
Connecting Science to the Community at Florida Atlantic University

Jon Moore and Stephanie Fitchett, Harriet L. Wilkes Honors College, Florida Atlantic University, Jupiter, FL

Faculty members from biology, chemistry, environmental studies, mathematics, and economics worked together to design the foundation for the science curriculum in the Harriet L. Wilkes Honors College, a new liberal arts college within Florida Atlantic University. With the support of the NSF, the college has developed a discovery-based approach to learning by introducing extended student projects in first- and second-year biology and chemistry courses; promoted interdisciplinarity by creating educational links among the sciences and between mathematics and the sciences; brought science and mathematics out of the classroom and into the community, using local ponds, lakes, forests, and greenways as science laboratories; and supported the building of partnerships between the college and the wider environmental community. At all levels of undergraduate studies, students conduct independent research projects and give oral and written presentations of their findings. Their regular experiences culminate in (required) senior thesis projects, many of which are interdisciplinary in nature. For faculty, students, and community partners, the discovery-based approach to science integrates teaching, learning, and research in a holistic form of scholarship. The portions of this project that involve connecting science and education to the larger community provide the focus for this chapter.

The Project and the College

Discovery-based science and mathematics in an environmental context

Our larger project addresses a number of current challenges, including the following important national issues in science education:

- The need for science courses, at all levels, to engage students as active investigators rather than as mere spectators or passive consumers of information
- The need to exhibit the sciences and mathematics as interconnected and mutually informing areas of human knowledge rather than as isolated fields (or “stovepipes,” as Rita Colwell [1999] aptly called them) separated by impervious disciplinary boundaries
- The need to show the connection between science and the world beyond the classroom, especially by exploring local and regional environments

As one historian noted (Sayre, 1978), educators are often skilled at communicating the content of science but not necessarily the process. In an effort to get students to understand the entire research cycle, our continuing goals are to give students hands-on field and laboratory experience in collecting and interpreting data and, at the same time, to present them with valuable opportunities to contribute to ongoing scientific investigations of their own environment. One way we have found to address many of these goals is to have students do science in the community, using the local environment as a living laboratory where, for instance, biology, chemistry, statistics, and management policy all may be fundamental aspects of a single study. Moreover, to the extent possible, we foster relationships that allow students

to have opportunities to conduct research with community partners. By working with environmental professionals, students develop a greater understanding of the way society uses science to describe the environment, evaluate the economic impact of decisions, and set policy.

The College and its Setting

The Harriet L. Wilkes Honors College of Florida Atlantic University (FAU) opened in 1999 on a new campus in Jupiter, Florida. There are currently 350 students and 40 faculty members in the college, and, at full capacity, the college expects to have roughly 500 students and 50 faculty members. The Honors College was designed to emulate the small liberal arts colleges of New England by providing small classes, close student-faculty interaction, and student research opportunities. Its interdisciplinary curriculum emphasizes environmental and international studies, areas that are especially well suited to the college's location in South Florida. Seniors are required to complete thesis projects, and theses are generally based on original research.

The college campus is part of a 2,050-acre planned development in a mixed-use community called Abacoa. In addition to the campus, Abacoa includes residential and business areas, as well as a 267-acre greenway system that provides water management and natural habitat corridors running through the community. This juxtaposition of community and green spaces provides a nearby laboratory for students studying natural habitats, as well as a common feature for communicating environmental and natural sciences to local residents. It also provides an opportunity to examine the public's perception of natural areas and wildlife.

Connecting Science to the Community in the Abacoa Greenways

The Abacoa greenways have provided a locus for exploring science in lower-division courses, for faculty research, for joint student projects, and for educational outreach to the community.

Lower-division courses

Biology professors at the Honors College take their students to the greenways to examine local flora and fauna, to discuss common South Florida ecosystems, and to illustrate the effects of greenways management. Students in Introductory

Biology examine, for instance, the difference in species diversity in disturbed and undisturbed areas of the greenways. Students in General Chemistry complete research projects as part of the laboratory component of the course, and many groups conduct their studies in the greenways. For example, students have compared ponds in the golf course to ponds in the less disturbed greenways, finding that their results reflect the use of fertilizers and copper chemicals on the golf course. More details on early projects are available from Green et al. (2004). Statistics and calculus classes use actual data sets generated from several of the environmental studies in the local habitats.

