

Campus Eco Tours: An Integrative & Interactive Field Project for Undergraduate Biology Students

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ABSTRACT

Outdoor areas within or near college campuses offer an opportunity for biology students to observe the natural world and apply concepts from class. Here, I describe an engaging and integrative project where undergraduate non-major biology students work in teams to develop and present professional “eco tours.” This project takes place over multiple class sessions and is customizable on the basis of course content. This project encourages students to work collaboratively and demonstrate creativity, and empowers students with opportunities to enhance public-speaking skills and share findings with the greater campus community.

Key Words: Ecotourism; eco tours; ecological literacy; environmental education; field project.

Educators face the challenging task of designing course activities that both educate and engage students. Increasingly, there are calls for biology teachers to implement comprehensive and interdisciplinary projects, particularly ones that encourage students to communicate about biology to others (AAAS, 2011). Here, I describe a field project that meets these objectives by using inspiration from the ecotourism industry.

The International Ecotourism Society (<http://www.ecotourism.org>) defines ecotourism as “responsible travel to natural areas that conserves the environment and improves the well-being of local people.” One popular form of ecotourism is an ecological (“eco”) tour, in which tour guides lead participants through a natural area and draw attention to interesting biological features and anthropogenic effects. This experience encourages participants to form connections between biology and their lives, which is one important component of ecological literacy (Jordan et al., 2009). Several colleges and universities are incorporating courses that emphasize environmental or ecological literacy into their undergraduate curriculum (Rowe, 2002). Educators who teach non-major biology courses have opportunities to promote ecological literacy by emphasizing ecological concepts and engaging students in interactive activities (Powers, 2010).

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I developed a campus eco tour project for an introductory non-majors biology class. Student groups were responsible for developing and delivering a 20-minute eco tour for a specific natural or seminatural area on our campus. For example, one group was assigned to give a tour of a campus pond, and another group was assigned to give a tour along a bike trail in a wooded area. Each group was also responsible for creating a PowerPoint file that served as a written outline of their tour and included original photos from their tour area.

This project can provide several benefits to both the students and the teacher. Students spend time outside, make observations of nature, and apply concepts they’ve learned in class to their local campus. Importantly, students practice and apply skills that will be important in future careers (creativity, teamwork, technical skills, research, public speaking, and professionalism). Teachers can customize the project to the specific content covered in class and engage students in applying and synthesizing those concepts. Conveniently, the project requires minimal supplies and setup preparation. Finally, the project facilitates a dynamic and collaborative learning environment in which both the students and the teacher learn together. Here, I suggest strategies for implementing this project in a college or university setting.

○ Course Context & Flexibility of Course Context

I developed this project for an introductory biology course for non-majors at The Ohio State University, Mansfield branch campus. My course ran during the summer session, covered many biological topics, and had both a lecture and a laboratory component. There were 20 students in the course, and I divided them into four tour groups. I devoted seven 2-hour laboratory sessions to this project, spaced evenly throughout the 7 weeks of the course.

Instructors can implement this project under a variety of course contexts. First, although the summer is an ideal time for students to

work outside, this project would also work nicely during the first part of the fall semester or the second part of the spring semester. Indeed, the fall and spring would provide opportunities for students to observe seasonal changes in their habitat (for ideas about implementing phenological content, see Long & Wyse, 2012). Second, this project could be adapted for colleges located in highly urban areas by choosing tour locations in urban gardens, vacant lots, or parks. Likewise, for colleges located in agricultural areas, instructors can select tour locations that incorporate small streams or edge habitats along fields. Finally, this project could easily be adapted for students at the high school level, or for biology majors in undergraduate ecology-related courses.

○ Safety Considerations

This project involves outdoor work, so students should dress for the weather, wear comfortable shoes, and bring plenty of water. Additionally, it is important to make students aware of potentially harmful species around tour areas (e.g., poison ivy).

○ Materials Recommended for Each Tour Group

- An area within or near campus that students can safely access and explore
- A map marked with eco tour locations

Table 1. Assessment criteria for students. Provide at the beginning of the project, and repeatedly emphasize, these components throughout the project. Consider providing the students with a more detailed assessment rubric ~1 week before they give their eco tours.

