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Review of *Curbing Catastrophe: Natural Hazards and Risk Reduction in the Modern World*

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Abstract

Timothy H. Dixon. 2017. *Curbing Catastrophe: Natural Hazards and Risk Reduction in the Modern World*. (New York, NY: Cambridge University Press) 300 pp. ISBN 978-1108113663.

In *Curbing Catastrophe*, Timothy H. Dixon explores commonalities among natural disasters like Hurricane Katrina, the 2010 earthquake in Haiti, and the meltdown at Fukushima. He identifies communication failure between scientists and policy makers as a major culprit in the devastation that results from such events and offers strategies for improving that communication. He includes optional in-depth scientific and quantitative examinations of the events and the resulting devastation, making the book appropriate for use in teaching as well as for recreational reading.

Keywords

global warming, climate change, natural disaster, geology, Fukushima, Hurricane Katrina, earthquakes, tsunamis, hurricanes, nuclear power, coal

Cover Page Footnote

Kira Hamman teaches mathematics and directs the Honors program at Pennsylvania State University, Mont Alto. In addition to curbing catastrophe, her interests include the intersection of mathematics and quantitative literacy with social justice issues. She is co-editor of an upcoming *Numeracy* special collection on that topic.

Another week, another catastrophe: earthquakes, tsunamis, wildfires, hurricanes; power grid failures and poisoned water supplies; melting ice caps, rising sea levels, starving polar bears. The list is long, and Timothy H. Dixon's new book *Curbing Catastrophe* wisely does not attempt a catalogue. Instead, Dixon seeks to identify similarities among a representative sample of such events–catastrophic commonalities, if you will—in the hope of finding ways to mitigate their effects, or better, avoid them altogether.

It's a noble goal, and Dixon does an admirable job working toward it. He examines recent major catastrophes, including Hurricane Katrina in 2005, the 2010 earthquake in Haiti, and the 2011 earthquake and resulting tsunami in Japan, and compares them to historical catastrophes such as the 1900 hurricane in Galveston, Texas and the 1911 fire at the Triangle Shirtwaist factory in New York. He notes that many readers may think this last example differs from the others in being a "human-made" disaster while the rest are "natural." But, Dixon says, the hurricanes, earthquakes, and tsunamis themselves are not the catastrophes; the resulting damage and loss of life are. In New Orleans, the disaster was not Katrina but the breach of the levees. In Haiti, it was the obliteration of infrastructure. In Japan, of course, it was the meltdown at the Fukushima nuclear power plant. Those catastrophes, he argues, stem from the same root causes as the fire. Comparing Triangle Shirtwaist to Fukushima he says, "both were preventable, and suffered from poor facility design, poor management, and lack of oversight. In both cases, common sense advice that in retrospect seems obvious was not followed."

The *Numeracy* reader may not be surprised to learn that the most significant commonality Dixon identifies among the various catastrophes is neither lack of knowledge nor lack of funding but lack of communication. Geologists knew the Japanese coast was likely to experience large tsunamis. Engineers knew the levees in New Orleans were too low. (According to Dixon there is a saying among engineers that there are two types of levees: those that have failed, and those that will fail.) Scientists, he says, "knew these disasters were inevitable, but felt powerless to do anything about them. The public was largely ignorant, and government officials … were focused on issues deemed more demanding." Quoting *Cool Hand Luke*, he lays blame for this "failure to communicate" squarely on, well, everyone. Scientists fail to communicate effectively about science to non-scientists, and public officials fail to listen to them.

Citing both Strunk & White's first rule of writing in *Elements of Style* ("use fewer words") and his own sixth-grade writing teacher ("always have a clear topic sentence"), Dixon chides scientists for unnecessarily convoluted and abstruse scientific writing. (As an aside, the book is worth reading for the well-chosen quotes alone.) Scientists quite rightly value precision. Beyond that, they are taught to be scrupulously honest about the level of certainty of a particular assertion, and to acknowledge the presence of uncertainty even when the level of certainty is high.

These are responsible habits for doing science, but they can be detrimental to effectively communicating it. When being interviewed by the media about the relationship of a catastrophic event to, for example, global warming, scientists will often emphasize the difficulty of determining causation, "and then go on to give a scientifically rigorous statement about possible statistical correlations, with appropriate caveats, an explanation of uncertainty, and perhaps a short introduction to radiative transfer theory." The audience, of course, stopped paying attention back at "it's hard to tell."

But there is plenty of blame to go around. Politicians and the public are "poor listeners." Those in the media are at best insufficiently critical of pseudoscience and at worst guilty of obfuscation in the name of balance. Beyond that, as a geologist Dixon is understandably convinced that a major part of the communication failure stems from the average person's inability to conceive of geologic time. Catastrophes, he argues, "may only show patterns when considered over thousands of years," making it difficult for many people to believe that such patterns exist. This makes natural events like hurricanes and earthquakes seem like random "acts of God" —unpredictable and, therefore, unpreventable. In fact, while the events themselves may be unpreventable, the damage they do could be mitigated by preparations like stronger building codes and updated infrastructure. The failure to see patterns on a long time scale causes people, and especially public officials, to resist making inconvenient and expensive preparations.

All of this is carefully laid out and well-articulated, but most of it will not be new to readers who have spent time thinking about issues of numeracy and scientific communication more broadly. It is Dixon's careful analysis of the science— and his meticulous connecting of scientific minutiae to broader issues— that makes the book different. He also threads economic considerations though virtually every topic, an innovation that expands the book's audience and potential impact considerably.

So, what to do? In the last chapter, Dixon offers some thoughts. With sections on communication, transparency, using the markets to effect change (a pleasantly surprising addition), the roles of technology and research & development, and the advisability of independent boards for review and oversight, the reader is left feeling, if not exactly hopeful, then at least not completely powerless.

Dixon's approachable tone and down-to-earth sense of humor make the book well suited as a project for the nightstand. That said, Dixon clearly also intends it for students, and his laid-back writing style is offset by an urgency that many students feel keenly. He doesn't shy away from sensitive topics like the disproportionate effects of climate change on nations which have had the least role in creating it. Beyond that, the necessity of quantitative and scientific literacy as prerequisites for meaningful engagement is implicit throughout, making the book a good fit for a quantitative literacy course. The main text includes boxed asides with deeper exploration of the scientific and quantitative issues raised, which would be great jumping-off points for class projects and discussions. And the online appendix, which sadly is not included with the print version, adds significant value in terms of making the book a tool for teaching. With expanded discussions of topics ranging from "what is a fault?" to the relationship between population growth and oil prices, and a whole section dedicated to "the magic of differential equations," the faculty reader might easily find herself inspired to assemble an entire syllabus around *Curbing Catastrophe*. And that would not be a bad idea. As catastrophe becomes practically routine in our world[1], we will need a generation prepared to cope with it. If they can learn to curb it, even better.

[1] Editor's footnote: For a discussion of how routine or rare certain events should be considered, including catastrophes, consult Tunstall's review of books by Lásló Mérő and David Hand appearing in this same issue of *Numeracy*.