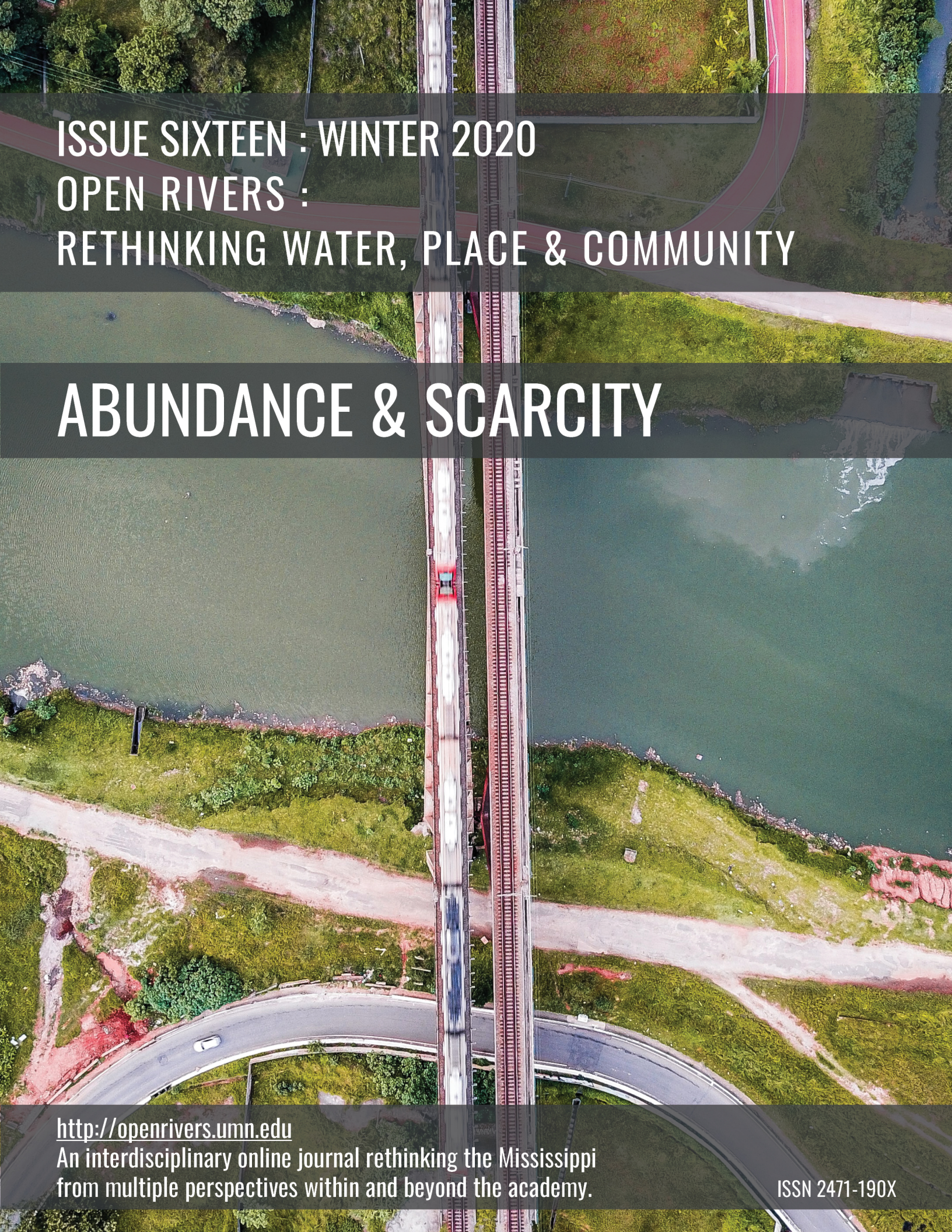

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TEACHING AND PRACTICE

SCIENCE 101: TEACHING SCIENTIFIC ANTHROPOLOGY IN THE AGE OF "ALTERNATIVE" FACTS

By Olivia Navarro-Farr

I am a professional archaeologist and researcher, but my primary role is that of teacher. I teach a range of courses in both anthropology and archaeology at a liberal arts school in the eastern Midwest. I typically offer at least one or more introductory classes each year. In these classes, students tend to represent diverse disciplines and grade levels whereas in upper division courses, students tend to be geared towards more specialized fields such as anthropology, sociology, and/or archaeology. As an archaeologist who teaches undergraduates, my classes have always dealt with elements of scientific process in research at various levels. One mainstay is discussing how scientists reconstruct ancient climate in order to more fully understand the conditions which

