



**Geep** GLOBAL ENVIRONMENTAL EDUCATION PARTNERSHIP

*Sharing ideas to create a more just and sustainable future through the power of environmental education*

## CASE STUDY

# Students and Teachers Restoring A Watershed (STRAW)

San Francisco Bay, California, USA

### CONTRIBUTORS

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GEEP is a partnership of the U.S. Environmental Protection Agency, the Environmental Protection Administration of Taiwan, and the North American Association for Environmental Education.



## Students and Teachers Restoring A Watershed (STRAW)



GOALS KEY

[United Nations Sustainable Development Goals](#)  
addressed

### Overview

The [Students and Teachers Restoring A Watershed \(STRAW\) Program of Point Blue Conservation Science](#) is a collaborative network of K-12 students and teachers leading their communities to restore their local ecosystems.

In addition to providing all the benefits of any professional-quality habitat restoration, STRAW has the added benefit of bringing in community ownership and integrated science education. STRAW has decades of proven success providing in-class lessons and field studies for students, as well as professional development for teachers that brings greater understanding, meaning, and commitment to habitat restoration work. Today STRAW is addressing climate change through innovative restoration practices that students implement through cutting-edge restorations proven to increase ecosystem health and resilience.

#### This case study illustrates how:

- K-12 students can engage meaningfully in professional-quality ecosystem restoration work in their communities
- Teachers can be effectively supported and encouraged to integrate watershed studies into their curricula
- Partnerships across diverse groups of stakeholders including students, teachers, ranchers, scientists became central to the program's success



Photo: ©STRAW



## Background

STRAW builds upon the work of the award-winning Shrimp Club, founded in 1992 by Laurette Rogers' 4th grade class. The Shrimp Club publicized the plight of the endangered California freshwater shrimp and pioneered methods by which students could participate in the professional restoration of creek corridors, guided by restoration scientists. By 1998, local ranchers saw multiple benefits to the land, and the community wanted to expand this work. The Shrimp Project became STRAW, a project of two nonprofit organizations: [The Bay Institute](#) and the [Center for Ecoliteracy](#). The STRAW program then began to seek more grants and donations so it could partner with more ranchers and teachers, hosting community events and professional development.

STRAW is now managed by Point Blue Conservation Science, an organization that advances nature's health through science, restoration, outreach, and partnerships. Point Blue's highest priority is to reduce the negative impacts of accelerating changes in land-use, climate, and the ocean on wildlife and ecosystems, while fostering adaptation to the changes ahead.

Today STRAW organizes and supports an even larger network of schools, landowners, environmental organizations, restoration specialists, and community members to pursue environmental studies and restoration projects on a larger scale in local watersheds. STRAW students are immersed in a year-long study of restoration science education.

# Approach

The STRAW Program uses innovative strategies, sound scientific information, and wide-ranging partnerships to sustain a community-based education network focused on protecting and restoring critical ecosystem functions in San Francisco Bay creeks and wetlands, which greatly improve the health of the Bay. STRAW brings rigorous scientific content into the classroom and provides hands-on restoration activities for students that provide critical thinking and problem solving skills. One of the greatest strengths of STRAW is that the project is about “real work.” Students and teachers, along with STRAW partners are restoring watersheds. This singular focus brings a sense of importance to the project and the work being accomplished. STRAW participants develop commitment to their work and to each other.

Through its collaborative partnerships, STRAW links ranchers, rangers, restoration scientists, biologists, and other professionals to teachers and students resulting in about 50 habitat restoration projects implemented annually by over 3,500 K-12 students and about 150 teachers. STRAW staff maintain and monitor all restoration sites for 3 to 10 years to ensure success. In addition, STRAW provides regular professional development training for teachers and restoration science education for students, with every class receiving at least one to four lessons a year.

**Empowering Students** — STRAW emphasizes a project-based learning approach, allowing students to explore their own questions, think critically, and develop positive social skills and values. Students apply and deepen their knowledge of academic subjects such as math, science, history, and language arts as they explore creek ecology and hydrology, bird and aquatic insect studies, water quality monitoring, mapping, native plants, and nature writing. They learn that they have the power to contribute to their communities through habitat restoration. Environmental science education is delivered in coordination with other school science curriculum, the [Next Generation Science Standards \(NGSS\)](#), and Common Core curriculum through multiple sessions throughout the year. The program also introduces students to science careers by connecting them with scientists, restorationists, and other conservation partners during field trips.

