

## **Howard Hughes Medical Institute Precollege Science Education Initiative Teaming with Life: Kids and Teachers Exploring and Restoring San Francisco's Natural Areas**

### **Program Overview**

The California Academy of Sciences in San Francisco proposes a four-year informal conservation science program for 400 middle school students and their teachers. Teaming with Life: Kids and Teachers Exploring and Restoring San Francisco's Natural Areas is characterized by its focus on biodiversity and the sciences that support effective conservation, its basis in authentic scientific inquiry, and its use of ongoing, neighborhood restoration projects.

The Academy will partner with six middle school classes from schools serving San Francisco's African-American, Latino and Chinese communities. The Academy will work closely with the San Francisco Unified School District (SFUSD) to identify and recruit teachers and students from schools with a significantly higher-than-average number of free lunch recipients and students from backgrounds under-represented among science professionals.

The City and County of San Francisco's Recreation and Parks Department Natural Areas Program (SFR&P NAP) will provide natural areas targeted for restoration within close proximity to our partner schools. They will advise in training and direct restoration activities.

At each site, students will examine the existing biological diversity and design and implement a long-term field study to monitor the incidence of native and introduced plant species and other ecologically-linked species. Based on their observations, participants will propose a restoration strategy to the SFR&P NAP. The plan, after any revisions on the advice of the Academy and SFR&P, will be implemented by the students as a project of the NAP.

Throughout this process, the Academy will provide field and in-class instruction for students and teachers to help them understand the concepts of biodiversity, ecology, and the impacts of introduced species. They will be trained in the methodology of scientific inquiry, principles of experimental design, adoption and use of study protocols, data management and interpretation, research of restoration strategies, practical techniques of ecological restoration, and public presentation.

The Academy will provide extensive professional development opportunities for the teachers. Training for teachers will focus on how to integrate field studies with classwork and how field studies correlate with national, state, and local science standards and frameworks.

### **Program Goals and Objectives**

Through Teaming with Life, the Academy's over-arching goal is to facilitate an understanding of and inspire an appreciation for biodiversity and the science that supports its conservation. As a prominent research and public education institution, the Academy can offer outstanding content and methodology expertise and rich material resources to help students and teachers make that fundamental connection between nature, science and environmental stewardship.

Programming based in authentic field research methodology is pivotal to this project. The Academy will:

- Develop age-appropriate identification and classification training materials and activities on botany, ecological relationships among plants and other taxa, biodiversity, conservation science, the scientific method, field study, and data analysis;
- Partner with schools to reach participants from backgrounds under-represented in science professions including girls, ethnic minorities, and students from low-income families;
- Guide the development and implementation of a long-term ecological monitoring study conducted by middle school students;
- Partner with the SFR&P Natural Areas Program to address sites in students' neighborhoods and coordinate and implement restoration activities that arise out of student findings;
- Train and employ the Academy's high school and undergraduate interns – recruited from the same neighborhoods as Teaming with Life participants – as program assistants and mentors;
- Develop and offer year-long training in content, field study methodology and project-based pedagogy to participating teachers;
- Offer teachers the experience and resources to integrate field work with class work, so that they are able, ultimately, to independently use field studies as a pedagogical strategy; and

- Examine our efforts to determine if they have impacted students' and teachers' cognitive abilities and all participants' affective gains, and whether a combination of informal field studies and formal classwork can be effectively used to teach about biodiversity.

## Projected Outcomes

All of the Academy's educational programs work to strengthen our community's science literacy, stewardship ethic, and interest in science teaching and research career paths, especially among those historically under-represented among science professionals. Teaming with Life's impact will be evident if we successfully:

- Equip middle school students with the ability to effectively pose questions, collect and interpret data, draw conclusions, and develop and implement an action plan;
- Help teachers build their science literacy and diversify their pedagogical strategies;
- Equip teachers with the knowledge, skills and desire to incorporate field studies with classroom science on an ongoing basis, independent of Academy involvement;
- Invest participants with or strengthen an environmental stewardship ethic;
- Create links, such as recruitment, between middle school student participants and other Academy "career ladder" programs, including science teaching and research internships for high school students;
- Provide San Francisco with an informed population of people prepared to help restore the city's natural areas; and
- Build the Academy's understanding of the efficacy of field studies and restoration activities in teaching about biodiversity and conservation.

## The Need for Programs Like Teaming with Life

The global loss of biodiversity (the variety of genetic material within species, the variety of species in all taxonomic groups, and the variety of ecosystems within which species evolve and coexist<sup>1</sup>) has been well established. We are approaching an unprecedented extinction crisis – biologist E.O. Wilson estimates that 27,000 species vanish each year<sup>2</sup> – almost exclusively driven by human activity. Population growth, the over-exploitation of resources (principally in developed countries with high consumption rates like the United States), and environmental degradation are driving into oblivion both our life support system and the intangible but invaluable benefit of the rich diversity of life around us.

While Americans may seem to be developing an environmental ethic, our understanding and concern is limited and erodes when competing considerations, such as economic growth and convenience, come into play. Educating the next generation and engendering a stewardship ethic in children is often touted as the key to changing our ways. A 1993 survey of 2,081 U.S. middle school science and social science teachers revealed that the majority of the teachers agreed that environmental education, specifically centered on biodiversity, "should be established as a priority in their given institutions."<sup>3</sup>

However, findings also showed that the majority of respondents felt unprepared to accomplish this alone. Educators "feel they lack the necessary training, time, and resources to educate middle school students effectively on issues related to biodiversity." A Review of Research on Project-based Learning noted that, "most teachers will find aspects of [project-based learning] planning, management, or assessment fairly challenging and will benefit from a supportive context for [program] administration."<sup>4</sup>

The Academy's own evaluation of its professional development programs for teachers reveal that educators are often intimidated by their own naturalist-instructors, who "seem to know everything." Teachers have felt that limits in their knowledge of every taxa and ecosystem disqualify them from taking advantage of the "teachable moments" that field studies uniquely provide. Logistically, field work is difficult to integrate into classroom studies. Furthermore, teachers, educated in the classroom themselves, have a bias toward classroom-based teaching. Clearly, natural history museums can make a significant impact by contributing their informal education skills, specifically field research experience and resources to formal science education.

<sup>1</sup> Biodiversity, Science, and the Human Prospect, 1997, Center for Biodiversity and Conservation American Museum of Natural History, p. 2.

<sup>2</sup> *Diversity of Life*, E.O. Wilson, 1992, New York, New York, Norton & Co., p. 280.

<sup>3</sup> *Windows on the Wild: Results of a National Biodiversity Education Survey*, 1994, World Wildlife Fund, pps. 2-4.

<sup>4</sup> *A Review of Research on Project-based Learning*, 2000, J.W. Thomas, Autodesk Foundation, p. 34.