**Sustainability and Understanding Time**

**When I’m talking with students in geology courses about sustainability, I don’t use the word much. As one of my colleagues, Aaron Swoboda, puts it, we know what’s unsustainable about our current practices, but we don’t know too much about the opposite. Instead, I try to devise assignments around geoscience and sustainability that:**

* Complicate students’ analyses and judgments
* Help students connect their actions to consequences (personal, local, global)
* Deal with questions of efficacy of actions
* Examine the past carefully and critically
* Make the invisible visible ("Much of the damage inflicted on land is quite invisible to laymen," Aldo Leopold, Round River, cited by Dennis Anderson, Minneapolis Star Tribune, January 7 2011)

**One item on this list, “examine the past carefully and critically,” has been on my mind lately. I recently attended the biennial meeting of the American Quaternary Association (AMQUA) in Duluth, MN, June 20-25. The meeting, titled “From Floods to Droughts: Water, Climate Variability, and their Impacts in the Holocene,” was full of ironies, all related to what we, as geoscientists in society, consider “normal” in natural systems. We arrived in Duluth just after the area received up to 10 inches of rain in less than 24 hours June 19-20. The north shore of Lake Superior is steep, bedrock is at or near the surface, and the streams were overwhelmed by water. Lake Superior turned bright red as a result of the plumes of sediment from the rivers. Estimates of damage – for public infrastructure alone – are in the neighborhood of $100 million dollars. The previous week, we had a storm in southern Minnesota that that dumped 8.83 inches on our neighboring town of Cannon Falls (8.83 inches). In September 2010, we had the flood of record in Northfield.**

**Climate scientists, quite rightly, do not attribute these rainfalls (or the severe and prolonged droughts in other parts of the country) directly to anthropogenic global climate change. They say that the increased frequency of extreme events is consistent with expectations for a warming planet. And that’s where the talks we heard at AMQUA come in. Over and over, whether the subject was monsoon frequency in China, fires in the American west, drought in New England, the message from study of paleoclimate proxies is that the last 200 years doesn’t even come close to matching abrupt fluctuations in precipitation in the earlier parts of the Holocene. So what does sustainability mean in a world of constant natural change on which human climate forcing is superposed?**

**This is why the emphasis in geoscience on “examining the past” (deep time and on understanding the past, the present and the future together as a single temporal system is so important to convey to students while we are talking with them about the more conventional dimensions of sustainability (water, energy and mineral resources; life cycles of “stuff,” etc.). Sustainability isn’t about saving the earth or stopping climate change, it is about (perhaps) modulating the effects of natural and artificial transitions on human lives, societies, and ecosystems. History, as well as the Club of Rome, tells us that, depending on how we understand and manage (or not) these transitions, the result can be a graceful segue or a societal end in “fire or ice” (Robert Frost) or overshoot and collapse (Club of Rome).**

**Mary Savina**

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