Faculty research

Professor Jon Moore has an ongoing study of a gopher tortoise population in the greenways (Figure 1). He is examining the demography, growth, and behavior of tortoises and has marked and collected data (four body measurements, weight, and age) on 127 individual tortoises since June 2001. The measurement, weight, sex, and age data have been used in statistics and precalculus classes, and Moore has given lectures on tortoises and the value of greenways to several classes, including Human Ecology, Principles of Ecology, and the Honors College Forum. He has also taken a handful of classes on field trips to his research site.

In addition to the educational impacts of the gopher tortoise study, the monitoring project provides valuable information on a protected Florida species. This population is near the southernmost end of the species range, and the physical



Figure 1. A gopher tortoise.

environment is quite different from that of North Florida, where these tortoises have been studied the most. Examination of reproductive behavior has determined that this population has a definite fall breeding season as well as a spring season. There is also possible evidence for winter breeding, which is unknown elsewhere in the species' range and may have conservation implications for this turtle.

From a management standpoint, the greenways are designed to protect native species, but do they accomplish this? The demographic studies show a significant number of young tortoises in the study site, indicating that this population is reproducing and possibly stable. Other protected species of plants (pine lily, dahoon holly) and animals (eastern diamondback rattlesnake, indigo snake, gopher frog) have been found within the greenway system as well.

Professor Jim Wetterer studies native and invasive ants associated with the tortoise burrows and has found a strong edge effect with the invasive fire ant species. Native ant species, including a number of rare species, were found in interior greenway sites, indicating that the greenways are in fact preserving at least some native organisms. Another study by Wetterer is highlighting the impact of fire ants on the nesting sea turtles along a nearby beach. Fire ants are apparently responsible for a significant mortality of hatchlings within the nests.

Student projects

Moore's gopher tortoise study has provided a springboard for senior thesis projects. Melissa Karlin's thesis, titled *Home Ranges and Movements of Gopher Tortoises*, studied demographic and sex differences in burrow fidelity and forays from the burrow. She completed her thesis in May 2002 and was immediately hired by an environmental consulting firm. In fall 2003, she returned to FAU to begin an MS degree further examining the ecology of gopher tortoises. Jessica Olsen is completing a study of maternal transmission of antibodies to fire ant venom in sea turtles and gopher tortoises. Likewise, Wetterer's ant studies have provided a foundation for several student theses.

Educational outreach to the community

In addition to facilitating student and faculty research, the greenways provide a locale for reaching out to the wider community. Professor Moore has given tours of greenways and introductions to the gopher tortoise population for com-

munity K-12 schools and has guided greenway walks for residents of Abacoa community. FAU's Catanese Center for Urban and Environmental Solutions has worked in partnership with the Honors College to develop several outreach opportunities with the Abacoa community. Honors College students participate in greenway cleanups and work with faculty in the creation of bird lists and other wildlife lists for the Abacoa community.

Abacoa, in conjunction with FAU's Center for Environmental Studies, also hosts an environmental summer camp for elementary schoolchildren. Over the last three years, six Honors College students have acted as counselors for the three-week camps, at which students study a variety of South Florida ecosystems, including coastal habitat, and the wetlands and pine flatwoods of the community greenways.

Making Other Community Connections

In June 2001, the Honors College invited representatives from local, regional, and state environmental organizations to a conference and asked that they share the interests and goals of their organizations and suggest ways students might potentially contribute to their agendas. The conference introduced all these organizations to the Honors College and served as a platform for many local environmental professionals to meet each other for the first time and network among themselves. One outcome was an excellent network of internship opportunities for our students, but the most influential outcome has been the inclusion of the Honors College in several partnership programs, most notably the Florida State Park Service's "Parknership."

Florida Park Service "Parknership" program

The "Parknership" program, initiated by Florida Park Service wildlife biologist Hank Smith, provides students and supervising researchers (primarily Mr. Smith, with the assistance of additional Park Service personnel and faculty members from FAU and Palm Beach Community College) with the opportunity to conduct wildlife ecology and wildlife management projects in Southeast Florida. The reason for the focus on wildlife biology is the immense popularity of animal-related projects among students and the importance of the "watchable wildlife" phenomenon to the Florida Park Service's visiting public. The program includes projects that

involve the economic evaluation of wildlife management practices for efficacy and others that involve economic or other policy decisions, adding an interdisciplinary aspect to a substantial portion of studies. Finally, a condition of participating in the Parknership is that interns write up their field research for publication in a peer-reviewed scientific journal. Actual publication induces students to do a good job with their projects, and the emphasis on writing dovetails well with the writing-intensive, thesis-required curriculum at the college.

