudes would be crucial to our long-term success. Our target audiences included students, staff, Northside residents, and the general public. I gave many guest lectures on the creek to classes in landscape architecture, biology, planning, forestry, environmental

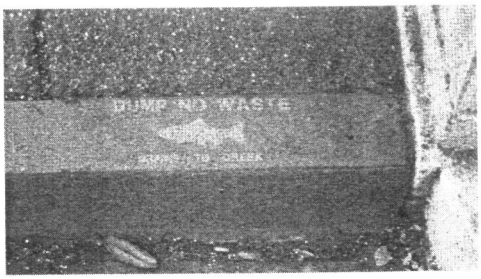


1990 booklet.

science, and conservation resource studies. I also gave presentations at professional meetings and conferences and to campus administrative departments. Vince and I led numerous walking tours of the creek and canyon watershed for classes, conferences, and docent and staff groups. We also created the booklet "Strawberry Creek—A Walking Tour of Campus Natural History," which was extremely popular with over 10,000 copies distributed. We are currently completely revising it, and EH&S hopes to print 10,000 copies of the second edition this spring.

In 1989, we embarked on two major public education campaigns. The first was an idea we borrowed from an urban stream restoration group in Seattle. We designed a curb stencil that read "Dump No Waste—Drains to Creek" around a playful fish logo. To the best of my knowledge, we were the first in the Bay Area to spray-paint these stencils on curbs next to gutter storm drains and eventually on all campus drains. We also got permission from city public works to paint these stencils on storm drains in the Northside district. Similar curb stencils can now be seen in cities all over the country. In 1988, Sonja and I participated in the founding of a grassroots citizens group (Berkeley Citizens for Creek Restoration) that would later stencil drains located above each culverted creek in Berkeley with its own distinctive ecological symbol and the name of the creek.

The second major public education effort was a mass informational mailing to all Northside residents and businesses located within Strawberry Creek's North Fork watershed area. As part of this cooperative effort with the city, a cover letter was jointly signed by Vice Chancellor Boggan and the city manager informing people how to be environmentally friendly watershed residents. This may be one of the few times that both high-ranking university and city officials jointly endorsed a public letter.



Courtesy of Vincent Resh.

In March 1989, the committee collaborated with the city and Berkeley Citizens for Creek Restoration to sponsor Spring Creek Week, a weeklong series of events held around the campus and city. Activities included planting native vegetation along the creek, lectures, receptions, dance performances in Faculty Glade, walking tours, and environmental art installations around campus. The week ended with storytelling, a dance performance, and a community potluck at Strawberry Creek Park in West Berkeley, where the creek had been daylighted out of its culvert in the mid-1980s as the urban park's centerpiece.

Later in 1989, we assisted the university's Botanical Garden with the funding, design and layout of a creekside trail, a watershed overlook deck, and interpretive displays in the lower part of the garden. The garden later celebrated the completion of these projects with a Creek and Watershed symposium in 1990. The garden became the focal point for environmental education about the creek headwaters and its upper canyon watershed.

The author leading a creek walk. *Photograph by Allen Stross.*

Restoration of the Native Fish

Our restoration efforts culminated in May 1989, when we reintroduced native fish into the creek for the first time in over a century. Fisheries likely disappeared from the creek after the University of California relocated to Berkeley in 1873, diverted the creek in Strawberry Canyon for its water supply, and dumped raw sewage until the turn of the century when sewers were built. Obstacles such as check dams and culverts were installed beginning in the 1870s. These actions resulted in very low stream flows, poor water quality, habitat destruction, and barriers to fish migration, which all led to the disappearance of fish in the creek.

The initial 1987 creek study used bioassays with two sensitive aquatic organisms (fathead minnows and a crustacean) to study the feasibility of restocking fish. When these clinical observations indicated it was theoretically possible, restoring native fisheries became a priority and an important symbolic goal of the project.

Campus ichthyologists helped me to identify likely native fish species and their nearest present-day sources. The creek committee initially nominated trout, but then dismissed them as non-native and potentially risky in terms of suitable habitat and water quality conditions. We eventually decided to stock with three-spined sticklebacks, a small native, hardy fish able to live in disturbed habitats. As a bonus, the sticklebacks were interesting to study and observe from a teaching standpoint, and their prominent dorsal spikes made them such an attractive icon that the fish's image eventually found its way onto the cover of student orientation booklets and T-shirts.

With the cooperation of East Bay Regional Parks District biologists, we collected sticklebacks from Wildcat Creek, and released about a hundred into Strawberry Creek with accompanying publicity including local television and radio coverage. We were anxious for a few days, but the fish did well, and no mortality was observed. Interestingly, the sticklebacks have since been displaced by two species of native minnows (California roach and hitch) stocked later, which proved to be better adapted to living in the creek. The sticklebacks, flushed downstream during winter storms, are now abundant around the Berkeley Marina near where the creek enters the

San Francisco Bay. The minnows are still doing well and continue to spawn each summer. Early in 1991, snowy egrets were observed foraging for fish in the creek for the first time in memory. We are hopeful that over time other native animals will return to the creek and its recently bolstered ecosystem.

