Natural Wonders

Implementing Environmental Programming in Libraries

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Children explore the "Skulls Tell It All" mystery box with Naturalist Center Staff.

The Naturalist Center is the public library and resource center of the California Academy of Sciences. Visitors come to find out more about the natural world, either on their own or with the help of our staff. This article describes some of the programming offered to help children engage with and increase their appreciation of the natural world, as well as their science literacy. It also describes ways in which these programs could be implemented in public and school libraries.

Environmental programming is crucial to giving children the knowledge and tools they need to work for change and to help them put into practice some of what they are learning. In addition, libraries can help fill the gap in science education that has emerged since the implementation of No Child Left Behind. Many of the environmental problems we face are complex and can appear onerous. With many scattered, small actions, however, we can achieve a more sustainable future.

A giant *Tyrannosaurus rex* greets you as you walk in the door of the California Academy of Sciences, a natural history museum, planetarium, and aquarium all under one living roof. You then make your way to the heights of a rainforest canopy, taking in the sights, sounds, and smells that surround you. Later, you dive into the depths of a Philippine coral reef filled with brilliantly colored fish and an array of uniquely shaped corals. A safari through Africa, including a peek at some playful penguins, is the next part of your visit. Then, you decide to go even farther afield taking a journey to the stars. After all of this stimulation and excitement you come to a quieter, but no less engaging, spot—the Naturalist Center.

The Naturalist Center is somewhat of an anomaly for most museums. It is a library on the public floor, geared toward naturalists, teachers, and children. Often museum libraries are located in the administrative areas of the museum and can only be accessed by appointment for outside researchers. Their collections tend to include more scholarly or technical publications and archival materials, and they serve researchers, curators, scientists, and college-level students from the institution or elsewhere.

The California Academy of Sciences has just such a library, with a collection that focuses on natural sciences. In addition, however, we have the Naturalist Center, a sort of branch library to our main Academy library and liaison for the general public to it. Our collection focuses on the same areas as the main library,

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Citizen scientists collect data on the number and types of plants growing on the Academy's Living Roof.

but with a different user focus. In addition, we have expanded our collection on sustainability and green architecture coinciding with the opening of our new LEED Platinum–certified building.

Not only do we have a library of books and media, but we also have a library of natural history specimens, which represent the different research departments at our institution. Many people do not realize that the Academy has scientists on staff doing research, so we act as a liaison between our researchers and the public as well.

The mission of the Naturalist Center is to promote lifelong learning by creating a welcoming environment that offers individualized, in-depth inquiry about the natural world and inspires people to play a role in sustaining life on Earth. We serve as a space where people can go to learn more about an animal they saw in our aquarium or delve deeper into an issue that was briefly presented in one of our exhibits. We can help people identify that unusual bird they saw or a dazzling rock they found. We are also a lending library for Academy members, staff, volunteers, and California teachers.

In addition to traditional library services, the Naturalist Center offers a variety of programs, many of which seek to engage children, foster their appreciation of and desire to protect the natural world, and increase their scientific literacy. Although a library within a science museum possesses innate qualities and resources to undertake scientific activities, many of these programs could be implemented at public or school libraries as well. Indeed, given the realities of science education in the United States and the many environmental problems the nation faces, the need for science programming becomes even more imperative. Hopefully, the programs described here will inspire other librarians to incorporate activities about the natural world and sustainability at their libraries.

Environmental Programming in a Library?

Before describing our programs, we would like to discuss briefly why librarians might consider incorporating environmental education into library programs. Today we face myriad environmental problems both locally and globally, including global warming, deforestation, desertification, and the pollution of air and waterways. People have turned to environmental education as a means to deal with these many problems, in particular targeting programs at children.

With the evolution of environmental education, however, it became apparent that teaching people about environmental issues was not enough, in most cases, to lead to changes in behavior or to impel people to take action. Often teaching children about the environment led to gloom-and-doom scenarios, leaving children feeling powerless to change anything. Therefore, various authors have stressed that people also need to learn the skills and values necessary to act.[1] Children need to be given opportunities to see how they can work for change and actually have the experience of implementing some of what they are learning. This led to educators stressing the need for a more action-oriented environmental education.[2] Certain types of library programming, such as our Living Roof Project described below, can adopt this approach to environmental education.

