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Berkeley Scientific Journal

Title

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Permalink

<https://escholarship.org/uc/item/8x60h5gk>

Journal

Berkeley Scientific Journal, 30(1)

ISSN

1097-0967

Author

Brandon, Kaitlynn

Publication Date

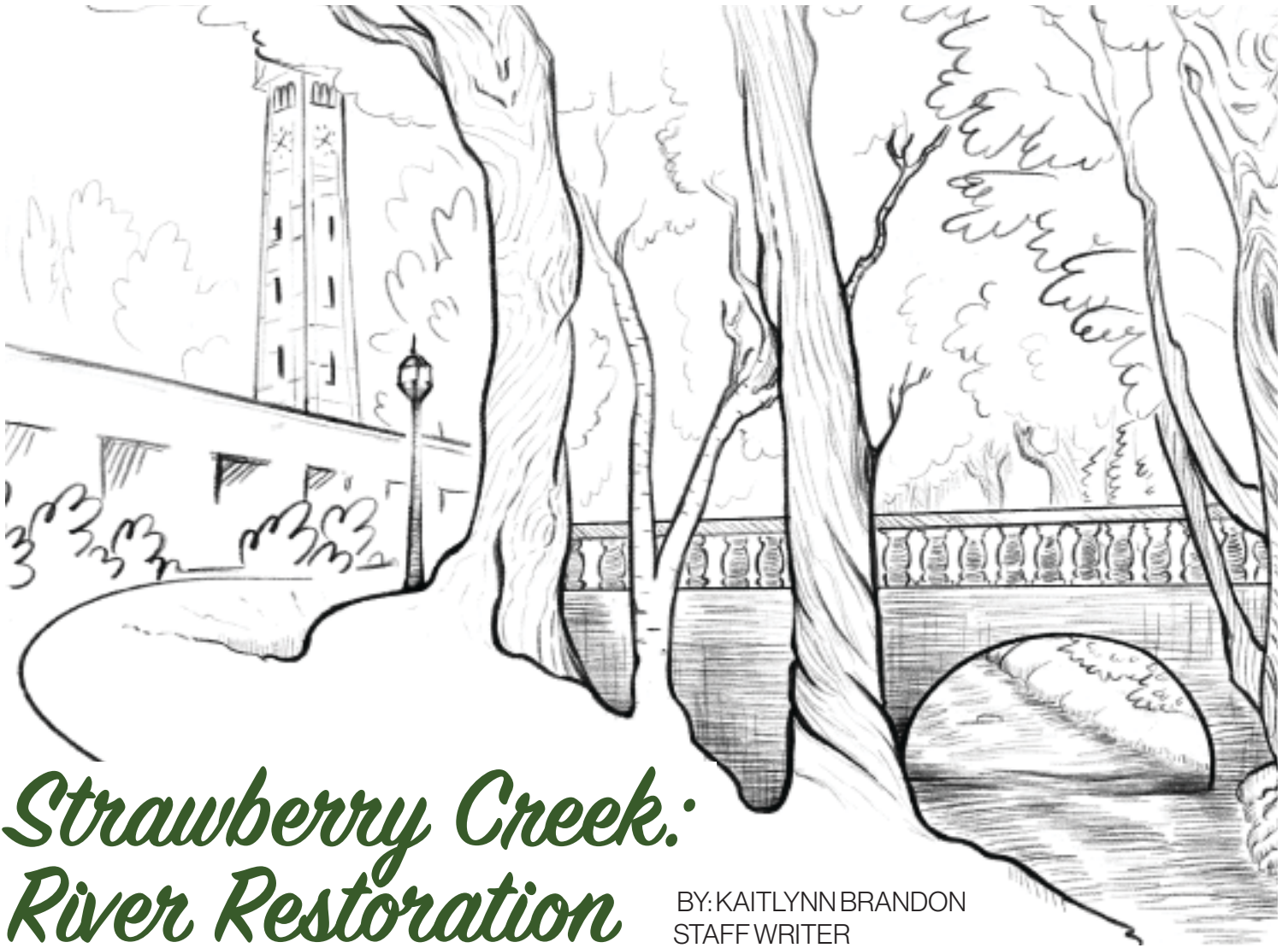
2026-10-30

DOI

10.5070/BS3.69969

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Strawberry Creek: River Restoration

BY: KAITLYNN BRANDON
STAFF WRITER

Pollution is more than just toxic smokestacks and oil spills. Less obvious ecological disruptions such as urban advancement — which often leads to local construction, road runoff, and human waste mismanagement — expose habitats to unprecedented levels of pollution and damage ecosystems. A notable example of this is Berkeley's very own Strawberry Creek, which experienced significant damage to local ecosystems following urbanization. This forked river that runs from Oxford Street through U.C. Berkeley's campus has been carefully studied by restorationists and researchers. Restoration efforts seek to reestablish a new, healthier creek ecosystem that balances native wildlife with urban development.

THE HISTORY OF STRAWBERRY CREEK

Prior to colonization, Strawberry Creek served as a culturally significant foodway for ancestors of the Huchiun-Ohlone community¹. Then in the proceeding 150



Fig. 1 Strawberry Creek's original flow photography by L.S. Smith Feb 1916.



