Conservation Education Partnerships in Schoolyard Laboratories: a Call Back to Action

> If facts are seeds that later produce knowledge, then the emotions and the impressions of the senses are the fertile soil in which the seeds must grow.
> Rachel Carson (1965)

Finding ways to reconnect people to nature, through relevant experiences in school, work, and recreation, is a critical challenge for conservation biologists in this new century. Throughout the world, citizens and community leaders are being asked to make increasingly complex and difficult decisions related to problems of environmental degradation, development, and the use of publicly and privately managed natural resources. Effective solutions to environmental problems require the active participation of scientifically and technologically literate citizens—people who can deal sensibly with issues that involve evidence, logical arguments, quantitative considerations, and uncertainty. The question is, what can we do, beyond the work we do behind our academic doors, to improve scientific literacy?

We can form educational partnerships with local schools in areas where conservation and research occur (Brewer 2002) and where we live. The National Science Education Standards (National Research Council 1996) underscore the potential role and responsibility of "science-rich" institutions in meeting the challenge of developing and sustaining scientifically literate citizens. Many readers of *Conservation Biology* are affiliated with science-rich institutions, and we can bring the expertise and resources of our institutions of higher education, government, research, national and state parks, museums, zoos, botanical gardens, and nature centers to collaborations with teachers in our local schools. Many of our institutions already have partnership programs with local schools that we can join.

Why is it so important for conservation biologists to get involved in partnerships with our colleagues in pre-college classrooms? Consider the following: although 70% of biologists think the world is undergoing the fastest rate of extinction of species in its history, less than 50% of science teachers believe we are in the midst of a mass extinction, and only 38% of these teachers describe themselves as being very familiar with the concept of biodiversity (Ayres 1998). Our role as conservation biologists is greater than simply defining the term biodiversity and providing a generalized figure from a textbook that compares rates of extinction through the last 500 million years. We can take teachers and their students outside to their schoolyards, collaborate on approaches to teaching that model what conservation biologists do, and immerse ourselves (teachers, scientists, and students) in ecological investigations in the schoolyard laboratory. Through such authentic experiences, teachers and students discover what most conservation biologists have learned through their own explorations of nature: science is not only a corpus of knowledge, but also one way of knowing the world around us. And even a short outdoor learning experience can have a positive influence on the future environmental attitudes of children (Bogner 1998).

Schoolyards as Local Outdoor Laboratories

The idea to use schoolyards for science explorations is certainly not new, yet surprisingly few teachers, particularly in elementary schools, use this resource to teach about ecological principles or to conduct ecological investigations (e.g., Simmons 1998). Strangely enough, the balance of ecological and conservation instruction in many locales around the world tends to focus on exotic locations and animals. For example, I have worked with education colleagues on opposite sides of the equator in western Montana (U.S.A.) and northwestern Patagonia (Argentina), and in both places children often know more about the ecology and conservation status of tropical rainforests and African savannahs than their own temperate forests. Why don't children (and their parents) know more about the places in which they live? Backyards and schoolyards are filled with interesting, living, interacting (nonhuman) organisms: ". . .pull out the flower from its crannied retreat, shake the soil from the roots into the cupped hand, magnify it for closer examination. The black earth is alive with a riot of algae, fungi, nematodes, mites, springtails, enchytraeid worms, thousands of species of bacteria" (Wilson 1992). While rural schools may have vast wild areas at their doorsteps, even the most humble urban schoolyards have shrubs. And shrubs hide many kinds of insects for an ecology lesson. So why don't more teachers use these valuable educational resources outside

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their classroom windows, and how can we make use of partnerships to transform how teachers and students view and use their schoolyards for ecological studies? Elementary school teachers in Montana have a lot to say about the answers to these questions and about how conservation biologists can work with teachers as partners to bring ecological studies into the schoolyard.

Identifying Barriers

The reasons reported by teachers for not using their schoolyards for instructional purposes often relate to previous science training and negative preconceptions of the schoolyard as an educational resource. In surveys conducted over the past 10 years, elementary school teachers participating in ecology education institutes at the University of Montana frequently reported negative experiences in science courses and workshops which undermined their confidence in their science knowledge. Many expressed a fear of science and a general suspicion of scientists. One veteran teacher reported, "I really lack knowledge in the area of science and I feel very inadequate teaching it." Aside from the many hours they had spent sitting through science courses in large lecture halls, most of these teachers had had little previous interaction with scientists, and they tended to view science as mystical and scientists as unapproachable. Few elementary teachers had any experience "doing" science during their academic training or after they began their careers in the classroom. Furthermore, they were inclined to view the process of science as rigid—typically as the recipe presented in most textbooks, with a question that led to a fixed, well-known answer. They saw little opportunity for creativity. For example, one teacher confided that ". . .the thing that turns me off about science is the scientific method. It is so rigid. . ."

