Book Review of an Open Textbook – *Sustainability: A Comprehensive Foundation*

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Paper was once the lightest, lowest-cost way to make information widely available in a form suitable for study and self-improvement. But paper-based textbooks, in the modern era, tend to be heavy and they can also strain the budgets of typical students. Given the fact that you are now reading an open-access journal, you may understand why many faculty members would possibly want to use an open-access textbook for some of their courses. This editorial considers one such course, and the assessment is generally favorable. But in addition to the classroom, a good open textbook may be regarded as a suitable foundation for one's research. By citing an open textbook in the introduction to your research article, you can provide your readers with the option of gaining enough background to better appreciate your latest research findings.

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The Open Textbook, an Option for Faculty and Students

Recently I was asked to provide critical comments regarding an "open textbook". In the course of completing the assignment, I discovered aspects that seem worth passing along to readers of *BioResources*.

Like the journal that you are now reading, an open textbook can be defined as content that can be freely downloaded from the Internet. A main motivation fueling the movement towards open textbooks is to reduce costs for students. College students often pay many hundreds of dollars a semester for books, some of which they never look at again later. Many students, to avoid costs, take courses without acquiring the textbook. Instead they may use a superseded version, borrow a copy from friends, or find access to unauthorized electronic copies of a textbook in order to pass a course. Open textbooks, to the extent that they are being adopted by college faculty, can "level the playing field." They can help make education less dependent on the student's ability to pay, their attendance at a prestigious institution, or even where on the globe they are situated.

Open textbook publishing changes the scheme by which the publisher gets compensated for making the item available. In the case of traditional textbooks, the publisher first invests in creating the book, then attempts to recoup their costs by selling copies to students and to libraries. In the case of an open textbook, a funding organization, a university, or a benefactor may pay the publisher to produce the work, based on a commitment to make it freely available to anyone with a computer and a connection to the Internet. The author of such a book generally would be paid up front rather than having to wait for royalty payments. Many open textbooks, already available, can be obtained from a website at the University of Minnesota, http://open.umn.edu/.

A Source for Teaching about Sustainability

The book that I volunteered to critique is called *Sustainability: A Comprehensive Foundation.* As many readers of *BioResources* already will know, the topic of sustainability is very broad, encompassing information from many more fundamental fields. At 626 pages, this open textbook would probably be a two-volume set, if printed. The strength of the book, if we are allowed to use that term, is that the contributors have assembled a great deal of information in one place. If you suddenly need some basic information about climate change, you can find it somewhere in the open textbook. If you need to brush up on the terminology of life cycle assessment, US federal regulations, or resource economics, *etc.*, you can quickly find extensive explanations on those topics as well. Memorable images, such as pictures of the Deep Water Horizon oil spill and graphs of CO_2 levels over time, help enliven the text. The authors generally have done a great job in collecting the most prominent facts, opinions, and concepts, providing literature citations for each.

If I were teaching a course related to sustainability, I would be very tempted to assign readings from this book to my students. Since the students can view it or download it for free, I would feel no regret in assigning just a few pages. Alternatively, I could assign a series of essay questions, asking students to use the open textbook as their main resource. I could ask different teams of students to consider a specific issue, such as paper recycling, from the perspective of different chapters in the book, *e.g.* chapters on environmental policy, sustainable energy, ethics, and sustainable infrastructure. It would be fun to have such teams give back-to-back 20-minute presentations. I imagine that each team could become intrigued at how one set of processes can be perceived quite differently by people focusing on different aspects.

From a Cellulosic Materials Perspective

As someone who has a research interest in cellulosic materials, I found the following parts of the book especially interesting:

- The **Forword** to the book mentions that, according to some of the contributing authors, "the text does not necessarily present a self-consistent set of ideas." The discipline of sustainability is still in a state of rapid evolution and internal debate.
- **Chapter One** gives a nice overview of the IPAT equation, *i.e.* $I = P * A * T$, where I represents environmental impact, P represents human population, A represents per-capital consumption, and T represents environmental impact per unit of consumption. I liked the concluding statement of this chapter, which states more clearly than any other part of the book that "absent the enactment of new policies and practices … the future of humanity and the attainment of our aspirations and goals are not assured."
- As someone living in the US, I expect to refer often to **Chapter Two**, which gives a great overview of the evolution of US environmental law. Clearcutting (see Fig. 2.6 of the book) is one of the issues highlighted.
- In **Chapter Three** it was fascinating to read that "for most of the Earth's history, carbon dioxide concentrations have been higher than they are today". The culprit, apparently, has been those pesky lignocellulosic plants that keep sucking the CO_2 out of the atmosphere!

- **Chapter Four** helps to clarify terms like "ecosystem services". For instance, a forest can help to regulate the climate, decrease the intensity of flooding, and purify the water, in addition to providing inspiration and respite. Also, we learn in Chapter Four that "We harvest ~25% of the total plant biomass that is produced each year on land surface."
- **Chapter Six** gives background on environmental and resource economics. There's a great discussion of the "tragedy of the commons." For example, suppose that all land were public land and that there were no regulations; in such a system the resources would all tend to be depleted in a very short time. There's also a great discussion of "cap and trade" policies. The author makes the case that cap and trade is an efficient way to minimize or phase out unfavorable environmental activities, such as uses of leaded gasoline and chlorofluorocarbons.
- **Chapter Seven** has a nice discussion of incineration, which has the potential to convert wastes to energy. Even though there have been advances in incineration technology, people still don't trust that incineration will be carried out in such a way as to avoid the emission of toxic gasses or soot.
- Anyone engaged in the study of biomass-to-energy technologies is urged to study **Chapter Eight** of the book. Here we learn that coal, nuclear fission, and wind farms are often cheaper sources of energy than biomass, except that there are other problems. For instance, coal is non-renewable and tends to have a high CO_2 emission factor compared to other available fuels.
- Life cycle assessment (LCA) is covered in **Chapter Nine**. This is a must-read chapter for anyone starting to study LCA with a focus on cellulosic materials.

Open Textbooks as a Foundation for Research and Scientific Writing

Though I don't currently teach a course in sustainability, I do write about it, as you can plainly see. Have you ever experienced the frustration of needing a literature reference for something that ought to be well known, but which might not be known to all of your audience? You could cite a regular textbook, but such contents would be easily available only to a minority of your future readers. If you get lucky, you might be able to cite a review article, but many review articles require that either you or your institution must have paid a subscription fee or a per-item fee. You could cite something on Wikipedia, but you might be concerned that such content has no assigned author and can be revised at any time. In the case of an Open Textbook, when obtained through the University of Minnesota system, one has a chance to see what ratings have been given by previous readers, and you can read their comments. You have the option of citing portions of the book by chapter and even by page number – giving readers of your article free access to a "comprehensive foundation". Chapter 10 of the book (page 477) starts with the words, "Once we begin talking about sustainability, it's hard to stop." Accordingly, the book probably could be improved by shortening. But that's probably true for most writings, including this one.

Reference

Theis, T., and Tomkin, J. (eds.), *Sustainability: A Comprehensive Foundation*, http://legacy.cnx.org/content/col11325/1.43/