Your final grade will be based on the following
1. The quality of information included in your eco tour: <ul style="list-style-type: none"> • incorporating and effectively addressing all the content guidelines (see Table 2) • incorporating your own creative content
2. The quality of your eco tour from a <i>participant's</i> viewpoint: <ul style="list-style-type: none"> • excellent speaking skills and participation of all of the tour guides • tour skills: enthusiasm, professionalism, knowledge, organization, ability to answer questions
3. The quality of the PowerPoint file that you develop to provide a written documentation of your tour: <ul style="list-style-type: none"> • accurately reflects/mimics your eco tour (contains all information and your own photos from your tour) • well organized • cites references for each major piece of information (from acceptable sources only)
4. Your participation in the process: <ul style="list-style-type: none"> • determined partly from instructor observation • determined primarily from peers in your group • in the last project session, you will be "graded" on your participation by your peers • a negative peer grade may result in your receiving a lower final grade than your group

- Access to computers for the group to conduct online research and develop their PowerPoint file
- Access to a binder/notebook or a shared online space for the group to share ideas, helpful websites, photos, and files (note: many college course management systems have a feature where teachers can assign students to project groups and provide these groups with a shared file space)
- A digital camera (many students will have one; ask them to volunteer to use it for their group)
- A list of species identification websites (check your state's DNR website), or field-identification guidebooks
- Optional: a group budget for supplies (I provided each group with a \$75 budget using funds from the course lab fees, and my students used this budget for various supplies such as butterfly nets, field stake flags, and soil test kits)

Teacher Implementation Part 1: Designing & Introducing the Project

When starting to design this project, first decide the following:

- The number of class sessions to devote to the project
- The number of students per group, and whether you will assign group membership or let students choose their group members
- Locations on or off campus that will be used for the tours, and whether you will assign groups to locations or let them choose
 - The budget amount (if any) for each group, and a deadline by which groups should submit their request/proposal for supplies to you
 - The date(s) on which students will present their tours, with at least one back-up option in case of inclement weather

When introducing this project to students, clearly communicate the project goals, rationale, deadlines, and assessment criteria (Table 1; also see assessment section below). Students may not be familiar with ecotourism, so it is helpful to describe eco tours and have students that have attended one share their experiences. Then, advise students on additional project expectations, including the approximate length of time and intended audience for the tours, procedures for sharing information in the shared online space, procedures for supply requests, completion of progress reports, participation by group members, and acceptable forms of task allocation within groups. Finally, contact the campus security office and grounds crew to inform them about the project and make them aware of the days they can expect to find students working outdoors at the tour sites.

Teacher Implementation Part 2: Maintaining Momentum over Multiple Project Sessions

To assist groups with making progress in this project, strive to create a balance between both

Table 2. Content guidelines. Provide a few content guidelines during each project session.

Area of Biology	Sample content guidelines to provide to students (tailor guidelines to your class content)
Species concepts	<i>Identify at least six species present on your tour and explain how participants can identify each.</i>
Nature of science	<i>Develop and answer a biological question in your tour area using the scientific method. Summarize the methods and findings of a recent biological study involving a species on your tour.</i>
Evolution	<i>Identify and explain an adaptation of a species on your tour. Briefly explain the evolutionary history (or life history strategy) of a species on your tour. Explain and provide an example of sexual dimorphism on your tour.</i>
Genetics & molecular biology	<i>Determine the genetic basis of an observable trait on your tour: - What is the mode of inheritance displayed by this trait (incomplete dominance, epistasis, etc.)? - What genotypes and phenotypes are possible for this trait? - What gene(s) is/are involved in the phenotypic expression of this trait?</i>
Population ecology	<i>Use a sampling technique to estimate population size for a species on your tour. Explain abiotic & biotic factors that may influence population size for a species on your tour.</i>
Community ecology	<i>Find an interaction involving two species on your tour: - Describe the type of interaction (competition, parasitism, mutualism, etc.). - Explain in detail the specific positive/negative effect on each species in the pair. Estimate measures of community structure (species richness, diversity, etc.).</i>
Ecosystem ecology	<i>Determine the habitat type of your tour area. Explain in detail the various ecosystem services provided by your habitat. Explain how nutrient cycling occurs in your habitat. Measure and explain the significance of soil nutrient levels across various locations in your area.</i>
Human impacts	<i>Identify an introduced or invasive species along your tour; describe history and impacts. Identify an example of habitat fragmentation along your tour, and explain impacts. Identify an example of pollution along your tour, and explain impacts. For each species you've identified, list two interesting economic uses. Detail the campus history involved in the creation, maintenance, and use of your tour area.</i>

structure and flexibility. To provide structure and guidance, provide the groups with content guidelines (specific content that they must include in their final eco tour; see Table 2). I recommend assigning only between one and three content guidelines during each project session. This allows you to introduce guidelines tailored to current topics being covered in the class and allows students an opportunity to focus their efforts on target guidelines during each project session. To promote creativity, devote part of a few project sessions to the specific task of developing creative content.