When queried about barriers to using their schoolyards as a teaching resource, teachers, students, and administrators commonly expressed the opinion that the schoolyard was a synonym for playground, a place for recreation, not formal education. Likewise, tracts of land within or adjacent to schoolyards were not identified as resources either. The general perception was that "ecology happened on field trips" (usually requiring costly transportation) to parks, nature centers, and zoos. And not surprisingly, most teachers expressed deep reservations about managing their students during outdoor lessons.

What Teachers Want from Partnerships with Scientists

Over the last 10 years, colleagues and I have asked scores of teachers, from North and South America alike, what would be required for them to incorporate outdoor explorations and investigations into their curricula. Regardless of the school or locale, the teachers we have worked with have related similar needs: (1) meaningful opportunities to learn about ecology in a relevant context, and time to plan instructional activities; (2) resources specific to their regions and schoolyards; (3) access to inexpensive instructional materials; and (4) occasional, dependable interaction with scientists during the academic year.

How can partnerships with conservation biologists be used to meet these needs? First, scientist partners can provide an ecological lens through which to view the schoolyard so that, instead of a playground and weed patch, teachers see a laboratory filled with organisms with interesting adaptations and interactions, dynamic populations, gradients and microhabitats, patterns of disturbance and successional change. Furthermore, we can relate the types of questions conservation biologists ask and our approaches to scientific investigation. After working with an ecologist partner to utilize her schoolyard as an instructional resource, one elementary school teacher said the following: "I am learning as I'm going along doing ecological investigations with my students. I've never been a science person, but it has become more fun for me. I don't have to know all the answers. I can ask questions just like the kids in my class. Science is a process, not just knowledge. I realize I don't have to be a scientist to provide an atmosphere for great science inquiry." With few exceptions, teachers I have worked with report that having the opportunity to ask and explore ecological questions with ecologists was the most valuable training for using their schoolyards as ecological laboratories. So, most important, we can provide opportunities for teachers to participate in scientific field investigations through venues such as our own research studies or by participating in or leading local workshops on the ecology of schoolyards (see, for example, North Carolina Museum of Life and Science 1990*a*, 1990*b*; Feinsinger et al. 1997; National Research Council 1997; Caton et al. 2000).

Teachers also want to know the names and general natural-history traits of common organisms in their schoolyards. With our graduate and undergraduate students, we can develop general field guides to the common plants and animals at our neighborhood schools (e.g., Feinsinger & Minno 1990; D'Avanzo 1996) and provide ideas for ecological investigations. We can also supply additional resources and support as well. For example, few primary school teachers will turn down offers of used field supplies (e.g., meter tapes, quadrat frames, sweep nets, compasses, wind sensors, thermometers, voucher specimens of plants and insects, animal study skins). Furthermore, we can arrange for undergraduate and graduate students alike to work in local schools with teach-

ers as "naturalist" interns and volunteers. We may also be needed to educate school administrators and groundskeepers about the ecological and educational value of a weed patch placed somewhere on school grounds (Uhl 1998).

Institutional Rewards Systems: Barriers to Participation by Scientists

Why aren't more scientists actively involved in educational partnerships with local schools? There is no mystery here: we measure and reward what we value. At the top of the list of what is most valued by our colleagues, departments, and institutions during promotion and tenure reviews is the number of publications and amount of research funding (and overhead) generated. Participation in the education of children through partnership or other programs is rarely valued or rewarded in our institutions, and may actually jeopardize career advancement. Consequently, Metzgar et al. (1994) have lamented that "as played out in reality, the high value of research productivity limits our ability to engage in service or optimum teaching." But we cannot wait another generation for the system to change. It is time to change the system that devalues accomplishments other than "research productivity" and to overcome the institutional barriers that limit our participation in promoting ecological literacy. We can start by insisting that criteria for career advancement include recognition for service in precollege science education. And we can vote on tenure and promotion decisions in a way that values and rewards these activities. After all, the rewards system starts with us.

We have a responsibility to be advocates and activists for ecological literacy and to collaborate with our teaching colleagues to ensure that children understand something about the ecological systems around them. To do this we must promote (and model in our own courses) teaching practices focused on "learning by doing" in outdoor laboratories, and work with teachers and their students to develop scientific ways of thinking. By getting involved in the ecological education of young children, we foster learning that provides a strong sense of place and connection to local environments. We develop this sense by promoting understanding of ecological processes and relationships and by taking personal responsibility for conservation in our backyards and schoolyards, as well as in the exotic locations we see in nature programs.

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