

Description of my integration of sustainability into BSCI 467, “Freshwater Biology”

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Sustainability of freshwater resources for future generations is a major concern of governments, economies, and citizens across the globe. Although “Freshwater Biology” focuses on ecological processes and organismal species that are found in freshwater habitats, I am unable to avoid discussions of human use and abuse of water resources. I have made a number of changes in the syllabus as well as plans for topics to directly address the inclusion of sustainability principles in the course. Generally, these changes fit into 3 objectives:

1. To include the topic of sustainability in my “Science Friday” discussions. On Fridays, I bring up a recent topic in the news or scientific literature in relation to freshwaters. I plan to use a topic of freshwater resource sustainability on at least three occasions. Although the specific topics will be based on current events, examples of these topics may be 1) flooding caused by mismanagement of rivers through damming and channelization, 2) melting of glaciers in Asia caused by climate change, thus increasing variation in public water supplies, and 3) ecosystem services provided by freshwater organisms that help clean our water supplies. Questions from these discussions will be included on the midterm and final exams.
2. To engage students in a week-long discussion of sustainability of water resources. The week will begin with a background lecture on the importance of sustaining water resources for future generations. Conflicts are common over water resources between nations as well as among states within nations. Case history examples will be provided of the Colorado River, the Nile River, and Chinese rivers originating in the Himalayas. In addition to allocation of the *quantity* of water resources, the need to protect the *quality* of water resources will also be discussed. Thus, examples of past and current pollution will be provided, with a focus on how to maintain clean water through laws and regulation. (Lectures later in the semester will include aspects of current methods of biomonitoring and the maintenance of biodiversity.) At the end of the first lecture of the week, I will assign students to small groups to discuss a hypothetical conflict over water resources. Examples include:
 - a. Solutions for polluted water flow between adjacent states, specifically in the Platte River from Colorado to Nebraska.
 - b. Solutions for limited water supply for irrigation, municipal use, and industry within a California county.
 - c. Solutions for reducing deforestation of Kenyan land that is causing reduced seasonal flow of water in the Serengeti.
 - d. Solutions for adapting for expected climate change effects on water infrastructure in a municipality (to be named) as a result of precipitation extremes.

Within each group, students will be assigned a specific role among stakeholders representing citizens, government, industry representatives, and scientists. During the Wednesday class session, students will meet in their groups to discuss the problem,

suggest plans for possible solutions, suggest what information they will need for decision-making, and prepare an oral report for the whole class. On the Friday, each group of students will stand in front of the class and give a 10-minute report on their water resource conflict. Students will be graded on their engagement of the problem and their creativity of providing solutions.

3. To aid students to recognize the importance of water resources in their own lives. I provide homework assignments to students each week during the first half of the course. During one week, I will provide them with a set of discussion questions called the “American Rivers Quiz”, based loosely on information provided by the American Rivers organization. The questions are designed for students to use the internet to research and consider answers to such questions as:
 - a. Where does your drinking water come from? What is done to the water to purify it?
 - b. Where does your waste water go? What is done to it before it is released to the environment?
 - c. What happens when a quart of oil is spilled down a storm sewer?
 - d. What is the final destination of pesticides and fertilizers applied to lawns?
 - e. How can you influence the sustainability of water resources for future generations?

During the last week of the class, I will review the course in its entirety, with a focus on the overarching theme of sustainability of water resources. Applying the principles of sustainability to water resources is not only critical to humans, but also to the organisms residing in freshwater habitats. The balance of providing for our current and future needs, while maintaining biodiversity and critical ecosystem services in the landscape, is key to sustainable water resources.