Innovative Idea Poster

# Using Localized Environments for Student-led Experimental Research in Natural Resource Management: An Example of Classroom Practice

Blake C. Colclasure & Andrew C. Thoron
University of Florida

310 Rolfs Hall
PO Box 110540
Gainesville, FL 32611
(217-898-2036)
bcolclasure@ufl.edu

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## Introduction

The academic subject matter of school-based agricultural education (SBAE) programs are widely diverse and often tailored by each state and/or program toward regional agriculture, business, and environments. *The National Council for Agricultural Education* propose eight Agriculture, Food, and Natural Resource Career Clusters (NCAE, 2015). Among them, Environmental Service Systems and Natural Resource Systems (ENR), promote the need for environmental-based education within SBAE. ENR courses provide SBAE programs an excellent opportunity for the integration of core sciences into the agricultural curriculum (Nolin & Parr, 2013). Furthermore, the emphasis of hands-on learning and skill-based learning in SBAE provides an opportunity to make science topics applicable and relevant to students (Despain, North, Warnick, & Baggaley, 2016). The use of outdoor learning laboratories common in SBAE, such as school gardens and livestock production areas, provide students hands-on learning through real-life practice. ENR courses should use the same approach of hands-on learning and integration of applied sciences through the use of outdoor learning areas. Areas found on school grounds, nearby parks, forest preserves, and waterways can be used as outdoor learning areas for courses pertaining to ENR. In outdoor learning labs, students will be able to conduct authentic scientific fieldwork that provides experiences to construct new and meaningful scientific knowledge (Dresner & Moldenke, 2002), while making the living and non-living world around them relevant (Hodge & Lear, 2011). This innovative poster submission will describe an example of classroom practice utilizing an outdoor learning laboratory in a natural resource management course.

## How it works/Methodology

Although there can be many different approaches to using outdoor learning labs that can be successful, this example utilized inquiry-based instruction as a method of active learning. Inquiry-based instruction in Agriscience has been demonstrated to increase student content knowledge, argumentation skills, and scientific reasoning over the subject matter approach (Thoron & Myers, 2011; Thoron & Myers, 2012a; Thoron & Myers, 2012b). The instructor was teaching a unit on wildlife populations and gave the opportunity for the class to create a research project using a nearby prairie preserve. Students were given a chance to brainstorm populations of interest that could be found in the preserve. Students came up with many possible populations of interest (e.g. prairie grasses, rabbits, ticks, earth worms, deer, coyotes). Students came to a consensus on which population they were most interested in and why. Several students wanted to investigate ticks because they came across them often while hunting and hypothesized there would be a variation in tick populations dependent on location. This hypothesis became a guiding component of the class's study. From the previous unit, students' recalled that habitat was a major factor that influenced species in a given area. Students hypothesized that the biodiversity of plant material and the location to the edge of the prairie would influence the number of ticks found in a given area. The instructor had students use the scientific method to propose a study that supported or rejected these two hypotheses. The instructor helped guide students in this process to ensure that the study followed scientific procedure and was feasible. Students identified biodiversity of plant species and meters to the edge of the prairie as independent variables that influenced the dependent variable – the number of ticks. Students spent time researching methods to collect tick samples and found that an easy way to collect them was to use a "tick drag" that could be easily constructed from a one $m^2$ burlap cloth, PVC pipe, and rope. Students also found that biodiversity of plant species in a prairie can be determined by using a one $m^2$ quadrat and counting the number and types of plants within the quadrat. These measurements can be used in a formula to produce an index score for biodiversity. Students came up with the follow procedure: (1) Measure and mark five areas within the prairie that appear to have varying levels of vegetation; (2) For each area, run the tick drag through the prairie for 15 minutes (stopping every 60 seconds to collect ticks on the drag and to place them in labeled vials); (3) For each area, use a quadrat to determine the number of plants and types of plants within the quadrat (repeat this three times within each area); (4) Transfer data from field notebook to Microsoft Excel® and analyze data using correlation functions and graphing; and (5) Create a report showing the results and implications of the study. Students spent approximately three weeks designing, implementing, and analyzing data for their study. While collecting data, students wore tick-deterrent clothing and spray while following recommended safety precautions for the collection process.

**Results/Implications**

Students collected 68 ticks in total. Students identified 30 Lone Star Ticks and 38 Dog Ticks and determined the sex and life stage of each using a compound microscope. Students found that plant biodiversity and tick abundance had a 0.828 correlation, indicating that larger populations of ticks are found in areas of higher grassland plant biodiversity. Students did not find a significant correlation of distance to prairie edge and tick abundance. Students created and shared reports of the research with parents, science teachers, and school administration.

Outdoor learning laboratories in SBAE and ENR courses provide teachers an opportunity to teach students in a way that encourages them to gather scientific skills, problem solving skills, and connections to the environment. Although student data was not collected by the teacher during this experience, the teacher did notice positive changes in student motivation, attitude, and knowledge of unit concepts. Research that exposed students to similar real-world environmental investigations found that students improved on academic achievement and increased enthusiasm for learning (Lieberman & Hoody, 1998). Powers (2004) found that one of the largest factors in student engagement is the established relevance to the local community. Establishing local environmental relevance to students increase positive environmental attitude and responsible environmental behavior (Ernst & Theimer, 2011).

**Future Plans**

The use of outdoor land labs continued throughout the school year. As the year progressed, the instructor noticed that students became more comfortable designing research investigations that pertained to course topics. The instructor was able to provide less guidance on student investigations as they become more familiar on how to design and conduct research. The current SBAE program still teaches courses in natural resource management and utilizes similar educational approaches. The instructor has seen success with this practice and recommends that ENR-based land labs be shared and researched in teacher education programs.

**Resources Needed**

It is a great resource to have a natural area on or adjacent to school grounds that is available for use as an outdoor learning lab. However, an existing area is not required to provide students with a unique and rich research experience. Outdoor learning labs can be made (e.g. native plant bed) or found within short distances from the school. Transportation can be used for a "field trip" day in which planned research can be conducted. Urban environments are also home to many species of plants and animals that can be studied.

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