

8-1-2012

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Recommended Citation

Myers, M. R. (2012). A Student and Teacher Watershed and Wetland Education Program: Extension to Promote Community Social-Ecological Resilience. *The Journal of Extension*, 50(4), Article 14. <https://tigerprints.clemson.edu/joe/vol50/iss4/14>

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A Student and Teacher Watershed and Wetland Education Program: Extension to Promote Community Social-Ecological Resilience

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Abstract: *A middle school student and teacher watershed education project supports a large wetland restoration effort. It provides community-based, science education for urban, low-income, multicultural 6th-9th grade students and their teachers. This is a bottom-up approach to extending information to the local community about the restoration. The project includes teacher workshops, teacher and student restoration/water quality fieldwork with expert guidance, scientist classroom visits, an essay contest, and research cruise. The project is an example of using place-based, participatory learning toward achieving social-ecological resilience. It is a student education project with broader, community-wide Extension goals.*

Introduction

Extension programs have successfully promoted community change through hands-on youth education. The 4H program, initiated over 70 years ago (Van Horn, Flanagan, & Thomson, 1998), historically introduced innovative farming techniques to the community through youth projects (Rasmussen, 1989). More recently, 4H and other Extension programs have developed environmental education programs for youth and adults (Foerster & Barry, 2007; Hosty, 2005), including watershed education and restoration projects (Kirwan, Williams, & Kirwan, 2005; Conway, Godwin, Cloughney, & Nierenberg, 2003). Here I describe the Research and Education for Students and Teachers about the Ormond Beach Restoration (RESTOR) project. This multi-faceted, place-based education project for multicultural middle school students and teachers is aimed at increasing community awareness and support for southern California's largest wetland restoration effort.

Methods

Over 1500 mostly low-income, multicultural 6th-9th grade students and 33 teachers from Ventura County, California participated in the RESTOR project between October and June 2008-2011. Students and teachers learned about the Ormond Beach wetland, their local watershed, and water quality monitoring through classroom, field, and independent activities outlined below. A diverse array of activities were provided over the course of a school year to encourage long-term learning (Patton, 1986).

Teacher Workshop #1

Teachers learn about watersheds, wetlands, and the history of the Ormond Beach restoration from local experts directly involved in the restoration project, including: non-profit group scientists/educators, land managers, Parks Service staff, an Extension agent, and a university professor. Teachers are provided the necessary training and resources to convey the information they learn during workshops to their classes. They are introduced to wetland and watershed curricula and hands-on activities by educators from the California Coastal Commission

and National Marine Sanctuary Programs. Educational videos about a local watershed, the Ormond Beach wetland, and birds, and other relevant resources are provided.

Teacher Workshop #2 and Field Research Days

Teachers are trained to collect scientifically reliable water quality data by scientists who lead/train local stream water quality monitoring groups (Waterkeeper Alliance staff). Water quality monitoring is the scientific activity that links the wetland and watershed components of the RESTOR project, allowing teachers and, later, students to use their data to explore connections between the watershed, the wetland, and the ocean. Teachers collect baseline water quality data (pre-restoration data) that are archived for future comparison to post-restoration data.

Scientist Classroom Visit and Water Quality Lab

During the winter, a Waterkeeper Alliance scientist/educator leads a water quality laboratory in each teacher's classroom. Students test water samples collected from the local watershed (e.g., a nearby stream or street runoff), preparing students for water quality monitoring during the field trip. All water quality monitoring equipment is available for teachers to use any time during and after their participation in the RESTOR project.

Ormond Beach and Wetland Visit

In the spring, students visit Ormond Beach for a full day of activities guided by local experts. Students monitor wetland water quality and compare these data to those taken in their up-stream watershed. They learn about the land-sea connection and the watershed concept. Students also participate in native plant restoration activities, identify birds, learn about the Ormond Beach restoration, and perform a beach clean up.

Essay Contest and Channel Islands Research Vessel Cruise

In the late spring, after completing the field trip, students participate in an essay contest judged by local experts. At least one student winner from each class is selected to participate in a fieldtrip to the Channel Islands National Marine Sanctuary. Students measure water quality at near-shore, offshore, and island sites. They use this information to determine if watershed impacts extend from their watershed to the offshore islands.

Project Evaluation and Analysis

A summative evaluation method using pre and post-tests is used to assess change in student knowledge and behavior. The evaluation tool includes "content" questions, which directly concern material learned during the project, and "relationship" questions, which address changes in behavior and attitude. Teacher experience is evaluated using a post-project survey, provided to teachers after the final field trip. Surveys are analyzed qualitatively.

Results and Discussion

All RESTOR activities are place-based, centered on the Ormond Beach restoration. Place-based learning is effective for students living in urban communities (Endreny, 2010) such as the Ormond Beach area, where attitudes toward science may be more negative (Zacharia & Barton, 2004). Through identification with a local, natural place, youth may be empowered to improve their environment. Place-based learning improves scientific understanding, promotes ecologically sustainable behavior, and develops emotional attachment (Semken & Freeman, 2008). Generally, students are more engaged when provided a "real world," place-based experience, because they may perceive material learned only in the classroom as not related to the outside world (Stapp, Wals, & Stankorb, 1996).

Environmental learning is enhanced through a participatory approach to ecological restoration (Ballard & Belsky, 2010). When students engage in productive activities such as monitoring water quality, planting native plants, and removing non-native "weeds," they change both the environment and themselves (Engeström, 1987). Through participation in restoration activities students gain a sense of ownership of a project, connection to the natural world, and

empowerment to improve their environment (Gruenwald, 2003).

Student participation in the Ormond Beach restoration promotes community involvement and adds value to the restoration. Multiple groups from local government, non-profit, university, and the community are brought together to educate students and teachers. Good working relationships are fostered though working toward the common goal of youth education. Student field trips attract positive attention from the media and local elected officials. Also, parents are educated about the restoration through their children's involvement in the project.

Ecological restorations present an opportunity for hands-on science education while restoring ecosystem function and improving social wellbeing (Krasny & Tidball, 2009). By educating students, working to restore ecosystem services, and raising community awareness, social and ecological benefits may be achieved at multiple levels, contributing to social-ecological system resilience (Walker et al., 2006; Walker et al., 2002). The RESTOR project both provides multifaceted education for an underserved population and extends information to the broader community, promoting a more socially beneficial ecosystem restoration. The implications of the RESTOR project for Extension work are that student education projects may be useful for multiple purposes, including extending information to a wider audience.

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