Outreach and Partnership Programs for Conservation Education Where Endangered Species Conservation and Research Occur

In almost any region of the world facing conservation issues, a key challenge is to capture the imagination and interest of local people in a way that stimulates cooperation and conservation action. As conservation biologists, how can we cultivate ecological and conservation literacy in communities adjacent to threatened and endangered species and their habitats? How can we bring local people into the conservation fold and keep them involved? As a first step in answering these questions, scientists have been encouraged during the last 5 years by the efforts of funding organizations, governments, and policymakers to forge "outreach and research partnerships" with local communities through school and informal citizen science programs, particularly where long-term monitoring programs are planned or underway.

Outreach and partnership programs typically focus on taking scientific information out of the ivory tower and onto the streets, but the scope of the programs can differ markedly. Outreach programs tend to connect scientists with an audience in a fairly unidirectional way: scientific knowledge is transmitted through venues such as seminars, discussions, or workshops. By comparison, partnerships represent multidirectional sharing of information and perspectives. By definition (McKechnie 1976), a partnership gives participants a more-or-less equivalent share or stake in something with others; everyone makes contributions and shares in decision-making, risks, and benefits.

Effective outreach and partnership programs would (1) increase the knowledge base of participants and their ability to use scientific approaches to understanding conservation issues; (2) collect long-term ecological data by capturing the interest and enlisting the assistance of local communities in general and students and their teachers in particular; and (3) facilitate opportunities for constructive dialog between scientific researchers and communities located within or adjacent to ecosystems being studied, which builds a more fruitful foundation for the development of environmental policies and conservation plans.

Philosophically, there are compelling reasons for conservation biologists to work more closely with residents of local communities. Through field-based research outreach and partnership programs, participants learn firsthand what scientists do, how they do it, and why they do it. Furthermore, by working with local communities, scientists can learn how local residents relate to the threatened species and habitats they study. Well-designed programs can foster understanding of the ecology of local ecosystems and encourage participants to become more engaged in conservation efforts close to home.

Establishing Research Outreach and Partnership Collaborations

For most of us who finished our formal scientific training in the last century, instruction on developing outreach and partnership programs for precollege students or lay audiences was not typically a part of the graduate science curriculum (although such training may have been available through other disciplines in the humanities). Based on my own experiences and some of those reported in the literature (e.g., Feinsinger et al. 1997; Caton et al. 2000; Yaffe & Wondolleck 2000), at least five elements are common to outreach and partnership programs that successfully engage nonscientific audiences in science:

First, to develop ecological literacy, participants need to experience the wonder of science in addition to factual information (Orr 1989). Partnership and outreach programs should allow participants to be stakeholders in the research experience and outcomes of study. Participants can be encouraged and expected to ask their own questions, collect and evaluate data, and present their results to one another and their scientist partners. When participants design and implement their own studies, they develop a strong vested interest in finding answers to their questions (National Research Council 1997).

Second, collaboration with teachers is critical because they support their students throughout the outreach or research partnership program and provide valuable assistance in preparing students for the program. Furthermore, teachers ultimately determine the extent to which their students will continue program activities after the

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grant has expired and research teams have moved on to new studies.

Third, scientists need guidance on how to make the experience successful for the participants and themselves. For example, biologists working with students for the first time may have limited knowledge of how to account for the different ways students learn. Moreover, the maturity level and attention span of students are important considerations because students can get bored and lose interest after hours or days of watching or doing the same (tedious) research protocol. Given the lack of experience many of us have teaching outside higher-education settings, another key element of many successful programs is collaboration with a colleague (a scientist-educator) who is skilled at translating information across knowledge levels and disciplines. Fortunately, more and more graduate students in conservation biology today are seeking formal training and postdoctoral experience in education. Their new teaching skills are becoming increasingly valuable in bridging the gap between researchers and the public.

Fourth, training of participants is vital to the success of outreach and partnership programs. Careful attention to the methods of data collection is essential. Data must be accurate for the study to be useful in informing decision-makers about important species, interactions, and ecosystem processes as conservation strategies are developed.

Finally, successful programs incorporate some form of program assessment. This is particularly essential in the early stages of a program when curricula and approaches are being implemented for the first time.

A Case Study

From a practical viewpoint, what does an outreach or partnership program look like at a field site? How are students integrated into fieldwork, and can they collect useful data? Some answers to these questions come from a program designed to involve local students in sea-turtle monitoring in Costa Rica, the Sea Turtle Education Program (STEP; Pankratz 2000). Two objectives of STEP address some of the goals of successful programs described previously: (1) to increase appreciation and understanding of the ecology and conservation of endangered leatherback sea turtles and lowland rainforest ecosystems, thereby fostering awareness in the local community of their role in the conservation of the ecosystems and the species that live in them; and (2) to facilitate collaboration between Costa Rican students, teachers, and researchers for long-term monitoring of endangered leatherback sea turtles. Scott Pankratz of the University of Montana worked with scientists and staff at the Pacuare Nature Reserve on the Caribbean coast of Costa Rica. The STEP curriculum targeted high school students and was designed to mirror a typical collaborative study of the conservation biology of an endangered species. Pankratz and his colleagues facilitated interactions between scientists and STEP participants. Program highlights included the following activities.