A look at the state of science education in the United States also makes the case for increasing science programming in libraries. With the implementation of the No Child Left Behind program, many elementary schools shifted their focus heavily to reading and math often to the detriment of science education.[3] Here in the San Francisco Bay Area, a 2007 study found that "80 percent of K–5th grade multiple-subject teachers who are responsible for teaching science in their classrooms reported spending sixty minutes or less per week on science, with 16 percent of teachers spending no time on science."[4]

The effects of this lack of time spent on science can be seen in California's ranking on standardized tests. The 2007 fifth grade California Standards Test showed that only 37 percent of California students scored proficient or above in science.[5] Libraries can be one venue to help fill this gap in science education. In addition, another study demonstrated that early exposure to science and encouraging an interest in it at a young age led to a higher percentage of students going into a career in science as an adult.[6] With the many environmental problems the nation faces, we need future scientists to help solve them.

Another reason for science programming in libraries is to combat what the author Richard Louv refers to as "nature-deficit disorder."[7] Our children live in an ever-increasing digitized world. Many live in urban environments and might never have swum in a lake or seen a deer in the wild. Even the wildlife that exists in urban environments might go unnoticed by today's youth.

Louv ties this distancing from nature to many childhood ills, such as obesity and depression. At a more fundamental level, however, one can argue that we cannot protect what we do not know. If we do not instill a sense of wonder and appreciation for the natural world in our children, where does that leave our environment in the future? The programs described next provide one step towards a more sustainable future.

Science Story Adventures

Most libraries have storytimes, and the Naturalist Center is no different. However, in keeping with our mission, our storytimes are themed around the natural sciences and focus on active learning. Although we initially called the program Story Time, we felt that title did not provide the true flavor of the hands-on activities that the children would get involved in, so we renamed it Science Story Adventures. These Sunday afternoon programs are targeted at younger elementary school-aged children and their families.

Each Science Story Adventure is thematically linked either to an exhibit in the Academy, such as the Rainforest, or to a larger Academy theme, such as evolution or recycling. Taking this theme, we then set some learning outcomes, usually drawn from the California Education Science Content Standards.

Once we have these, we then devise the content of the adventure. We usually have two stories, split by an activity, and finish with a craft. Finding stories to read is particularly challenging, as a book needs to be scientifically accurate and thematically linked as well as being a good read-aloud. We have some suitable books in our collection, but we often find additional books in the San Francisco Public Library collection and sometimes purchase them for future use.

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Rather than relying solely on nonfiction, we use a mixture of fiction and nonfiction books. Often introducing a scientific topic can be more fun and easier to understand in the form of a story. Stories can provide a context and characters with which children can relate making the environmental issues or concepts seem more real and pertinent to their lives.

Our activities vary week to week but always include an active element. We have touched sea otter pelts and skulls, played recycling bingo, plotted the solar system on a roll of toilet paper, experimented with water, and looked at germinating seeds through microscopes. Although libraries and schools may not have access to actual specimens, it is relatively easy to find simple science activities through the Internet.

Our crafts are linked to the day's theme and are usually very simple, as our guests need to take them at the end of their adventure. Some examples include bat paper-bag puppets, recycled holiday ornaments, climbing spiders, and frog finger puppets.

For each Science Story Adventure, we have a handout that is available on the Naturalist Center blog, "The Naturalist Notebook" (www.calacademy.org/academy/exhibits/naturalist_center/nnotebook). In addition to the details of the books, activity, and craft, this also includes the learning outcomes and a list of further resources for those who want to pursue the topic.

These are available as well for librarians who would like to use them or adapt them for their own Science Story Adventures.

Mystery Boxes

Does chocolate really come from that odd-looking fruit? What can an animal skull's teeth tell me about what they ate? What is the difference between hard and soft corals? Each of these questions can be answered by delving into one of our Mystery Boxes.

We have several of these fun-filled activity boxes on tables in the Naturalist Center. Each box is centered on a different theme—such as chocolate, animal skulls, corals, tide pools, butterflies, human evolution, and seeds. In each box are natural history specimens, scientific models, photographs, books, and other objects, as well as cards that contain more information about the items and self-guided activities to do while exploring them.