**Supporting Teachers** — STRAW provides teacher training, mentoring, and in-class support for teachers at no cost, so that they can integrate watershed studies across their curricula throughout the school year. For the past 18 years, an annual teacher training called Watershed Week engages teachers in deeper learning on a theme related to climate-adapted restoration. It is a three-day experience in August designed to expose 65-100 participants to cutting-edge watershed science and watershed issues, with time to learn from each other. In addition, two other evening training events are offered throughout the year, building on an annual theme. Partners serve as faculty, collaborating in the design and facilitation of the training opportunities.

**Restoring the Environment** — Each year, over 3,000 K-12 students do 45-50 professional-quality restoration projects designed to withstand future impacts of climate change (climate-smart restoration). Restoration activities can include planting a diverse suite of native species chosen to survive in future climates and to provide food and cover for wildlife. Students also remove invasive non-native plant species and building biotechnical structures—mainly willow walls—that help the creek banks recover from erosion. All of these techniques help improve water quality and create new habitat for wildlife. Working with restoration professionals, students have re-created important habitat on urban and ranch sites, seeing the return of songbirds and other native species. STRAW restoration projects are designed to directly benefit at-risk species, improve in-stream conditions, aid in compliance with state regulatory water quality requirements, and improve the land’s ecological and agricultural productivity.

**Reconnecting Communities** — Watershed studies and restoration emphasize the interconnections between natural and human communities. Collaboration with partners is the backbone of STRAW. These relationships support a professional and authentic experience for our students and partners. Our partners include government agencies, agricultural organizations, businesses, and other nonprofit organizations.

**Implementing Climate Change Research Recommendations** — Working with Point Blue scientists, STRAW restoration projects have been influenced by a climate-smart restoration design process which involves gathering information about current conditions, making predictions about the future, and making decisions that maximize the likelihood that a restoration will be successful in multiple climate future scenarios. For example, STRAW students and teachers implement restoration projects that are more resilient in the face of an uncertain climate by planting a greater variety of native plants that fruit and flower at different times so that migratory species might be sustained. In this way, students and teachers can attain a climate-smart mindset that acknowledges the imminent pressures of climate change, and looks for ways to address these pressures in a restoration project.

**Creating Innovative Partnerships** — STRAW connects to agencies, businesses and nonprofit organizations to form partnerships so that resources can be pooled and participating partners' goals set for water quality, habitat connectivity, carbon sequestration, community involvement, and project resiliency can be met through collaborative work. Many long-term partners such as the [Marin Resource Conservation District](#), [Prunuske Chatham Inc.](#), the [U.S. Fish and Wildlife Service](#), and [Marin Stormwater Pollution Prevention Program](#) support a variety of watershed studies and restoration activities.



An analysis of the economic value of STRAW's work was conducted by M. Cubed, an economic consulting service, based on the restoration of 17 acres over two years in Marin, Sonoma, Napa, and Solano counties in California. The analysis identified a cost-benefit ratio of \$14.22 to \$1. That is, for every \$1 invested in the STRAW Program, \$14.22 is returned back to communities through stormwater treatment and wildlife habitat alone. This does not include benefits to education and community-building.

**Connecting People with Sustainable Agriculture** — Two important factors that STRAW addresses are the disconnection between the urban/suburban and agricultural communities, and increasing regulatory pressures for the reduction of non-point source (NPS) pollution in the watersheds in which the STRAW Project works. Strong relationships with farming families allow STRAW to help to ensure the viability of local independent agriculture.

# Evaluation Plan

**Evaluation of STRAW Restoration:** STRAW evaluates its restorations to determine short-term and long-term successes. For the short-term, STRAW measures plant survival by species and percentage of cover. STRAW also uses photo monitoring of the site to visually assess success and inform future projects through an adaptive management process. A subset of STRAW sites are monitored for changes in wildlife response over time, using birds as indicators of ecological function and overall health (see Tracking Ecological Progress, below).

## TRACKING ECOLOGICAL PROGRESS USING BIRDS AS INDICATORS



Photo: Rick Clark

Birds respond quickly to changes in their environment, which include enhancement projects like habitat restoration. Monitoring bird diversity and abundance quickly and effectively helps to evaluate the long-term effectiveness of STRAW projects.

The total number of birds detected at STRAW restoration sites can be compared with the following averages over a subset of STRAW projects at various ages of maturity.

- 0-6 species detected in poorly vegetated or recently restored (1-2 years) sites
- Up to 38 species in the well-vegetated or oldest sites (10+ years).

With proper management and maintenance of restoration sites, the diversity of bird species increases over time as seen in the composite graph above, which shows data collected by Point Blue Conservation Science at STRAW restoration sites in 2009.