Developing background knowledge. Working in groups, participating students shared their knowledge about sea turtles. Many of the Costa Rican students had seen turtle eggs for sale on the street, others had seen television programs about sea turtles, and a few had seen live sea turtles nesting. Students compiled what they already knew to begin their studies of turtles. Then they were introduced to concepts related to sea-turtle range, habitat, life cycle, and nesting ecology, and to a scientific approach to investigating sea-turtle ecology. Finally, they were acquainted with the population of sea turtles nesting at the Pacuare Reserve.

Developing miniprojects through collaborative research teams. Student teams met with research mentors to formulate a research question of interest to them, set in a comparative framework and answerable in the time available (e.g., Feinsinger et al. 1997). With questions in hand, and with the help of scientists and teachers, teams devised miniprojects to complement monitoring activities underway at the reserve, and learned and practiced data-collection techniques.

Combing the beach for leatherback sea turtles. Armed with measuring tapes, stopwatches, tagging pliers, sea-turtle tags, scales, and meter sticks, student teams patrolled the beach for nesting turtles. Teams perfected data-collection techniques and teamwork and communication skills on the first turtle they encountered. As they gained experience, teams were given more responsibility by their research mentor for collecting the core long-term monitoring data for each turtle located (i.e., date and time of capture, tag numbers, length and width of turtle carapace, number of fertile and infertile eggs).

Participating in daily research-team meetings. Each morning, students relived their nighttime turtle research adventures, discussed the data they collected, and developed plans for improved data collection. The reality of fieldwork was captured in the following journal entry by a student researcher from San Jose (Pankratz 2000): "It was a very different experience. I think it was eye-opening for most of us because most of us came here thinking it was such a romantic thing to do. 'Oh we're going to go save the little turtles, going to get the eggs.' Once we were there to get the eggs, it wasn't as romantic as we thought."

Communicating research results. After two nights of data collection, teams reviewed their data and original hypothesis for their miniprojects. Using information from their field journals, the teams analyzed their data and prepared summary tables and figures. In a presentation to their peers, teachers, and mentor scientists, each team described its research question, hypothesis, and study methodology, and interpreted the results of their miniproject.

Measures of Program Impact

The Sea Turtle Education Program and other programs like it create a learning atmosphere conducive to developing new scientific understandings of and changing personal perspectives on species and habitats of interest to conservationists. Program-assessment data are vital for gauging a program's impact. Based on data from pre- and post-tests on sea-turtle ecology and conservation during STEP, student understanding had improved significantly ($p \leq 0.01$) by the conclusion of the program. Moreover, teachers reported that STEP had a very positive impact. For example, one high-school teacher commented that "with respect to the content, depth, and relevance [of STEP], I believe that our Ministry of Public Education needs to include this type of experience for all schools. This type of learning is very important for our country" (Pankratz 2000).

Furthermore, monitoring data collected by program participants can be highly reliable. One way data collected by program participants can be vetted is by comparison with data collected previously and/or simultaneously by scientists. For example, because the same turtle will come ashore to lay eggs every 9–10 days, the reproductive cycle of leatherback sea turtles made it possible to spot-check the accuracy of data collected by students. Students recaptured several turtles that had nested and been measured by scientists within 3 weeks of their field work at the reserve. Measurements collected by student teams on carapace length and width varied from prior measurements, on average, by only 1–2%. What's more, student teams collected 60% more core monitoring data during their stay than could be collected by staff at the reserve during a similar time period.

Through outreach and partnership programs, scientists and residents from local communities can look at species familiar to them from new and different perspectives. Thoughtfully constructed programs focused on local conservation issues help participants enjoy and engage in science learning because they can recognize the effects and context of their learning (National Research Council 1996, 1997). Moreover, long-term monitoring programs can benefit from cultivating relationships with schools in nearby communities via a steady supply of energetic research assistants and the reliable data they collect. Partnership and outreach programs can forge cultural connections because, through their shared work, local participants and scientists come to know each other and understand something about the connections each has to the ecosystem being studied.

More Insights from Field Sites

What else do we know about the effects of outreach programs and partnerships in conservation biology? What experiences beyond the visit to the field site have demonstrated the effects of such programs? Please contact me with your ideas, comments, and manuscripts on outreach and partnership programs, as well as on new educational approaches being developed and successfully demonstrated in conservation education.

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