Scorched vegetation inside the Maya Biosphere Reserve at the Archaeological site of El Peruito following attempts to illegally invade the area in 2017. Image courtesy of Ever Sánchez of the Instituto de Antropología e Historia de Guatemala (IDAEH).

gave rise to major changes in paleoenvironment and therefore created conditions within which evolutionary forces could (re)act. Though I have periodically referenced how human-induced environmental changes are wreaking havoc and making impacts on our current evolutionary trajectory that we are ignoring as a global society, much to our detriment, I had not created specific content permitting consideration of these realities from archaeological perspectives. More specifically, I have not devoted, in any one of my classes, a specific section describing the challenges of archaeology in the Anthropocene. Therefore, when asked to contribute to a professional discussion about the Anthropocene and its importance with respect to teaching at a recent professional meeting, my responses to which are the subject of this brief article, I initially felt underprepared. Ultimately, however, I felt participating in this discussion would offer a perfect opportunity for me to learn how others present this information to students. At the same time, it also provoked me to think about the ways that I do cover material related to climate change, and how science literacy in general is so essential to critical thinking. I've also been challenged to deeply consider how I approach content delivery of items such as paleoclimate reconstruction, human-induced climate changes, and the impacts of such changes on our research today. Can I link these items together more deliberately? Can I link these items to present discourses on skepticism about science founded in a lack of trust or understanding of what science is? Can I build

From left, Sarah Van Oss (College of Wooster Class of 2016) and Haley Austin (College of Wooster Class of 2016) seen documenting a stela fragment at the site of El Perú-Waka' in 2015. Image courtesy of Keith Eppich.

this better into my learning goals for my courses? I would say "yes" to all. Before addressing my approaches to (re)considering course content, I provide some context for the discussion as it relates to teaching about science from my own disciplinary perspective.

A necessary feature for teaching about the basics of climate science (for my instructional purposes, as it relates to anthropological interpretations) is science literacy. In my more recent teaching experiences, I have not encountered significant pushback from students' willingness to accept scientific evidence. What I do sometimes encounter, however, is a degree of fear surrounding science-based courses that appears to be rooted in some degree of misunderstanding about science as a practice and as a way of knowing and measuring the world. I will return to this idea later.

The fact that most of the students I have encountered have not needed to be convinced about the validity of science, combined with the inherently progressive and insular nature of academia had resulted in a degree of naive comfort regarding my own broad assumptions that scientific reasoning was largely unquestioned more generally. The result was that I found the overt politicization of science and reactions to it from the far right of our political spectrum ahead of our recent election to be shocking. Since the events that led to the tumultuous and deeply concerning 2016 election and the March for Science that followed, I have been driven to find ways to instruct my students on how to educate others/peers about basic science literacy. I realized that, though my students might not need convincing, they would certainly encounter others in their worlds who would. I began to note that my mission should be to prepare them to encounter ignorance about science with enough literacy to comfortably engage with such thinking.

In order to more critically consider how my course content could more deliberately address humans' involvement with climate change in terms of a more recent and distinguishable geologic time frame, the term widely known as the "Anthropocene," I began to look at the kind of content I already include which is directly relevant to such discourses. I talk in classes about ancient climate, its fluctuations, and how we reconstruct these without spending as much time on how archaeologists can contribute to current discourses on growing illiteracy about science as process. I had not typically incorporated deliberate class discussions about how scientists could participate in the political conversation about policy and change in regard to climate change. Upon reflection I found this unconscious omission to be inconsistent with my deliberate efforts to talk about other forms of advocacy within academic work such as decolonizing archaeology and what archaeologists could bring to that classroom conversation. As I consider what critical conceptual connections I could cover more thoroughly in teaching on the Anthropocene specifically, and on the importance of science literacy more generally, I think it is important to strike a delicate balance between detailing how archaeology can inform a broader public on *both* (1) how pasts elucidate our present *and* (2) how pasts cannot be directly compared with current circumstances. This seemingly contradictory position presents a subtle dichotomy that must be carefully explained. I am not of the view that we can look to the past to extract seemingly convenient analogues of climate-related social perils and directly compare these with current systemic and global environmental crises. I do not favor using ancient people as examples for how we can and should do better today. I do believe, however, that we can look to the past to retrieve broad trends and explain that over *very* long periods, climate does fluctuate and that such fluctuations cannot be compared with the yearly extreme variances we see today.