Parting Thoughts

An incredible amount of progress was made for Strawberry Creek in a relatively short time, more amazing given the bureaucratic nature of such a large institution as the university. This rapid progress was mainly due to the hard work and dedication of the many people directly involved in the project but would not have been possible without the political support that allowed us to do the work.

Strawberry Creek reflects the urban conditions of its watershed. Unfortunately, we are bound by the constraints that over a century of development has forced upon both the creek and us. The creek will always serve as the storm drain system for the watershed, and human carelessness and accidents will inevitably result in sporadic spills and releases into the creek. Extensive development in the watershed has permanently altered the creek's hydrology, creating "flashy" flow conditions. Channel alterations and obstacles, such as check dams, limit the creek's available habitat and create barriers to fish migration. Moreover, the environmental quality of this urban creek cannot be sustained without constant vigilance and regular maintenance.

Periodic re-education of campus staff and contractors is needed to maintain awareness about the creek and activities that can adversely impact it. However, we achieved the goals set forth at the start of the restoration, and the project is widely considered a success. The creek is certainly much healthier than it was. Our greatest accomplishment may be that attitudes towards the creek have changed, and awareness has been heightened. Now, when spills occur in the creek, campus officials receive multiple reports, in contrast to fifteen years ago when no one would have even noticed. I sincerely hope that many years from now I can revisit the creek and admire the descendants of the native fish we have reintroduced.

ENDNOTES

1 Robert Charbonneau and Vincent Resh, "Strawberry Creek on the University of California, Berkeley, campus: A case history of urban stream restoration," *Aquatic Conservation: Marine and Freshwater Ecosystems* 2 (1992), 293-307.

2 H.V. Daly, College of Natural Resources, memo to Calvin Moore, "Some preliminary information and thoughts on pollution in Strawberry Creek," May 2, 1985.

3 "Strawberry Creek Water Quality Issues," EH&S internal memo, September 12, 1985.

4 Don Erman, Associate Dean of College of Natural Resources, memo to EH&S Director, October 15, 1985.

5 Chairman Luna Leopold, Department of Geology and Geophysics, memo to EH&S Hazardous Waste Management Committee, March 19, 1986.

6 Ben Gonzales, EH&S Associate Director, memo to James Brown, Director, "Environmental Quality of Strawberry Creek," June 10, 1986.

THE CAMPUS CONSERVATORY

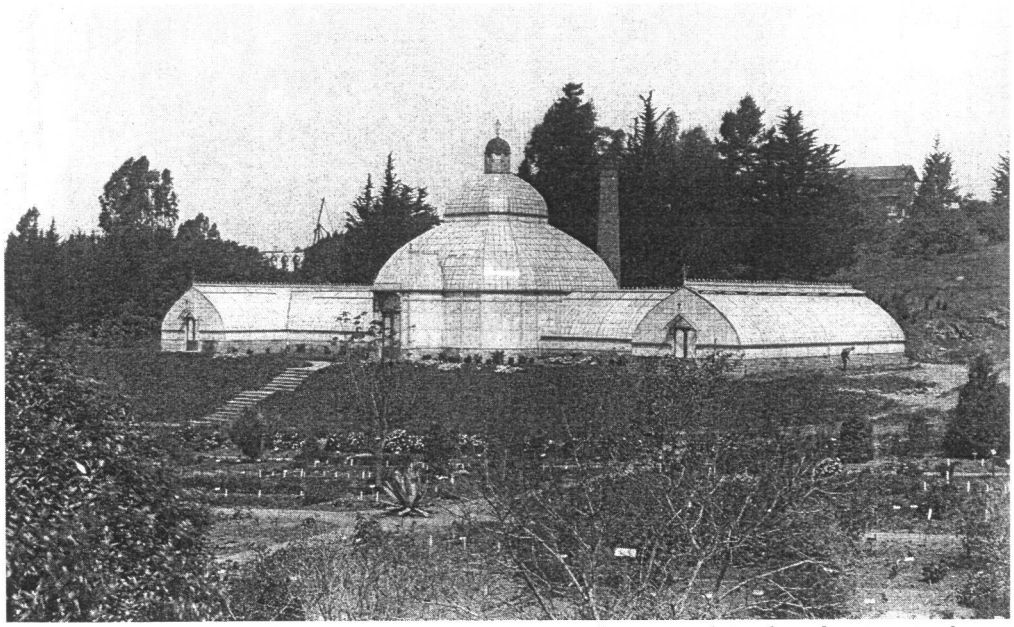
William Roberts

THE BEGINNINGS OF THE BOTANICAL GARDEN go back to the 1870s, with the appointment of Eugene W. Hilgard as professor of agriculture and agricultural chemistry. Hilgard called for the "continuation and expansion of the experimental cultures on the grounds assigned to the department on the university campus, and the establishment of a garden of economically important plants, both for experiment and for the instruction of classes by actual demonstration and exhibition of the growing plants."