For example, one activity might have you match photos of living corals with their skeletons found in the box, or you might put on a pair of special glasses to see the world like a prey animal does. The boxes are completely self-contained, and visitors can go through them on their own; however, our staff sometimes enriches the experience by going through the box with a child or pointing out something unique about the specimen that he or she might not notice right away.

Creating your own Mystery Boxes in a public or school library would not be difficult. Several online stores sell natural history educational materials and scientific models such as Acorn Naturalists (www.acornnaturalists.com), Carolina Biological Supply (www.carolina.com), and Bone Clones (www.boneclones.com). You might even be able to find some of the contents on your own, such as seeds for a botany box. These simple boxes develop both science and literacy skills in a fun and engaging manner.

Explore Golden Gate Park with Naturalists

The Academy has the good fortune of being situated within Golden Gate Park, so for Earth Day last year and throughout the summer, we developed programs that took us outside of the museum and into the park. We offered two programs, Water Wonders at Stow Lake and Wild Woodlands. Each program lasted three hours with a limit of thirty participants, and anyone seven years or older could attend. Many family groups came, which was a nice way for parents and children to learn together. The programs were interactive and hands-on, not a traditional walk with a guide doing much of the talking.

In Water Wonders at Stow Lake, we explored aquatic ecosystems at a nearby man-made lake. We began with an activity that demonstrated how little fresh water is actually available for human consumption using our participants as human percentages. After this, we divided into two smaller groups. One group learned some birding basics and then did some bird watching around the lake. San Francisco is actually a birdwatcher's paradise, with nearly four hundred recorded species. The other half of the group did some plankton trawls on the lake and looked more closely under microscopes at some of the smallest organisms of a lake ecosystem.

Using senses other than sight to examine a tree during a Wild Woodlands program.

For Wild Woodlands, we went to an oak woodland area in Golden Gate Park. Oak woodlands were one of the most predominant ecosystems in Northern California, and many of the oaks in this area are some of the oldest ones in San Francisco. We began this program by talking about the importance of oak woodlands in California and the many different layers of a forest. We also explored the importance of trees in preventing soil erosion by playing a game where participants got to be trees and soil particles. We then learned about native versus invasive plants and looked at some examples of both in the park. Finally, we did a series of activities to hone our observation skills and learn more about tree identification and the different parts of a tree.

In both programs, we always ended with a "web of life" activity where all of the participants formed a circle. Each person said one thing he or she learned or liked the best about the program before throwing a ball of yarn (while holding on to a piece of it) to someone else in the group. This continued until everyone had a chance to share, and we had formed a web. We noted that the web represented the importance of all of us in maintain-

ing a balance in the environment. What we had learned would make us stronger in keeping this web together, and if one of us were to drop out or not do our part, the web would be broken.

Programs similar to these could be replicated at parks or nature reserves close to other libraries. Even urban libraries could develop programs that look at how animals and plants adapt to urban environments. Raccoons, crows, and peregrine falcons are just some of the many animals that have quickly learned how to take advantage of the new conditions created in cities.

Partnering with university students, Audubon Society groups or other nature groups can also be a great way to develop workshops like these. Several of the participants in our programs were families that homeschool their children; programs like this can also be a great way to serve this population in your community.

Citizen Science Programs

Citizen science programs involve the general public in collecting data that are used in scientific research. They often allow scientists to carry out experiments that might not otherwise be feasible due to logistical and time constraints. In the Naturalist Center, we act as a liaison for two citizen science projects—the Bay Area Ant Survey and the Bay Area's Most Wanted Spider. In addition, we oversee a third citizen science project, the Living Roof Project, which will be discussed in more detail in the next section.

The Bay Area Ant Survey and the Bay Area's Most Wanted Spider both track the spread of invasive species in the Bay Area. The first one was started to survey what species of ants are actually found in the Bay Area, as well as to look at the spread of the invasive Argentine ant. Visitors can pick up an ant collecting kit from the Naturalist Center. They collect ants, fill out a data sheet about them, and send it back to the Academy. Our entomologists then identify the ants and add the names to a database of the distribution and population of all ants in the Bay Area. If visitors want to, they can also bring their ants to us in person, and we can work on identifying them together. Distribution maps of ants collected so far in this project can be seen on our website (www.calacademy.org/science/citizen_science/images/map_ants_all.gif). To date, more than eight hundred citizen scientists have participated in this program.