In discussions on climate science, I include a cursory review of paleoclimatic reconstruction and its importance for understanding ancient evolutionary changes. I discuss that global climate has undergone numerous drastic changes, that Milankovich cycles have been identified as key to these processes, and that we have been able to reconstruct these changes over periods of deep time that coincide with changes in fossil evolution and structures of migration, adoption of agriculture, and the rise and fall of populations centers throughout the ancient world. It would be entirely appropriate to explain (1) how archaeology permits an understanding of how ancient climate fluctuations across time and space have impacted ancient evolution and history and then segue to (2) what this helps us understand about the far more drastic human-induced causes we see in this Anthropocene era (which would more appropriately be considered the result of global capitalist forces, an idea I return to below). The utility of archaeology here, as I see it, is not in explaining what we might learn from ancient cases of environmental mismanagement (which I believe is itself a deeply flawed notion) but rather that archaeological questions have helped pioneer advances in paleoclimate reconstruction. These efforts permit real advances in climate science. These not only give us clues to the past but help us track the devastating impacts of global capitalism on our climate in real time.

I talk about paleoclimate reconstruction in my archaeology introductory courses and in my physical anthropology courses. My goals, in both instances, are to provide context. The context varies with the details of the courses. For example, in archaeology class I focus on how paleoclimate reconstruction allowed archaeologists to reconstruct the peopling of the Americas. In the physical anthropology class, paleoclimate reconstruction plays a much more central role throughout the course. Specifically, it permits reconstruction of the changing climatic and environmental circumstances which shaped and conditioned fossil hominin and primate evolutionary processes through natural selection adaptations. In terms of the impacts of climate change on research, I discuss certain examples, such as permafrost thawing and the emergence of evidence from Arctic conditions (one example is the naturally mummified remains of a man dating to between 3400 and 3100 B.C.E. discovered in the Otztal Alps known popularly as Otzi) as well as how submerged coastlines and coastal sites makes research on Paleoindian coastal route migrations challenging. In my upper division Archaeological Method and Theory course, we discuss partnerships between ecologists and archaeologists with cases from the Andes and the American Southwest, detailing how a closer collaboration between archaeologists and ecologists can provide important avenues for reintroducing ancient and highly sustainable agricultural practices.

One topic I also cover in both my Introductory Archaeology and in my First Year Seminar course deals with human-induced climate change and the "collapse" of the Maya. Though I handle this issue in both classes, I treat it in far greater detail in my First Year Seminar course, titled "Ancient and Modern Maya Worlds." In that class, we discuss how the Maya are conveyed to publics through five primary and popular discourses. These include the film *Apocalypto*, the Maya "collapse," the 2012 phenomenon, tourism, and museums and looted ancient Maya art. Good, bad, or indifferent, these discourses tend to frame most modern (Western) publics' knowledge of these complex people. The problem arises when dominant voices in those discourses (commanding the most attention and incurring the greatest profits) are people with actually limited knowledge of the ancient and modern Maya. One of those discourses we discuss and challenge, drawing on archaeological responses (see McAnany and Yoffee 2010) is that presented by UCLA Professor of Geography Jared Diamond (2005) through his book, *Collapse: How Societies Choose to Fail or Succeed*. Diamond devotes a chapter to the ancient Maya collapse as

Dr. Matt Ricker, North Carolina State University, doing a soil core in the northeast tank at the site of El Perú-Waka'. Image courtesy of Damien Marken.

