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Ecological Restoration-based Education Transforms Schoolgrounds and Education

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Abstract

The University of Wisconsin–Madison Arboretum, home to the world's first prairie restoration, has a threefold mission to conserve and restore Arboretum lands, advance the science of restoration ecology, and foster the Land Ethic. Since 1991, teams of teachers from more than 150 schools in Wisconsin have learned to incorporate ecological restoration into the curriculum through the Earth Partnership for Schools Program. This multi-disciplinary teacher professional development program emphasizes inquiry-based learning and multiple intelligences in a hands-on, collaborative setting. The majority of schools have focused their efforts on prairies. Recreating or restoring an ecological community on school grounds provides opportunities for students to study local history, map current site conditions, learn about species tolerances, conduct research, manage their restorations, and celebrate a new personal relationship with the land. A recent follow-up questionnaire sent to participants since 1994 indicates that 94% of the respondents make use of restoration sites that are on average five years old, at least 2,500 square feet in size, and used by six teachers and 250 students per year.

Keywords: Earth Partnership for Schools, ecological restoration, education, restoration-based education, teacher professional development, University of Wisconsin–Madison Arboretum

Introduction

The University of Wisconsin (UW)-Madison Arboretum, home to the world's first prairie restoration, has a threefold mission to conserve and restore Arboretum lands, advance the science of restoration ecology, and foster the Land Ethic. The Land Ethic, the idea that we consider soil, plants and animals as part of the community to which we belong and act in a way that allows for their continued existence, was proposed in *A Sand County Almanac* by Aldo Leopold (1949). For many years, classes from nearby schools would tour the Arboretum to learn about prairies, forests, and ecological restoration. About 15 years ago, Arboretum staff realized they wanted young people to connect with the natural world in meaningful ways that were more hands-on and sustained than a once-a-year visit to the Arboretum could provide. This desire evolved into the idea of teaching schoolteachers to actively engage their students in recreating prairies at their schools, spawning the creation of the Earth Partnership for Schools (EPS) program.

Earth Partnership for Schools

Since EPS was established in 1991, teams of teachers from 168 schools in Wisconsin, Texas, and New York have learned to incorporate ecological restoration into their curricula, reaching more than 120,000 students. This teacher professional development program emphasizes inquiry-based learning, a form of teaching where the students build scien-

tific knowledge, skills, and understanding by *doing* science (Carin and Bass 1997); multiple intelligences, a theory that proposes various intelligences such as linguistic, musical, and most recently, naturalist, among others (Gardner 2000) that should be targeted in teaching; and interdisciplinary connections in a hands-on, collaborative setting.

The theme of ecological restoration and the real-life task of recreating an ecosystem on the school grounds provide a framework that can unite lessons and activities across different subject areas and motivates students to learn about the world around them. Earth Partnership for Schools has created more than 100 lessons, complete with Wisconsin education standards and student assessment ideas. Although housed at the Arboretum, the program is funded entirely by grants, currently including the Howard Hughes Medical Institute, Wisconsin Improving Teacher Quality Program and U.S. Environmental Protection Agency.

Teacher Professional Development Model

Earth Partnership for Schools recognizes that a teacher working alone or with little support is less likely to be successful at developing a restoration site and will reach fewer students, so the program focuses on school teams. Each school team is typically led by two "lead" teachers. These teachers attend a two-week (80-hour) summer program (Institute A) that orients them to restoration-based education and project



development within their schools. During the winter, the lead teachers attend a one-day meeting to share ideas and practices and get re-energized about the work. Over the next few months, they recruit “associates” who will join them at a second two-week program (Institute B) during the following summer. Associates are frequently teachers, but may be community members, administrators or other staff. Earth Partnership for Schools encourages teams be comprised of teachers from many different subject areas, so their students will have multiple opportunities to learn through the project. Likewise, research indicates that professional development is more effective in changing teachers’ classroom practices when there is collective teacher participation from the same school, grade, or department (Desimore and others 2002). In addition to the restoration process, Institute B focuses on team building, advanced curriculum and strategic planning, leadership development, and using the restoration site for student-led scientific inquiry. Typically, eight to ten schools attend each institute.

Teachers receive three graduate credits through UW, a stipend for attending each institute, and all program materials and curricular activities. Earth Partnership for Schools staff model techniques and activities that show teachers how to use the restoration process to teach science, math, and related core subjects. Program evaluations indicate that students at all levels, with diverse learning styles and socioeconomic backgrounds can learn scientific concepts through this hands-on, context-rich experience (Clifford 2003a, Clifford 2004). As one teacher stated, “This is the best course I’ve ever attended. Your commitment to restoration and learning make you wonderful models in the teaching profession.” Another participant commented, “I have learned so much about prairie restoration and ecosystems. By taking part in the institute I feel I have been restored as a teacher.”