The Bay Area's Most Wanted Spider looks at the distribution and spread of the invasive spider *Zoropsis spinimana*. The spider, native to the Mediterranean coastal countries and northern Africa, somehow migrated to Northern California, probably by hiding inside someone's suitcase or inside shipments. Although harmless to humans, this spider is considered invasive, as it competes with local species. With the help of citizen scientists, we can study how the *Zoropsis* spider population is spreading in the Bay Area. Visitors can pick up a data sheet from the Naturalist Center and either send us photos of spiders or actual specimens for our Academy entomologists to identify. This is a more recent project, so we do not yet have distribution maps, but we hope to soon.

Some of the natural history specimen collection in the Naturalist Center.

Many citizen science projects exist across the country, and libraries could easily become involved in any number of them at a range of levels. The Cornell Lab of Ornithology has created a website called Citizen Science Central (www.birds.cornell.edu/citscitoolkit). It is a clearinghouse of various citizen science projects, and it also includes a toolkit for designing new projects. You might find a project that your library patrons could hook into, or you may become inspired to start one of your own.

Living Roof Programs

Renzo Piano, the architect who designed our new building, envisioned lifting up a piece of the park and slipping a building underneath it. Out of this grew our Living Roof, which consists of 2½ acres of 1.7 million native plants. Living roofs provide myriad environmental benefits, from decreasing the amount of rainwater runoff to moderating the temperature of the building and thereby decreasing the energy needs for heating and cooling.[8] They also provide habitat for plants and animals and allow us to have a natural classroom and laboratory. Two programs we deliver are Explore the Living Roof with Naturalists and The Living Roof Project.

We offer Explore the Living Roof with Naturalists as a weekly drop-in program for all ages. On our roof observation deck we talk about the design of our living roof and the benefit of living roofs in general. We then look more closely at the plants and briefly introduce some of the terms botanists use to identify plants. This is followed by a scavenger hunt to find various plants on the roof. We also go over some basic birding techniques, and then visitors can do some bird watching using binoculars they checked out from the Naturalist Center.

Many different bird species visit our roof daily, including Brewer's blackbirds, dark-eyed juncos, red-tailed hawks, and

Anna's hummingbirds. With some groups we do activities related to honeybees and bee communication. We have four, soon to be five, honeybee hives on our roof, and many bumblebees and other native bees also visit our roof. This program usually lasts about an hour, and visitors appreciate getting the chance to learn about our roof in greater depth.

The Living Roof Project is a citizen science program. The major goals of this program include

- monitoring the plant, bird, and arthropod diversity on the Living Roof over time;
- educating the public about green roofs, native flora and fauna, and the scientific process;
- promoting community involvement in real, hands-on science at the Academy; and
- utilizing the educational/research potential the Living Roof offers.

Visitors who are twelve years old or older can participate in this project. They attend a three-hour workshop where they become acquainted with project procedures and the plants and birds that they will encounter on the roof. As part of this initial workshop, they also go to the roof to collect data on plant, bird, and arthropod diversity. Because this is part of actual Academy research projects, young participants learn about the scientific method and the correct procedures for collecting scientific data, beginning their training as possible future scientists. Once participants are trained, they can come back monthly to assist with further data collection. The data they collect will help us monitor trends on our roof over time and observe how native fauna utilize our roof. To date, we have had fifty-one visitors become Living Roof citizen scientists, and they have identified seventeen arthropod orders, twenty bird species, and thirty-five plant species on our roof.

Most libraries probably do not have a living roof, but it is possible that they have a native plant garden on their grounds. These could be used as classrooms for similar programs as those described above. You could talk about native plants in your area and how patrons could grow them at their own houses. It might also be possible to do studies on what insects, birds, and other animals frequent the gardens.

Concluding Thoughts

The programs we described align with the mission of the California Academy of Sciences—to explore, explain, and protect the natural world. This is a mission we cannot undertake on our own, though, especially given the many environmental problems we face and the current state of science education in our country. Hopefully, this article has planted some seeds for ways to incorporate environmental programs at other libraries. With each of these seeds, eventually, we will harvest the fruits of a more sustainable future.

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