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Actively experiencing local ecosystems: Curriculum development to support the student visitors of Smith College's MacLeish Field Station

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Abstract

Environmental education is an important initiative to develop an awareness of conservation and sustainability issues in younger generations. Using scientific inquiry, experiential lessons, and interactive curricula, students can explore local ecosystems to then create a sense of responsibility and stewardship for the future of the environment. Smith College’s Ada and Archibald MacLeish Field Station, with 200 acres of preserved New England hardwood forests and agricultural pastures, provides extensive opportunities for local school groups to explore scientific concepts in local ecosystems. The sustainable building of the Bechtel Environmental Classroom will further enhance the educational resources available at the field station for student visitors of all ages. In order to support the MacLeish Field Station and to promote the diverse opportunities for environmental education at the site, I developed several scientific lessons and facilitated explorations into a curricula handout, which can engage visitors of a variety of age groups and with different educational goals. This document will be used to advertise to local teachers the extensive educational resources and learning opportunities at this site, in the hopes of increasing the number of students who visit MacLeish. If more students who experience the preserved ecosystems, environmental-consciousness could develop in more students so as to promote a more sustainable future.

Introduction

“Human needs and aspirations the world over can only be satisfied as environmental awareness leads to appropriate action at all levels of society, from the smallest local communities to the whole community of nations. Appropriate
action requires a solid base of sound information and technical skills. But action also depends upon motivation, which depends upon widespread understanding, and that, in turn, depends upon education.”

- Mostafa K. Tolba (former director), United National Environment Program

Young students today will become important participants in the world of the future. In order to develop in this generation increased consciousness toward sustainability issues, environmental education works to create a sense of responsibility and stewardship towards nature. In combination with conserving natural areas and specifically protecting declining species, an important focus for conservation efforts includes programming for schools and community groups (Jacobson, 1995). “Most environmental attitudes are formed during childhood. Thus schoolchildren are an important target for conservation education” (1995, p. xxviii). By teaching children about their local ecosystems and accessible examples of sustainable lifestyles, environmental consciousness can spread throughout their community. Consequently, environmental education programs and activities for students of all ages are important for enhancing awareness of conservation issues in the larger population.

To successfully engage the interests of young students and to create strong foundations for environmental consciousness, educational efforts often use hands-on, participatory programs and activities. Important principles in these educational initiatives include experiential, place-based learning and inquiry-based exploration of nearby natural settings. The students’ understanding of scientific methodology and perspectives is supported by inquiry-based opportunities for observation and analysis of the natural
world (Martin-Hansen, 2002). Environmental education using such interactive lessons can then “involve children in the complexities of environmental problem solving” (Jacobson, 1995, p. xxviii). By welcoming the younger generations into the discourse about current environmental challenges, changes in the future can be possible.

To promote a more sustainable world, environmental education involves providing children with experiences outside in the natural world, most often near their home. By interacting with the local ecosystems and the important species which make them up, students can appreciate their role in the local environment and later support a sustainability-focused global perspective (Bybee, 2008). With this in mind, locally focused activities, species-specific curricula, and student-activated learning in natural settings can greatly promote increased environmental-consciousness.

Smith College’s Ada and Archibald MacLeish Field Station is an excellent example of a unique site for environmental education programs, as it provides many opportunities for experiential learning and scientific exploration to promote a sustainable future. The many trails winding through 200 acres of mixed hardwood forests and agricultural pasture allow for the exploration of different New England species and their habitats. Major forest types, such as Eastern hemlock glades and deciduous woodlands including beech and birch forests, are the foundation for diverse microhabitats in the area (Forest, 2000). Active pastures and fallow meadows also support diverse communities of plants and animals. As a result, the variety of ecosystems preserved at MacLeish can help the student visitors to appreciate the diversity of species in the Massachusetts temperate ecosystems.
Student visitors to the MacLeish Field Station can take advantage of its natural resources to study conservation concepts beyond the classroom setting, while also reaching wider educational targets, such as literacy, numeracy, and employability (Bangay and Blum, 2010). For example, the extensive opportunities for on site learning of biological subjects at MacLeish can even meet the state requirements for the MCAS graduation examinations. The interactive lessons and scientific programs can support scientific literacy, as well as mathematical interpretations and social skills for working on projects in groups.