I recommend conducting each project session as follows. First, have students review their most recent progress reports to determine what they need to complete during this session. Second, assign one to three new content guidelines and remind groups to continue developing their own creative content. Third, turn students loose to visit their site and/or work on research and the PowerPoint file in a nearby computer room. While students are working, visit each group in turn. During these visits, encourage students to make observations, ensure that all group members are contributing, and answer questions. At the very end of the session, have each group fill out a detailed progress report (Table 3). Read these reports after class and follow up with groups accordingly.

Teacher Implementation Part 3: Finalizing Preparation for the Eco Tours

Near the end of the project, remind students that they should be delivering their eco tour in a professional manner. To encourage high performance by the students, I recommend that teachers do

the following. First, have the PowerPoint file due at least 24 hours in advance of the tour so that students can focus on practicing their presentations outside at their tour site. Second, consider inviting a few other students/faculty/staff on campus to attend the tours, and inform groups that they might have additional guests on their tour. Third, give groups several opportunities to practice multiple run-throughs of their tour in advance of the due date. Finally, address logistical considerations: stress the importance of attendance and participation during the tours, announce the order of tour presentations, and instruct students to come dressed for the weather.

During the last project session, have students fill out peer-evaluation forms. The purpose of the peer evaluation is to give students an opportunity to discuss how effectively their group functioned as a team, and to comment on the relative contributions of each of their peers to the project. After watching the group eco tours, teachers may use the results of the peer evaluations to adjust individual student grades.

On the day(s) of the eco tours, remind guides that they should speak loudly and wait to speak until the class gathers in an area. Additionally, remind participants that they are welcome to ask questions during the tour. Allow time for a quick break between every couple of tours so that students can rest and have a snack. Finally, enjoy the tours! One major benefit of the PowerPoint file is that it provides documentation of the tour contents, so that while you are attending the actual eco tours you can focus on the groups' speaking skills. You can also use the PowerPoint file as a back-up option in the unfortunate case of inclement weather.

○ Student Assessment

For a group project like this, involving specific content guidelines but also allowing students a great deal of flexibility, it is important to clearly explain how you will be assessing the projects. I provide my students with specific assessment criteria when I first introduce the project (see Table 1). During the course of the project, I remind students about the various assessment criteria and allow ample opportunities for students to ask questions and request clarifications. You may wish to assign weights to the various components; for example, I tell students that their grade will be primarily based on their actual eco tour, and only secondarily based on their PowerPoint file.

Table 3. Eco Tour Progress Report. Students fill these out in detail at the end of each project session.

Progress Report
Tour location:
Date:
Group members present today:
What did you accomplish today in regard to the <i>content guidelines</i> ?
What did you accomplish today in regard to <i>creative content</i> ?
What do you need to work on/follow up on the next time your group meets?

○ Instructor Thoughts & Student Comments

This project is a nice supplement to an introductory biology course. It provides opportunities for everyone to go outside, spend time observing nature, and develop and implement creative ideas. It also engages students in applying knowledge from class to the local campus environment. This project does involve teamwork, which may pose challenges to students who prefer independent work. However, tour groups can allocate tasks in ways that best utilize the strengths and interests of the group members. For example, some of the tour groups in my class had designated photographers, technical gurus, and history buffs.

When it came time for my student groups to give their tours, I was very impressed by the professionalism and enthusiasm of the guides (Figure 1). I was also highly impressed by the groups' creative content. My students incorporated many creative aspects into their tours, including hands-on demonstrations of cattail features, opportunities for participants to practice catching dragonflies, informative photos shown on an iPad, detailed maps of historical campus features, and food samples (pure maple syrup and sassafras tea).

Here are selected comments my students wrote 5 days after the tours (comments provided by all students were positive):

- "It was really cool how we were able to apply what we learned in class to what we saw on our trail (ex: trees bending to get light)."
- "Giving the eco tour was beneficial in practicing my presentation skills."
- "I actually took time on my way to class today to watch this insect pollinating a [flower]... I wouldn't have stopped to observe what was going on before this class."



Figure 1. A group of tour guides discusses abiotic and biotic characteristics of freshwater stream habitats (left), and a tour guide teaches the class how to identify sassafras trees (right). (Photos by the author.)

- “The tours were good; great way to force a class to apply concepts, explain them, show examples, and enjoy it.”

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