The overall EPS professional development model reflects many of the characteristics reported as essential to quality teacher professional development. McLaughlin and Talbert (2001) suggest policy changes emphasize professional development institutes, on-site coaching, and networking opportunities. National science standards, as well as professional developers and researchers, recognize the need for more comprehensive, longer-term, collective learning opportunities for teachers to gain additional content and process skills (Loucks-Horsley and others 1998, Bybee and Loucks-Horsley 2001). In addition, previous studies indicate a direct positive correlation between the amount that teachers teach about the environment and the amount of in-service or pre-service training they receive (Lane and others 1994, World Wildlife Fund 1994). Earth Partnership for Schools provides ongoing support to the school teams by providing school in-services, site consultations, a list serve, and a program newsletter. The fact that teachers self-select to participate in interdisciplinary school teams also avoids the pitfalls of teacher professional development being perceived as mandatory instead of personally motivated, and also results in more school cohesiveness. Earth Partnership for Schools reflects national standards for staff development by emphasizing ideas of collaboration, lead-

ership development and learning communities, while stressing teaching content and process knowledge, and development of skills to involve various stakeholders (National Staff Development Council 2001).

Partnering Institutions

Earth Partnership for Schools has partnered with various institutions to reach more teachers and, consequently, students. The Urban Ecology Center in Milwaukee has been a partner since 1997, helping to staff summer institutes in Milwaukee and provide ongoing support to neighborhood schools. Beginning in 1998, EPS has partnered with UW–Stout and Standing Cedars Land Conservancy (Osceola, WI) to provide summer institutes, continuing education and other support to schools in western Wisconsin. In 2002, we began collaborating with Northland College (Ashland, WI) to provide continuing education classes and other support to EPS schools in northern Wisconsin. In 2002 and 2003, we piloted a project with the Lady Bird Johnson Wildflower Center in Texas. Wildflower Center staff and a team of teachers from an elementary school attended the EPS institute series. All of these collaborations have enhanced the program’s ability to reach educators beyond the summer institutes. For instance, in 2002–2003, EPS, its Facilitating Centers in Wisconsin and the EPS pilot Cooperating Center at the Ladybird Johnson Wildflower Center provided additional professional development opportunities to 315 teachers from 41 schools. That same school year, two continuing education graduate credit courses focusing on local ecosystems issues were offered through Facilitating Centers, reaching 42 educators and community members from 25 schools.

The Restoration/Education Process

The agenda for the summer institutes follows the process of recreating an ecosystem, with each step containing a variety of lessons:

Investigate Site History – Review General Land Office surveyors’ notes to determine the ecological community that was present prior to European settlement. This step is an opportunity to integrate ecological restoration into social studies classes. Math classes can convert the surveyors’ chains and links to miles and feet or metric units. The Wisconsin surveyor’s notes are now available on-line at: <http://libtext.library.wisc.edu/SurveyNotes/>, providing opportunities to bring the use of technology into the project.

Community Connections – Reach out to the school community for support. Students can write articles in school and local newspapers, describing the project and needs; many people in the community welcome the opportunity to share their expertise and get more connected to the school.

Study the Model – Study and, ideally, visit a prime example of the target ecological community to become familiar with its



The entire student body from Lodi Middle School (Lodi, WI) seeded their school prairie site.

species composition, structure, and function. During visits to high-quality restorations, students can write in journals, observe and identify species, as well as imagine and plan what their restored schoolyard site can become over time.

Perform Site Analysis – Study the current site conditions to determine the suitability for different species. This step, appropriate for science or math classes, includes determining the soil texture by calculating the relative percentages of sand, silt and clay, calculating slope of the land, and mapping existing features such as paths, sun/shade, and existing vegetation.

Plan the Restoration – Choose an area for the project based on the site analysis, create a design, lay out the design, develop a budget and select appropriate species. Resources for species selection include native plant nursery catalogs and the Wisconsin State Herbarium's searchable Web site of vascular plant species that includes range maps and photos. Design considerations include choosing a site that is close to the school building for easy access by classes, one that doesn't compete with existing land use, and aesthetics, such as the use of curved instead of straight boundaries.

Prepare the Site – Options covered include cultivation, use of herbicides and sod removal, among others. Teachers are encouraged to have students involved in the decision-making and, if possible, actual site preparation.

Plant the Site – Involves seeding and/or planting. Teachers are encouraged to involve as many students as possible (often the entire student population) and engage students in planning and implementing a celebration for the "birth" of their site by performing skits, singing songs, or other presentations related to local natural and cultural history. Sites range from small plantings at Milwaukee schools to several acres seeded at once, such as at Lodi Middle School. Earth Partnership for Schools staff recommends that teachers engage students each

year to add a small area to the site versus creating a large area with only one cohort of students.

Manage the Site – Includes hand pulling of weeds, prescribed burning, and mowing, when burning is not possible. Teachers are taught to identify and how to control invasive plants. Many schools regularly have volunteers who conduct prescribed burns on their prairie recreations, often with all of the students watching; in a few instances, experienced teachers conduct the burns themselves.

Conduct Research – Research can be conducted throughout the process of recreating an ecosystem, such as by comparing the effects of different seed mixes in terms of their competition with weeds, site preparation and management techniques. In 2003, EPS hosted the first-ever K–12

student research conference on ecological restoration where approximately 80 students from nine schools participated in 15 oral and poster presentations. EPS hosted a second student research conference in May 2005 with more than 90 students and 25 oral and poster presentations.