Opportunities for successful environmental education at the MacLeish Field Station will soon be enhanced by construction of an on-site classroom. The Bechtel Environmental Classroom, which is currently in the planning and preparation stages of building, will provide a platform for lessons while containing many resources for exploring the nearby landscapes, including a scientific laboratory. The classroom is being built under the sustainable parameters of the Living Building Challenge, which has clear requirements for zero waste and closed systems of energy use; consequently, this structure will create a unique foundation for fostering awareness in sustainable issues (McLennann, 2007). This classroom and its resources for a variety of educational activities and environmental lessons will complement the surrounding landscapes and local needs for promoting sustainability and conservation.

The building of the Bechtel Environmental Classroom will expand access to the MacLeish Field Station. The many acres of preserved New England ecosystems and the educational tools in the classroom will all be available to Smith College students as well as the local school and community groups (Cole, 2010). As science “provides children
with direct experiences with materials, events, and ideas that are important to later learning,” it is important that students of all ages are encouraged to visit the site and use the resources for scientific exploration and environmental education (Worth & Grollman, 2003, p. xv). As a result, the managers of the MacLeish Field Station want to advertise the availability of the valuable educational resources to increase the number of students who visit the area (R. Bertone-Johnson & P. Wetzel, personal communication, April 25, 2011).

In order to promote the unique on-site educational opportunities at the MacLeish Field Station, this project seeks to help advertise the many interactive lessons and scientific activities possible at this site. I worked to develop curricula and activities which emphasize the important features of this ecosystem with information accessible to a wide range of students, from elementary school students to college-level classes. By developing example curricula which incorporates the many species, diverse ecosystems, and educational resources at the field station, I am hopeful that more local schools and community groups will visit MacLeish. Using discussions with the managers of the MacLeish field station, informative materials, and my past experiences in curriculum development, I created interactive, place-based curricula for field trips to advertise for the unique learning opportunities at the field station.

Methods

To successfully create example experiential, scientific curricula particular to the MacLeish Field Station, I conducted personal interviews and literature research. The interviews specifically illuminated the important issues at MacLeish and significant
concepts which should be included in the lessons and activities I was creating. The scientific research further supported the content of my curricula with specific topics which can be taught while on a field trip to the field station. I then used my past experiences in curriculum development to write several example lessons.

Results

The main result of my project was to create a handout highlighting several potential hands-on, scientific lessons and interactive activities which can be easily completed while on a field trip at the MacLeish Field Station. I have included this document in Appendix A for further review. Informal interviews, independent literature research, and additional resources and experiences all enhanced the results of this project.

The interviews greatly expanded my project. I discussed my curricula ideas with Paul R. Wetzel, a research associate for the Biology Department who is connected to the planning of MacLeish in the future, and Reid Bertone-Johnson of the Landscape Studies Department, who is the manager of the MacLeish Field Station. The outcome of these discussions inspired my work so that it could be directly relevant to the field stations’ needs for the future. For example, their ideas helped me to focus my project goals so that I could create multiple lessons which meet the needs of diverse student visitors. Also, they suggested that I format the lessons into a handout to be given to teachers as an advertisement of potential field trip activities. This greatly changed the concluding product of this project and highlighted the future implementation of my work.

Scientific research developed the content of the curricula in the hopes of making the subjects interesting to many students while meeting their educational needs for
scientific understanding. The topics I studied included other environmental education initiatives, New England hardwood forests, and relevant ecological concepts conservation issues. More specifically, I studied Eastern hemlock forests, the loss of foundation species, ecological interactions and local food-webs, and habitat disturbances in New England landscapes such as invasive species, logging and agriculture (Ellison et al., 2005; DeGraaf et al. 2006; Jacobs, 2007).

The project curricula were created using my past teaching experiences and supporting resources, including Myers & Smart (2002) and Unit 2 – Exploring Biodiversity at the Zoo (2006). Overall, six interactive, scientific lesson plans were created. Four example lesson plans were clearly organized into a handout to be given to local teachers as an advertisement of potential learning opportunities at the MacLeish Field Station (Appendix A). Two additional ideas for lesson plans were included for future use by student visitors, depending on their further development by the managers of the station (Appendix B).