**Evaluation of STRAW Education:** STRAW continues to develop and refine its curricula, depending on teacher and partner feedback, as well as information from various assessments. Each year STRAW assesses the educational value of its programs through some of the following methods:

### **Assessing student learning:**

- Pre and post oral or written assessments during pre-restoration presentations
- Pre and post oral or written assessments during restoration days
- Oral responses to questions at restorations
- STRAW Multi Visit Program (MVP) students complete a “share project” to represent their personal connection to the restoration and share their learning with their communities

### **Assessing teacher learning:**

- Watershed Week surveys
- End and beginning of school year surveys
- Occasional meetings with STRAW teachers individually or in small school groups

Over time, STRAW has undergone several comprehensive program evaluations. Most recently, to ensure the success of its education practices, the STRAW Program piloted a quantitative evaluation to measure student learning as a result of participation in the STRAW Program. During the first year of piloting the evaluation, preliminary results suggested that STRAW education programs resulted in a significant positive increase in student knowledge, behaviors, and attitudes relative to ecological health.

## Outcomes

Key outcomes over the 25 years of the STRAW program have included:

### *For ecosystems:*

- **Sequestration of an estimated 47 metric tons of carbon every year** for each kilometer of riparian habitat restored through STRAW, equivalent to offsetting the greenhouse gas emissions of 36 cars every year.
- **Reduction in nutrient run-off and water quality impairments** such as excessive sedimentation, leading to compliance with state regulations.

### *For participants:*

- **Changes in social behaviors and attitudes** among students, teachers, ranchers, and other community members, leading to stronger connections to and care for local ecosystems.
- **Participation by nearly 46,000 students in over 550 restorations** on rural and urban creeks and wetlands, planting over 45,000 native plants and restoring approximately 33 miles of habitat.
- **Stronger connections between K-12 students, the natural world, and agriculture**, so they can see their direct role in supporting nature conservation and sustainable farming.
- **Recognition among students that they can do professional-quality work**, and make important contributions to their communities.
- **Motivation for some participants to seek environmental protection college degrees or work in the environmental sciences.** Several students have come back to STRAW to continue doing community restorations as young adult interns.
- **Participation by over 700 teachers**, who have received ongoing support and training that enables them to create a yearlong context of watershed education.
- **Support for teachers to stay in teaching by “making environmental education easy.”** Teachers appreciate the connection and inspiration that the STRAW Teacher Network brings them, giving strength and support to the environmental work that inspires them and helps them meet the Next Generation Science Standards (NGSS).



Photo: © Don DeBold.

# Lessons Learned

Key lessons learned over more than 25 years of the STRAW program include:

- **The public wants to help protect the environment.** Many people are eager to participate and to help nature. Once the program began, a wide variety of stakeholders came forward to help implement the program.
- **Restoration of small tributaries is an effective way to restore a watershed.** The beneficial cumulative effects of successive, connected restoration projects within watersheds in terms of water quality improvement and habitat connectivity is well documented. Engaging multiple stakeholders in these projects has allowed STRAW to work on all property types, from private ranches to national parks, resulting in long-lasting and comprehensive positive impacts to the landscape.
- **The STRAW program engages student intellect and emotions.** The STRAW program brings learning alive for students and creates enthusiastic engagement and long-term knowledge retention. Students are learning to be leaders by leading their communities in cutting-edge restorations.
- **Students want to contribute to their community.** Students of all ages can do professional-quality restoration work and can be contributing citizens in their communities. They discover the gratification of seeing themselves as competent individuals working collaboratively to help their community and ecosystem.
- **Program participation helps teachers expand their knowledge and skill sets.** Participating in the STRAW program provides teachers with opportunities to gain insight into different learning styles, how students work in teams, and how they learn and behave outside of the classroom.
- **Developing partnerships and relationships are fundamental to success.** Relationships, including with children, teachers, ranchers, scientists, and others, are essential to the success of STRAW. These relationships are the heart of the program. Equally important are the partnerships developed to implement the program. Shared ownership means that STRAW is dynamic: always adapting to current needs and circumstances.
- **Building community is a valuable goal.** When community members work together, things become more human and humane as they begin to interrelate and understand differing perspectives. The restoration is a hub to gather around: a place to work together, get to know each other, appreciate each other.
- **The STRAW Program is a model replicable program.** STRAW has designed a Toolkit to help others begin their own restoration projects. STRAW is also preparing a guide and training with the goal of inspiring, mentoring, and connecting with other STRAW-like projects.



# Resources

## **For more information:**

- Students and Teachers Restoring a Watershed (STRAW) website: <http://www.pointblue.org/our-science-and-services/conservation-science/conservation-training/straw-program>
- A Simple Question documentary: <http://www.pointblue.org/our-science-and-services/conservation-science/conservation-training/straw-program#asq>

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