Learning Grounds – In addition to scientific research, there are endless learning opportunities available once students, teachers, and community members have recreated a native site on their school grounds. Through EPS summer institutes and in-services, teachers experience an assortment of EPS activities that incorporate language arts, science, math, social studies and service learning opportunities, among other disciplines.

Program Evaluation and Effects

Earth Partnership for Schools has a comprehensive evaluation plan in place, which examines program effectiveness, teacher learning, impacts on classroom practices, and student involvement in restoration-based education efforts at their school. Qualitative and quantitative data have been collected on participants' attitudes, behavior, and school-based project development. Evaluation methods include pre/post-summer institute surveys, focus groups with lead teachers, a survey to determine which EPS curricular lessons teachers have used, and compilation of student and teacher work. Responses from teachers in the 2003 and 2004 institutes suggest that EPS staff designed and taught an informative, inspiring event that exceeded teachers' expectations, addressed their concerns about taking on a daunting, long-term project, and built an esprit d'corps among teams that should carry forward into the school year (Clifford 2003b, Clifford 2004).

Effects on Teachers

Numerous teachers commented about the impact that the program had on them: "I was able to take home real ideas, lessons, and materials that will be put to immediate use." One participant in the Institute A 2004 wrote "[The EPS Institute] prepared me to lead in the development of a prairie at our school, [and] gave me creative new ways to think about teaching and my own curriculum." Another teacher wrote, "I gained a wealth of knowledge and understanding of the process of restoring a prairie. A seed was planted that makes me want to learn more and to share with others." The program's impact on teachers' practices was reflected in other comments such as, "[The EPS Institute] caused me to reflect on my teaching practices. Even after 22 years, I have many practices that I could change." And "I feel the subsequent years of my teaching career are indebted to this institute and the quality of the people facilitating it."

In addition to evaluative data suggesting a positive effect of participation in the summer institutes, a five-year follow-up study (Clifford 2003a) and research (McCann 2003) illustrate the program's positive impact on school culture, teacher leadership, and classroom practice, once the institute series is completed. The follow-up questionnaire sent to teachers who participated in EPS since 1994 indicates that 94% of the respondents make use of their schools' restoration sites that are on average five years old, at least 2,500 square feet in size, and used by six teachers and 250 students per year (Clifford 2003a). Previous research also indicates teachers' involvement in the EPS program effects changes in teacher practices at the school level, while transforming components of the school's natural landscape (McCann 2003). Teachers trained by EPS identify a "sense of place" and personal connection to their workplace because of the prairie's presence on site. As one teacher stated, "[School] is pretty cold and sprawling, pretty sparse...the prairie brings a little humanity," while another teacher mentioned, "I feel closer to the place I teach than I did before." Such findings suggest programs like EPS, which emphasize the establishment of native sites on school grounds, can positively impact the natural landscape and improve teachers' impressions of their workplace environment while enhancing their classroom practices.

Effects on Students' Sense of Place

Earth Partnership for Schools, which emphasizes outdoor experiences by using schoolyard habitat areas for learning, addresses several needs of young people to connect with the natural and built environments during their school experiences. Out-of-door opportunities can help to avoid what Pyle (1993) describes as the "extinction of experience" (p. 147) in natural settings and an historic trend toward loss of wildness



Students in Patrick Marsh Middle School's Discovery Club experimented with using vinegar to control Canada thistle in the school's recreated prairie.

where children play. Some argue that depriving young people of intimate interactions with the natural world can have detrimental intellectual, biological, emotional, and developmental impacts (Kellert 1997, 2002, Pyle 2002). Earth Partnership for Schools projects provide such meaningful experiences, as one fifth grade students' reflections on their prairie site suggest: "In September I choose a place on the prairie. In this place in the prairie I felt totally at ease with nature and insects. I felt like I could stay there forever. I felt I could let nature take over. I felt content and happy, and even though I was far from everyone else I felt like I wasn't alone." The EPS program hopes to continue to provide young people with opportunities to help them develop a sense of place as they learn more about the natural world and themselves.

Conclusion

Aldo Leopold wrote, "When we see land as a community to which we belong, we may begin to use it with love and respect." Just as Leopold's land ethic developed over a lifetime, the Earth Partnership for Schools program has continued to evolve over the years. Although we have adapted the content and process of the program to meet changing needs and new challenges, the mission of offering teachers and students of all ages and abilities with opportunities to connect with the natural world in positive, meaningful ways has remained central.

Acknowledgments

We would like to thank Molly Fifield Murray, Cheryl Bauer-Armstrong and Carol Edgerton, our EPS colleagues at the UW-Madison Arboretum, for their contributions to this article and the overall program. We also want to acknowledge program support provided by the Howard Hughes Medical Institute's PreCollege Science Education Program, the Wisconsin's Improving Teacher Quality Program and the U.S. Environmental Protection Agency.

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