Discussion

The creation of the handout to advertise field trips to the MacLeish Field Station using several inquiry-based, scientific lessons will support the use of the diverse educational resources at the site by many school groups. I expected that many students of different ages will visit the site, so I created multiple lessons focused on differing topics which can be selected depending on the students’ age and knowledge-base. I hope the incorporation of multiple example activities will successfully engage the interests of the local community’s teachers and their students so that they visit MacLeish in the future.
This final step of the project depends on the implementation of the current plan to send the handout to local teachers, as discussed with the managers of MacLeish.

The interviews and research greatly facilitated the development of activities relevant to the ecosystems preserved at the field station. From these resources there was a sufficient amount of information to create the different lessons. The lessons in the handout (Appendix A) are more complete than the additional ideas also included (Appendix B); however, I expect all curricula to be adapted by the managers of the field station and the teachers who will use them on their field trips. I welcome all adaptations to these lessons, and recommend that more activities be developed in relation to the specific resources available at the Bechtel Environmental Classroom after it is built.

Through lesson plans and activities accessible to a range of student visitors, the guided ecosystem interpretations will hopefully increase scientific understanding in every student who visits the MacLeish Field Station. Other studies of environmental education have shown that such interactive, inquiry-based curricula have successfully spread consciousness of and participation in environmental issues (Jacobson, 1995). I hope that this trend continues at MacLeish with these environmental education activities with enhanced environmental consciousness in the local community to consequently support a more sustainable future.
References


Appendix B: Additional ideas for future lessons at MacLeish

Lesson 5: Presence of Humans in the Landscape

Theme
There is the potential for a successful lesson in conservation biology and interpretation of the presence of humans in an ecosystem.

Age Group
This would be the best activity for older student visitors to the field center, from high school students to students from Smith College.

Objectives
- Students will experience and discuss issues in conservation biology about the presence of humans in a habitat
- Students will develop the ability to interpret a habitat and the factors which have supported its current state

Activity Goals
- Using conservation biology and landscape studies, the visitors of MacLeish will understand the role humans have had in this forest ecosystems for years
- Issues of nutrient cycling and the spread of chemicals as well as invasive species and pests into the protected areas

Possible Important Topics to Explore with the Class
- Property history and the development of the habitat we observe today
  - Presence of old agricultural rock walls and old mines on the property
    - In the mid-19th century, the property was home to hundreds of sheep, two homesteads, an ice pond and several barns.
    - Lead and zinc mines on the western half of the site were active in the early 20th century and much of the eastern part of the site remained open for agricultural use and pasture land through the 1950s (Cole, 2010)
  - Utilization of the Natural Resources
    - Succession of forest types after logging
      - There are many sites throughout the MacLeish property with varying degrees of succession, from freshly logged forest along the northern border to different species and levels of succession
    - Relationship between the forests and the reservoir which supplies with city of Northampton with its water supply
- Juxtaposition of forests and agriculture
  - Despite predominantly forested property, agriculture has influenced it greatly
    - 20 acres of MacLeish land leased to local farmers
    - The forest is surrounded by agricultural fields
  - Agriculture directly affects the forests:
- Spread of pesticides and fertilizers into habitat
- Spread seeds of crops and invasive species into the protected area
  - One mechanism is the presence of cattle, transporting the seeds of invasive species into the property

Lesson 6: Exploring the Evolution of Plants

Theme
The variety of flora ecosystems at the MacLeish Field Station could support an activity which explores the diversity and evolution of plants.

Age Group
This could be a successful activity for the older visitors, from high school students to college-level visitors.

Objectives
- Students will experience and examine plant ecosystems to discover differences in plant characteristics
- Students will develop an understanding of the evolution of plants

Directions
- Take your students on a hike through the MacLeish Field Station to explore the different plant ecosystems
  - Start by the streams to observe the aquatic algae, mosses, and ferns
  - Compare with the grasses shrubs in the pastures and meadows
  - Then go to the coniferous hemlock glades
  - Finally compare with the deciduous forests
- Have students record their observations in their field notebooks
- Important discussion questions:
  - What adaptations do these different plant species have for survival?
    - Water and nutrient transport?
    - Surface area for photosynthesis
    - Reproduction
  - Can you observe and interpret the similarities and differences between these different plants?
    - Ask the students to compare physical structures (e.g. leaves, roots, plant height, etc.)
    - They can take samples of leaves and other structures to further analyze in the Bechtel Environmental Classroom with the microscopes.
  - If the students have had previous learning in plant evolution, can they map out the order of species evolution - in time and from water onto land - using examples from MacLeish?