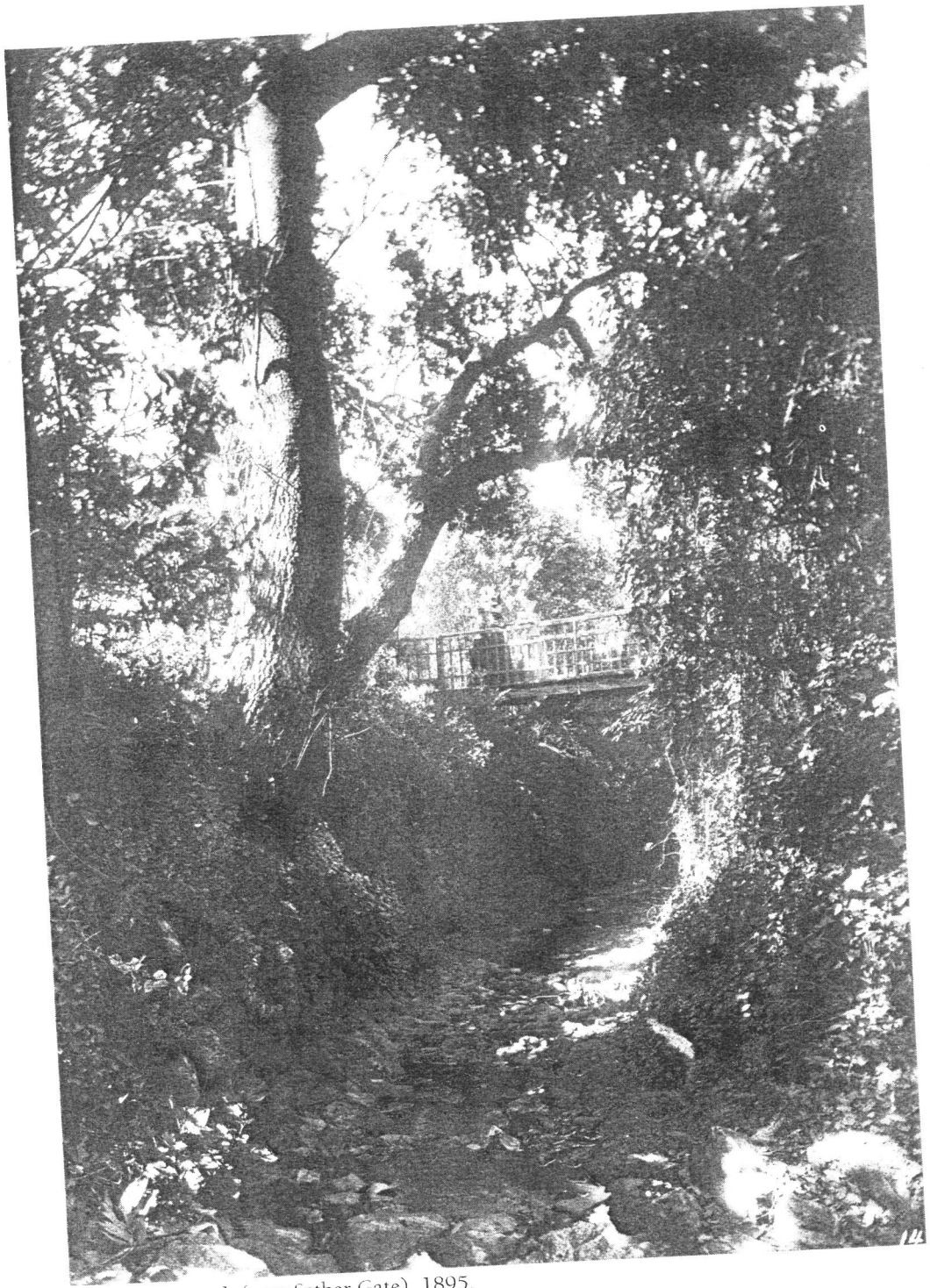
Formal and permanent instruction in botany was not established until 1890, however, with the appointment of Edward L. Greene, who almost immediately began to plan for a garden of native trees, shrubs and herbaceous plants native to California, which would complement Hilgard's "Garden of Economic Plants."

Within a few years there were as many as 1,200 plants in the university's garden, which occupied the swale north of the site of Doe Library, but propagation facilities on the west side of the north branch of Strawberry Creek were limited to small wooden sheds which had become highly inadequate.

In 1893 the regents approved a motion to build a new plant house, later referred to as the Conservatory, designed by Lord and Burnham of Irvington, New York. The new building was to have an interior area of some 6,000 square feet, and the central portion, the Palm House, was forty-five feet square with a height of forty-two feet. Construction was completed in 1894 at a cost of $20,000, on a site just north of the Botanical Garden, the present location of the Haviland



South and east façades of the Conservatory in 1900, with Botanical Garden plantings in the foreground. *University Archives (UARC PIC 10C:3).*



Bridge over creek (now Sather Gate), 1895.
University Archives (UARC PIC 2:151).