Fig. 2 The early years of urbanization's pollution of Strawberry Creek.

years, Strawberry Creek played a central role in the development of the U.C. Berkeley campus and the settlement of the City of Berkeley. This urbanization imposed serious ecological and geomorphological alterations upon the creek². Thus, since the late 1700's, Strawberry Creek has been greatly damaged by city pollution, which has become so severe that the creek became a public health risk in the 1980s. The SCMP, or The Strawberry Creek Management Program, was then proposed to revitalize the creek's natural ecosystem, and it is still in effect today along with other efforts, like the Kingman Hall Creek Restoration project.

Although the creek may never return to its precolonial condition, projects like these have greatly improved the creek's health and have led to the reintroduction of three native fish species. Such efforts fall under the umbrella of river restoration, which

focuses on reinstating, maintaining, and monitoring the health of a water body to improve the quality of life for dependent wildlife and surrounding communities.

RIVER RESTORATION SCIENCE

River restoration refers to a wide range of management practices aimed at returning a degraded ecosystem to as close to its natural state as possible. Restoration practices can include the removal of invasive species, the reintroduction of native species, and the return of natural water flow to rivers that were previously altered by human construction. While restoration groups

have become more active in recent decades, river restoration is familiar to many sciences including ecology and geomorphology. Ecologists study the interaction of organisms in an environment, ranging from plants to animals and even humans. In other words, ecologists study ecosystems. On the other hand, geomorphologists study the evolution of landforms, often working with landscape architects and engineers to mitigate the damaging impact of urban development on habitats like Strawberry Creek.

Urbanization directly damages creek health by reshaping natural river flow to suit human infrastructure. Alterations like culverting, which involves routing water through underground tunnels, can accelerate otherwise natural habitat fluctuations like bank erosion and bank hardening. These changes in water dynamics disrupt native species and overall ecosystem stability by altering habitat structure and resource availability. Ecologists and geomorphologists seek to alleviate these impacts by recreating dynamic fluvial processes so that rivers can flood, erode, deposit, and shift course naturally — all without causing significant harm to pre-existing human infrastructure.³ These changes have the potential to improve quality of life for both humans and the surrounding ecosystem.

SOLVING URBANIZATION AND RESTORATION CONSTRAINTS

Urbanization of Strawberry Creek has transformed this vital water source from an ecological hotspot into little more than a landscape feature.⁴ While ecological research demonstrates that river restoration is most successful when water flow returns to its natural free-flowing form, a quick look at a map of Strawberry Creek's tightly constricted flow through campus suggests a near impossibility of complete flow restoration.³ Constraints, such as preservation requirements for historic infrastructure, coupled with limited funding and manpower create a tricky situation for restoration. Further

Restoration efforts seek to reestablish a new, healthier creek ecosystem that balances native wildlife with urban development.

tricky situation for restoration. Further challenges include navigating large restoration projects in dense urban traffic and crowded campus streets.

In addition, considerations must be made for the plant and animal life that already exist at repair sites. For example, use of heavy machinery in an area can compact soils, damage tree roots, and limit future canopy growth which further disrupts ecosystem quality. Even the removal of invasive species must be executed delicately. Although the Eucalyptus Grove on the North bank of Strawberry Creek is invasive to California, getting rid of it may disrupt the aesthetics and shading of the creek for visitors. In some cases, restoration efforts that are too aggressive can cause even more damage to the habitat than the original pollution. The invasive species heder, or more commonly known as ivy,⁴ grows extensively along the banks of Strawberry Creek, where it monopolizes resources like sunlight and depletes nutrients from the soil, thus inhibiting the growth of native plants. However, aggressive removal of the ivy without careful planning may cause sudden loss of root structure and excessive bank erosion, leading to further habitat degradation. Thus, restoration planners must carefully weigh ecological goals against community needs and landscape constraints.

These above examples point toward a broader question: how should stream health and restoration “success” be measured? One practical, untraditional indicator of stream recovery is the non-invasive monitoring of macroinvertebrate communities.

MACROINVERTEBRATES

Macroinvertebrates are spineless aquatic animals that are large enough to see with the naked eye, and therefore classified as macro; these organisms include flies, crawfish, and midges. There are thousands of macroinvertebrates, and while not all are keystone species — organisms that play a critical role in maintaining the structure and balance of an ecosystem — they remain an invaluable link in the ecological chain. Macroinvertebrates break down organic matter, such as decaying leaves, and return nutrients to the environment through a process known as nutrient cycling.⁵ Some macroinvertebrates help purify the water by preventing algae overgrowth and maintain

population balance through predation of smaller organisms. Ecologists, however, have another use for macroinvertebrates: biomonitoring.