Other community partners

While we do not have formal programs like the Parknership with most organizations, we have developed a number of community partnerships, most of which grew from our initial conference for environmental professionals. Some of those organizations include Blowing Rocks Preserve, a protected park owned by The Nature Conservancy; the South Florida Water Management District, the agency charged with managing and protecting water resources of the region, particularly the Everglades; the Marinelife Center of Juno Beach, a sea turtle rehabilitation hospital and marine education center; and the Palm Beach County Department of Environmental Resources Management.

Student projects

A number of student projects are described below—some from the Parknership program and some from other community partnerships. Whereas we are proud of our students' work, and others may find ways to adapt or adopt these projects, there are two additional reasons for describing specific projects: 1) to point out the wide variety of projects that are readily available to students when faculty members make connections to the wider community and 2) to illustrate ways in which students' work may affect the community by, for instance, providing information that can inform management decisions.

- Gabe Young's thesis, *Ecology of the American Alligator (*Alligator mississippiensis*) at Savannas Preserve State Park*, studies the behavioral and thermal ecology of alligators at Savannas Preserve State Park in relationship to published studies from other locations. Park personnel may use his findings to manage habitat for alligators.
- Diana Marti's thesis project, *Politics and Public Perceptions of Reintroducing Prescribed Fire in Senescent Scrub for Endangered Species Management*, examines the politics and public perceptions of reintroducing prescribed fire in aging, overgrown scrub-oak habitats in the Savannas Preserve State Park, a park that borders affluent residential communities. The Florida Park Service is excited about ways in which Diana's work may facilitate future prescribed burning.
- Holly Kopp examined roadkill data in a state to determine seasonality of species mortality and potential ways to reduce roadkills. The study includes an economic analysis of the cost of wildlife losses versus the cost of preventive measures such as installing wildlife underpasses in areas of high mortality.
- Stephanie Sabshin is studying curly-tail lizards, an invasive species that is expanding its range in southern Florida. She is testing the dietary limits of this species to see what impact it may have on native insects, plants, and small vertebrates. Her results may be incorporated into state control measures.
- Several students in an environmental economics class did smaller projects on entrance fee structures for state parks, the economics of restoring habitat damaged by feral hogs, the valuation of an endangered cactus found in one of the parks, and the cost of managing outparcels (chunks of privately owned land that are completely surrounded by parklands).
- Lyndsey Wheeler's thesis project, *Impact of Recreational Activities on Sea Urchin Populations*, compares sea urchin populations in Coral Cove County Park, a recreational area, and adjacent Blowing Rocks Preserve. Lyndsey found lower urchin densities in sea-grass beds in the public park, presumably due to the high level of human activity. The Nature Conservancy, which owns Blowing Rocks Preserve, has used the results of Lyndsey's thesis for developing their own policy on public access to their sea-grass beds.
- Jenny McIvor's thesis, *Everglades Restoration and the Ethics of Restoring Ecosystems*, examines the relationships between ecological restoration and environmental ethics in terms of the Everglades Restoration Plan. She addresses questions such as, "What constitutes 'good' restoration and how will the Everglades restoration be deemed a good restoration? What are the broader ethical implications of pursuing restorations?"
- Jeannie Veneziano worked with the Palm Beach County

Department of Environmental Resources Management to examine the impact of beach renourishment on rates of sea turtle nesting, finding that nesting success was significantly lower on renourished beaches immediately after beach renourishment than on natural beaches. Her work may be used to inform the timing and location of future beach renourishment projects.

Strategies for Connecting Science to Society

We would like to close with some strategies for building connections with the community that have been used at the Honors College and that could be adapted in other environments. In looking back on our activities of the past three years, we believe the following have had the biggest impact on our students and on our curriculum.