a result of environmental degradation and therefore as a warning narrative about how societal failure resulted from long-term environmental mismanagement. The balance here is explaining the importance of understanding human influences in delicately balanced ecologies and biotopes while also struggling against Diamond's far-reaching and influential voice as his discourse appears to fault ancient peoples (the Maya, the ancestral Puebloans, etc.) for their own demise. Emphasizing the latter is problematic because it reads to wider audiences as blame of ancient Indigenous peoples for past societal demise rather than focusing on resiliency, long-term success, and the achievement of balance in an otherwise challenging environment over millennia. The ancient episodes of societal shifts which Diamond characterizes in the title of his book as "failure" are complex and deserve nuanced consideration. They can hardly be used to contextualize or be compared with circumstances which frame contemporary challenges, including modern post–industrial capitalist zeal for the bottom line and fossil fuel industry at the cost of humanity and, in particular, at greatest cost to those most on the margins of our globalized world. Current reliance on fossil-fuel capitalism endangers greater scales of planetary systems, both social and biophysical.

Therefore, my response to this problematic discourse is not to suggest that the Maya or any other ancient or indeed modern people do not modify their environment, nor do I suggest that such modifications won't be potentially detrimental in the longer term. What I do suggest is that the discourse comes across as blaming the ancient Maya and using a poorly understood narrative about their cultural demise as a lesson for contemporary Westerners about how to avoid perils we face today. The problems of this approach are directly analogous with those that uncritically blame humans for modern environmental degradation. We know this to be a supremely complex process, though the term "Anthropocene" would seem to suggest it can rather simply be attributed broadly to humans, rather than more rightly blaming structures of modern capitalism for their role in perpetuating these troubling patterns. Following scholars such as Jason Moore (2016, 2017), a more appropriate (though far less utilized) term would be the Capitalocene. The blaming of humanity without looking to the capitalist structures that create our circumstances is just as irresponsible as painting the ancient Maya collapse as an environmental disaster narrative (rather than as that of a political institution), and comparing the consequences of it with the extravagances of our modern post-industrial capitalist system. The material I teach aims to draw students' attention to these complexities and questions; part of that critical inquiry is using scientific reason to contest narratives which can do real damage to Indigenous and descendant communities.

As stated earlier, though I do emphasize issues concerning climate science in various classes, I have more recently paid greatest attention to emphasizing a deeper understanding of science as process and science literacy in nearly all the classes that I offer to anthropology, sociology, and archaeology students. Central to my efforts is gaining a better understanding of how my students react to this information. This work has yielded some interesting insights. In my physical anthropology class, I've focused most intently on instilling a focus on science literacy precisely because this course fulfills science credit requirements. My sense is that this course may be deemed less daunting than other "hard science" courses (such as chemistry or biology) and thus more amenable to social science students who have some trepidation about those other fields. This class is therefore an important "gateway" science course and may be one of the few such courses the social science and/or humanities-centered students take during their four years. From that perspective, this presents a real opportunity to educate an audience with mixed feelings about hard science classes. In the first two weeks, I

