Expanding coverage of sustainability in
BSCI 106: Principles of Biology II - Ecology, Evolution, & Diversity

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In the Fall of 2015 I will teach Principles of Biology II (BSCI 106), a large introductory biology course that reaches many incoming freshmen intending to pursue a major in biology, as well as many non-majors. The course covers major concepts in ecology and evolution and provides an overview of biological diversity, and is thus a natural course for covering concepts related to sustainability. This course already historically covers topics such as human population growth, carrying capacity, global climate change, and human-caused extinction. Inspired in part by the faculty workshop on sustainability, I will add new topics and increase the depth of coverage of existing topics related to sustainability issues in Fall 2015 (and beyond), with specific plans and goals as outlined below.

(1) Increase awareness of the data behind sustainability issues by incorporating many new graphs and data summaries in quantitative form into lectures.

> When I teach BSCI 106 I place a large emphasis on quantitative reasoning and graph interpretation. During and subsequent to the workshop I have found many excellent graphs to help convey the data behind issues related to sustainability and these make powerful examples to discuss. I often display graphs in lecture and have students take some time to read and interpret the graph on their own, and then answer several questions either on their own or with fellow students. Graphs related to issues of sustainability make powerful examples to discuss, and the data they contain can then prompt in class small-group discussions about solutions to the problems being presented.

> I will add more such in-class graph interpretation & discussion exercises on topics related to sustainability, helping students to understand the data behind some major environmental issues as well as helping them to initiate a dialog with their classmates about solutions to these issues. Topics that I will add graphical data on include climate change, carbon emissions, population growth, carrying capacity, water uses in agriculture, patterns of extinction, and alternatives to GDP as a metric of "success" (e.g., happiness indices). Many of the graphs I have already found come from resources I learned about at the workshop or found through UMD's Sustainability website, with those on GlobalEducationProject.org being a real treasure trove!

> Student learning will be assessed primarily through exams, where graphs (similar to those discussed in class) and discussion points will be incorporated into exam questions.

(2) Encourage students to use their sustainability-related knowledge to influence real-life choices (that they make or that policy-makers make) by adding two new assignments.

> Two new assignments will be added to this course to help students transform their knowledge of sustainability into action and to make data-driven decisions.

> The first of these will be to write to an elected representative on a topic related to environmental sustainability of their choice to influence the representative's policy decisions. Students will need to include in their letter some quantitative data to back up their reasoning. Student assessment will be made by having students submit an electronic

copy of the letter to me so that I can evaluate that the data are appropriately used to make the student's point and that the scientific conclusions are sound.

The second of these assignments will involve reading a short essay (e.g., from Choices for Sustainable Living) or viewing a short video (e.g., The Story of Stuff) and writing a brief description of how the personal choices that they make can influence one or more ecological, evolutionary, or biodiversity topics discussed in the course. I will read and evaluate these for logical flow of their arguments.

(3) Have students experience first-hand the powerful forces that lead to the Tragedy of the Commons through an in-class exercise.

I will incorporate some version of the Tragedy of the Commons exercise (recently highlighted by a UMD Psychology instructor in a Washington Post op-ed piece) into my class. This exercise makes for a very powerful and personal way to appreciate how and why the Tragedy of the Commons comes about:
https://www.washingtonpost.com/posteverything/wp/2015/07/20/why-i-give-my-students-a-tragedy-of-the-commons-extra-credit-challenge/?hpid=z10

I will couple this exercise with an in-class presentation of the Tragedy of the Commons and how it has led to environmental degradation and over-exploitation. We will then have an in-class discussion during a subsequent lecture (giving students some time to reflect on the exercise first) about how to counter-balance the forces that lead to this effect. Learning will be assessed by including questions related to this exercise and the associated discussion on an exam.

(4) Have students understand how lifestyle influences carbon emissions by having students calculate carbon footprints.

I will add a new homework on calculating and plotting the results of carbon footprints. In the first part of the homework, students will calculate their footprints using at least two different online footprint calculators (e.g., EPA household, TerraPass, Carbonfootprint, MyFootprint.org). They will plot their results and describe how the two calculators differ in their inputs and outputs, as well as what additional information or complexity they would add to this calculation to improve the calculator and make the data output more accurate. In the second part of the homework, students will use one of these calculators and answer the calculator's prompts as if they were their parents at their age, and as if they were their grandparents at their age (to the best of their knowledge). They will then plot all of these data along with current average carbon footprint values from the US and other countries and discuss the magnitude of the differences in footprints across generations and countries, and their understanding of what differences in lifestyle lead to these differences in footprints. I will present in class a graph of the distribution of carbon emissions of students in the class, so that students can see where they fall out within the community of the classroom, followed up by a discussion of how societal norms change. Learning will be assessed by grading this homework as well as by incorporating a question related to this homework and subsequent discussion on a subsequent exam.