1. Focus on the local natural environment.

Our entire project emphasizes environmental science and the mathematics and statistics necessary to analyze data and model systems arising in environmental studies, so emphasizing the environment was natural for us. Although South Florida has an especially rich setting for environmental studies, nearly all regions of the country have environmental issues that are of interest to educators, government agencies, and nonprofit organizations. Internship opportunities, in particular, seem to be more widely available in the environmental sciences, interpreted broadly, than in specific scientific disciplines.

2. Host a conference for environmental professionals in the area.

Our conference, hosted by the college the summer of 2001, turned out to be one of the most important and far-reaching aspects of our entire project. While we anticipated that the conference would provide many good ideas for student projects, we had no idea how fundamentally useful the conference would be for the development of an environmental science program at the college. It put the Honors College on the map, so to speak, with professionals in the field. It provided an initial networking opportunity for both faculty and professionals, led to research collaborations for faculty members, opened doors for student internship opportunities, and provided the contacts that enabled us to enter collaborative programs such as the Parknership with the Florida Park Service.

3. Make local field trips and hands-on activities a fundamental part of lower-division science classes.

We believe it is important to introduce students to the surrounding community and to regional issues in science and the environment early in their educational careers. Although the majority of our students are from South Florida, we have found that many know relatively little about the environmental concerns that are most pressing to the area. Getting them out in the field, having them meet environmental professionals in their "natural" settings, and having them actually complete projects in lower-division courses helps them get a sense of the opportunities available in the environmental sciences.

4. Bring in guest speakers from environmental organizations—public, private, government—to speak to students about the role of their organizations and opportunities for students to contribute to their ongoing research projects.

Meeting professionals in the classroom has many of the same benefits for students as meeting the same people in the field, with the advantage that guest speakers tend to be logistically easier than field trips.

5. Make it a priority to develop internship programs with local organizations and require substantial writing as part of the student internship experience.

Many of our students' internships led to thesis research opportunities. Agencies that have public education as part of their mission tend to be especially good at providing solid internships for students. For the internship to count for course credits, we typically require a final written report of the student's activities and impressions of the work conducted. This adds more experience with writing, provides the student with an opportunity to place his or her work into a larger context, and helps document the internship work undertaken.

6. Encourage faculty members to establish local research programs.

Two Honors College biology professors have been particularly successful in this endeavor. Professor Moore's research interests are primarily in marine science and deep-sea fishes, but he initiated a long-term monitoring of the local gopher tortoise population, which provides much more accessible projects for his students. Professor Jim Wetterer studies ants, with a focus on invasive

species, and he has students involved in projects concerning edge effects of invasive ants in the gopher tortoise range, as well as the effects of fire ants on new sea turtle hatchlings.

We recognize that the youth of our institution, the flexibility of our curriculum, and the small size of our classes have allowed for easier implementation of these ideas than might be possible at larger, more well-established institutions. But for us, the effort has been well worthwhile.

Acknowledgments

The activities described here are just part of our larger CCLI project, "Discovery-Based Science and Mathematics in an Environmental Context" (DUE 0088211), and we gratefully acknowledge the support of NSF for enabling us to fully develop our science curriculum. Dozens of people have contributed both to connecting science to society and to the larger project. In particular, we wish to acknowledge the contributions of current and former Honors College faculty members Julia Burdge, Mwangi wa Githinji, Bill Green, Todd Hopkins, Paul Kirchman, LuAnne McNulty, Blake Mellor, Bill O'Brien, Susan Richardson, Mark Rupright, and Jim Wetterer. We also wish to acknowledge the contributions of the Florida Park Service and especially wildlife biologist Hank Smith for his initiation of and dedication to the Parknership program; the Marinelife Center of Juno Beach, particularly Larry Wood; Palm Beach County Department of Environmental Resources Management; Ed Maietta of the Catanese Center for Urban and Environmental Solutions; The Nature Conservancy's Blowing Rocks Preserve; and the Abacoa Partnership for Community.

BIBLIOGRAPHY

- Colwell, R. 1999. Office of Polar Programs Advisory Committee Meeting: Spring. Arlington, VA.
- Green, W. J., E. Curtis, and R. Hays Cummins. 2004. "Prompted" inquiry-based learning in the introductory chemistry laboratory. *J Chem Educ* 81: 239–241.
- Sayre, A. 1978. *Rosalind Franklin and DNA*. New York: W.W. Norton.