focus on how we define and understand science. I begin on our first day by distributing a PBS-based science survey form available through their program on evolution distributed by NOVA. After that first day, we go on to discuss why science matters for social policy and review an historical lesson on science in politics through the PBS documentary "Judgement Day: Intelligent Design on Trial." This documentary reviews the case of *Kitzmiller v. Dover Area School District* of Dover, Pennsylvania, which evaluated whether or not intelligent design could be considered science and therefore included in school science class discussions as an alternative to Darwinian evolutionary theory. We then talk about what science is and why that question matters. We follow that conversation with the results of the science survey. The survey has the advantage of being short and straightforward. Students must survey at least four individuals of varied ages and backgrounds with the list of questions provided. I have never crunched the numbers on these data because I pass work back during the semester, so I don't have responses in my possession. What I *can* present here are my impressions of some of the qualitative responses that students have talked about in our class discussions, which are telling. The two survey questions which yield the most interesting and widely discussed responses in our classes are as follows: (1) What is science? (2) Do you like science? Why or why not? Many of the students find their respondents have a wider-ranging understanding of science than they might express. Many who have ill-formed ideas about science express a decided fear about science. Specifically, our educational predilection for grades has left many with a fear that science is out of reach or simply too labyrinthine to achieve a satisfactory grade. Those who may not see themselves performing well, academically speaking, in science are those who tend to express that they do not like science. I've used the exercise to start a conversation on how misunderstanding and/or fear of science may lead to rejection of it—though science need not be an endeavor that is out of reach. Rather, given the fact that many of my students are in the social science fields, I attempt to speak to them as scientists in training and instill an understanding that science as process is a clear path to critical thinking. We work on unpacking terminology—exploring complex words like empiricism (the idea that all knowledge derives from sensory, and therefore independently verifiable, observation) and falsifiability (a test of science which is that scientific questions must be disprovable or falsifiable). These terms can be confusing if not spelled out specifically in terms of how they are meaningful within scientific understanding. As with these complex concepts, even far simpler terms, because of their colloquial familiarity, can be profoundly misunderstood in scientific contexts. A major example is the term "theory" which is frequently synonymized with terms such as "hunch." We talk about how "theories" in science are not mere hunches or untested ideas based on one's "gut feeling." But, because of this unfortunate conflation, scientific theories can be questioned in popular discourse precisely because of the frequent association of "theory" with the idea of a "hunch" which may result in its being easily dismissed by popular audiences who are unfamiliar with the definition of the word "theory" in a scientific context. We who teach may assume the word "theory" is understood in a scientific context—but if it is not, the results can be disastrous. That entire process of unpacking terminology is the basis for scientific literacy; however, I would not have understood that I should probe students on these and other assumptions had I not introduced the aforementioned short survey which revealed this pattern to me. When we discuss our survey results, the students are always entirely engaged and really enjoy talking about what they've learned from their results about how people think of science. We also talk about how scientific opinion is not shaped by the opinions of people on the street. Science is not a democracy of ideas, but a competitive arena for seeking solutions to challenging problems. It is driven by skepticism, empiricism, and replicability through experimentation.

Further, we consider the difference between thinking of science as a subject in school versus as a way to understand the world; we also consider the importance of scientific literacy in the twenty-first century, a time when science influences every aspect of our lives from shopping at the grocery store (genetically modified food), to choosing a car (environmental implications), to voting on political issues (global climate change and increased frequency of extreme weather events, health, habitat conservation, and technology). The nexus of these ideas with the results of their surveys always provides an important starting point for grasping why science literacy is so fundamental to critical thinking.

Increased deliberate engagement of science literacy with students and teaching them to be advocates for science is also relevant in view of the discussions we are currently having on our campus as we look to broader curricular changes. These changes include questions about how to more effectively bring the sciences and the humanities together on concerns about social justice, and how to combat perceptions that antagonism exists between STEM (science, technology, engineering, and math) fields and the humanities. As an archaeologist of the ancient Americas, I see myself straddling these perceived gulfs almost daily. Regarding the importance of social justice issues with respect to science and/or STEM specific fields, I argue that a focus on global climate change and its impacts (including but not limited to unsustainable levels of energy use, the impacts of the green revolution, invasive species, the fossil fuel industry, and unchecked corporate interests that exploit sacred and protected landscapes home to diverse habitats and species) are inherent to issues of social justice. At greatest risk in our inexorable move beyond sustainability and a point of no return are those at the margins of our global communities—those who have long been exploited most vigorously and whose practices have been undermined and rendered obsolete by industrial scale agriculture and monocropping. These communities will be affected most severely by our inaction. We have seen the vulnerable Caribbean islands, including our own people of Puerto Rico, destroyed by a string of devastating hurricanes made deadlier by ever warmer sea temperatures. Our global economic policies have long exploited Puerto Ricans, rendering them colonized peoples without even the ability to represent themselves in our national government. Since that devastation I have seen museum experts and archaeologists scrambling to protect those at-risk cultural resources while people remain for months afterwards without basic utilities. As I see it, if I am to do better, and if I am to connect science discourse with social change, it is on behalf of those most vulnerable to these exploitative practices that I should be raising my voice while continuing to draw my students' attention to those disparities.

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