Biomonitoring describes a data collection process in which the macroinvertebrate population, or lack thereof, is used to monitor water body health. Macroinvertebrates are split into three groups that respond distinctly to pollution: sensitive, tolerant, and intolerant. Because some macroinvertebrate species are more tolerant than others to pollution levels, ecologists can use their relative population densities to assess ecosystem health and water quality.⁶ Additionally, many macroinvertebrate taxa require particular habitat conditions — for example, some prefer fast flowing streams while others thrive in slower-moving pools. Thus, shifts in community composition can reveal changes in both water quality and physical habitat.

Macroinvertebrates are ideal candidates for bioassessment tests because they typically have low or no mobility, which means they cannot easily escape the effects of pollutants or habitat disruptions.⁶ Therefore, changes in macroinvertebrate population levels is a dependable indicator of water body health.

In Strawberry Creek, surveys of macroinvertebrates conducted by the Kingman Hall Creek Restoration show that altered hydrology, through culverts and high-flowing bypasses, have detrimentally impacted riparian ecology in the North Fork — a change reflected in declining populations of certain macroinvertebrates.⁴ Culvert alterations can cause abnormally fast currents, which upset natural sediment formation and water flow. These changes can greatly disrupt certain macroinvertebrates’ habitat and life cycle. For some, like the native green darner dragonfly, (see fig. 3) which requires slow moving streams to lay its eggs, a change in current could prevent egg-laying. This in turn prevents larval growth, which eventually obviates an entire life cycle. The decline in this indigenous macroinvertebrate population reflects how industrial operations damage overall ecosystem health. Altering river beds affects so much more than just water flow.

CONCLUSION

Though Strawberry Creek will never return to its pre-colonial state, restorationists seek a new equilibrium: one that balances coexistence among plants, animals, and humans, while remaining sensitive to the ecological needs of the

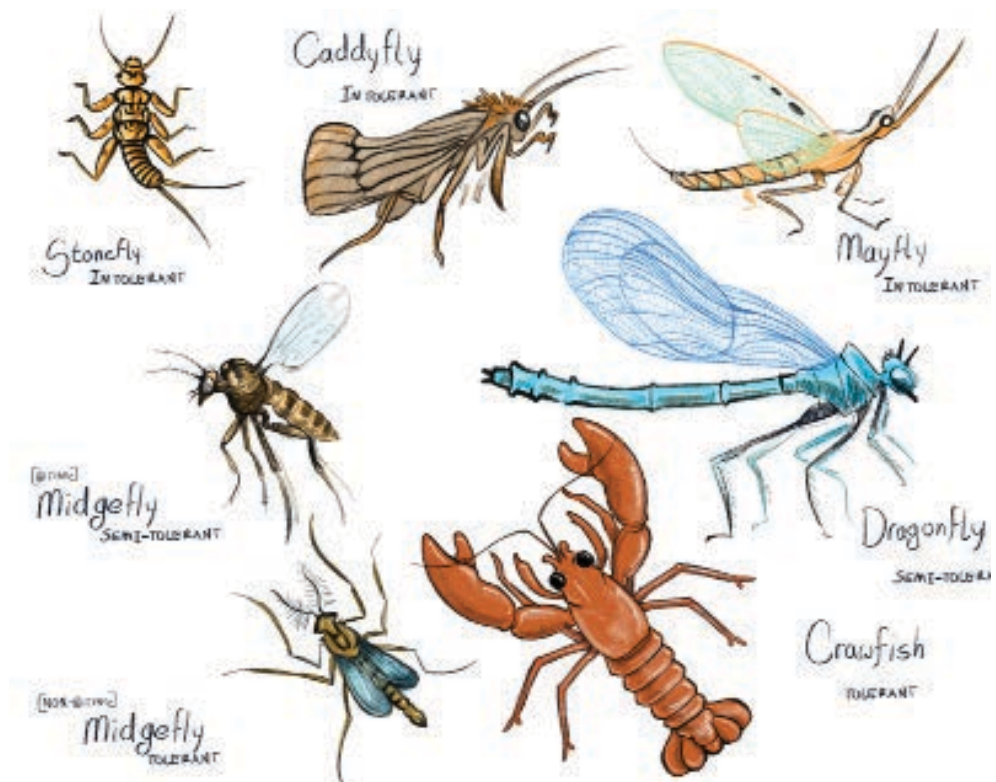


Fig. 3 “Author created” Macroinvertebrate populations have different tolerance levels to polluted water. The diversity of macroinvertebrates reveal to scientists a lot about waterbody health. Too many tolerant macroinvertebrates suggests water that is too polluted for more sensitive species, indicating an unbalanced ecosystem.

campus and surrounding city. Ideally, even non-native species can find their home along the banks of the creek, so long as they do not overwhelm their locally native neighbors. This equilibrium is not too far away, as long-term projects like U.C. Berkeley's 2021 LRDP, or Long Range Development Plan, 7 serves as a framework for sustainable campus development. Projects like LRDP outline long-term development strategies to ensure balanced stewardship of campus scenery, urban development, and ecosystem health, with the main priority being to preserve and heal the beloved Strawberry Creek.

ACKNOWLEDGEMENTS

I would like to sincerely thank Eytan Stanton Landscape Architecture Professional, river restorationist and Cal alumni for taking the time to peer review and provide this article with invaluable comments and feedback.

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