



Original research article

Enhancing student engagement and learning via the optional Biodiversity Challenge



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HIGHLIGHTS

- The Biodiversity Challenge asks students to submit slides on taxa they choose.
- Challenges offer examples of concepts and are easy to integrate into lectures.
- Students enthusiastically use and enjoy the optional Biodiversity Challenge.
- The Challenge increases student learning, participation, and value for species.

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ABSTRACT

Many of the world's species are unknown to the public, which potentially hampers support for conservation. Conservation ecologists often identify the need for better educational tools to train students to recognize these knowledge gaps. Here, I describe the optional Biodiversity Challenge that I use in my Conservation Biology course. It asks students to submit slides on taxa they find interesting; I incorporate slides into lectures and students are rewarded with chocolate and possible extra credit. Students reported that the Biodiversity Challenge increased their participation in the course, increased the value they had for conserving poorly known taxa, and enhanced their knowledge of conservation biology as well as making them deeply aware of the knowledge gaps we face in the discipline. This simple but versatile optional assignment could easily be adapted to other courses, such as evolution, animal behaviour, ecosystem-based courses, or restoration ecology.

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1. Introduction

Teachers strive to capture the interest, attention, and even passion of their students. Conservation ecologists strive to capture the imagination of the public, with an ultimate aim of motivating changes in policy and action that reduce our damaging impacts on other species. In both contexts, ecologists are hampered because the number of species vastly outnumbers the internal taxonomies our students and the public have. In our teaching, we often use well-known species as our default examples for conservation challenges (pandas *Ailuropoda melanoleuca*, salmon *Oncorhynchus nerka*, wolves *Canis lupus*, starlings *Sturnus vulgaris*, kudzu *Pueraria lobata*) rather than drawing from the numerically dominant beetles, marine invertebrates, lichens, or fungi. Indeed, Nichols and Gómez (2011) pointedly suggest that parasites are hugely under-represented in our mental lexicons of teaching conservation biology, despite many parasites suffering the same or even higher rates of imperilment than the more noticeable frogs, birds, and mammals (to underscore their point, how many

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threatened or endangered parasites can you name?). So one fundamental challenge we face as conservation educators is helping our students to remember that there are many more species than they will ever know in their lives, never mind that there are many unknown or little-known species on the planet, with many also at risk of extinction.

In the face of this knowledge gap about biodiversity, a basic question I confront in my 4th year Conservation Biology course is how to help students better appreciate that the concepts, tools, and threats we address in the course apply both to these student-unknown taxa as well as to the several hundred charismatic, local, or other species that each student knows. This simple question about how to embed this appreciation for all biodiversity into students' learning ties into several important ideas. First, if students remember that many taxa exist, it helps motivate conservation for ecosystems or regions, rather than managing based primarily on focal or well-known species. Second, it helps students in the educational transition from thinking science is a received body of facts to science as a way of exploring the unknown; when confronted with a species for which all we know is a taxonomy, students realize just how much knowledge would be useful to have to make a conservation plan for it and that such knowledge comes from people conducting research to obtain such information. Third, it helps students to have a richer understanding of the many ecological interactions that each species has.

In this paper, I outline an optional assignment I use in my Conservation Biology course. It asks students to become better acquainted with biodiversity by submitting some slides on a taxon of their choosing for use in lecture. As I illustrate below, this very simple assignment has helped students to better appreciate biodiversity, engage more deeply with the course material, and become more committed to conservation activities. In so doing, I provide a case study of an individual-based active learning technique for a university lecture course in conservation biology; much of the literature on teaching techniques in ecology focuses on laboratory or field exercises (Burt et al., 2012), group-based projects or cooperative learning (Moen et al., 2000; Etchberger, 2011), or countering misconceptions (D'Avanzo et al., 2012).

2. The basics of the Biodiversity Challenge

There is a clear mismatch between existing biodiversity (e.g., high diversity of beetles, fungi, and marine invertebrates), global assessments of risk to known taxa (e.g., how many taxa have even been addressed by bodies such as the International Union for the Conservation of Nature (IUCN)), and students' awareness of taxa at-risk (their mental lists are dominated by large-bodied or charismatic mammals and birds, as I routinely observe when I ask them to do a short in-class list of species of conservation concern). To help students understand biodiversity and threats to species a bit better, in 2009 I developed an optional assignment for my 4th-year/graduate Conservation Biology course. In the second lecture of the course, I provide an overview of known taxonomic diversity on the planet, estimates of how many taxa are as-yet-unnamed, and current estimates of imperilment across major taxonomic groups. I then issue the Biodiversity Challenge via several PowerPoint slides and a hand-out (Supplemental Online Material, see Appendix 1). The challenge asks students to submit 2–5 slides on a taxon of their choice (species, genus, or higher taxon); students are encouraged to provide information on basic biology, conservation status, and known threats to the taxon. I then select from the submissions and integrate them into subsequent lectures, often using the taxon as an example elsewhere in the lecture. I lightly edit the slides to reduce wordiness, correct spelling or grammar mistakes, and ensure PowerPoint compatibility. I embed the students' slides within my lecture, so backgrounds on slides are often altered as well. Students must cite their sources and avoid plagiarism as per detailed instructions given on the syllabus, and as I select submissions for use, I check on students' use of sources.

From 2009 to 2015, I have taught the course 4 times. In 2009 and 2012, the student was given a reward of a chocolate bar when his or her Biodiversity Challenge was chosen. In those years, I received a high number of challenges with familiar taxa (e.g., rhinoceros *Rhinocerotidae*, cheetah *Acinonyx jubatus*, giant redwood *Sequoia sempervirens*, kiwi *Apteryx mantelli*) and the slides did not contain as much conservation information as I had hoped; students also relied more on poorer sources (e.g., Wikipedia). In 2014, I made the assignment more explicit in terms of useful content, as well as suggesting a number of scientifically curated websites with credible biodiversity information.

I also encouraged students to explore taxa they or their classmates might not know: I offered one exam question if I did not know the taxon they submitted, and a second exam question if I did not know the taxon and none of their classmates knew the taxon. To probe for class knowledge, after presenting a Challenge I simply asked if anyone had awareness of the taxon. I set a low bar, i.e. whether a student even knew the taxon existed on the planet (this low bar makes extra credit hard to obtain). Most often, though, students claiming taxon knowledge were able to add information about the taxon or say where or how they had learned about it, so I was confident students were not falsely claiming knowledge. The majority of my exam questions are 6 points apiece; this reward was for 6 points. To use the reward, students simply wrote "Biodiversity Challenge" for an exam question of their choosing. To date, the maximum number of points a student has been awarded in a semester is 24, for two challenges of species unknown to me and to the class; in the term, there are 1000 points worth of assignments and exams, so the actual grade impact of this reward is minor.

2.1. Submissions to the Biodiversity Challenge

During four runs of the course, I have lacked submissions for only 3 classes out of 84 possible lecture spots, and those gaps were in the first two years. In 2012, I closed the last class with several challenges because I had extras; in 2014 and 2015, I used two or more challenges in 12 lectures because I received many submissions (Table 1). In 2015, I had far more

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