Discussing Geohazards and the Importance of Diversity in STEM

Authors: Robby Goldman and Camille Nava

(left to right, top to bottom) Camille Nava, Robby Goldman, Carrie McIntosh, and Mahta Ansari

In October 2019, the geoscience research and education consortium UNAVCO sponsored a short course in Portland, OR for journalists and geoscience students to develop and practice skills for responsible communication of geologic hazards, or geohazards. Following the course, two of these students, Robby Goldman (University of Illinois Urbana-Champaign) and Camille Nava (Portland State University), hosted a conversation with two of Robby's geoscience colleagues, Mahta Ansari (University of Illinois) and Carrie McIntosh (Scripps Institute of Oceanography, University of California San Diego). This conversation, summarized below, provides an inside perspective of how geoscientists think about natural hazards. This discussion also demonstrates the importance of promoting diversity in the sciences, and the need for scientists studying natural phenomena to inform and empathize with communities of people who are vulnerable to natural hazards.

An introduction to geohazards, and how scientists can communicate effectively with the public

Robby began the discussion with a definition of volcanic risk: "There are currently 57 volcanoes in the United States that pose a high or very high threat to people[1]. Volcanic threat, or risk, consists of two components. First is a volcano's ability to erupt dangerous materials, including lava, ash, and fast-moving mudslides called lahars. Second is the vulnerability of people, infrastructure, and aircraft to being harmed by those hazards." The most obvious volcanic threats occur shortly after an eruption begins. In Hawaii, for example, the 2018 eruption of lava from Kīlauea volcano on the Island of Hawaiʻi destroyed hundreds of homes in the lower Puna district.

[1] Ewert, J.W., Diefenbach, A.K., and Ramsey, D.W., 2018, 2018 update to the U.S. Geological Survey national volcanic threat assessment: U.S. Geological Survey Scientific Investigations Report 2018-5140, 40p., https://doi.org/10.3133/sir20185140.

Mahta, a PhD student studying groundwater contamination, notes that after an ash-producing volcanic eruption, the pollution of surface water by falling ash is often overlooked and can have long-lasting effects. Ashfall "can introduce a lot of toxic elements into the (surface water) system and change the pH slightly, and that on its own can ignite different chemical reactions with the surrounding rocks that can change the quality of the water." Mahta adds that ashfall "can also cause problems for water treatment plants," and the demand for water would be high for post-eruption cleanup efforts.

Carrie, a PhD student studying volcanism on Earth and other planetary bodies, mentions that earthquakes are a geohazard closely related to volcanoes, since "a lot of volcanoes are located near subduction zones, where one (tectonic) plate goes under another plate." The sliding of one tectonic plate beneath another, such as the Pacific Ocean beneath North America, is responsible for some of the largest earthquakes on our planet. Large earthquakes are also generated when two plates slide horizontally past each other, as they do along California's San Andreas Fault. Carrie stresses that "it's really important to retrofit buildings so they are able to stand up to a [large] magnitude earthquake," and that geoscientists should be able "to communicate with people about earthquake preparedness since earthquakes do happen, particularly along the western coast of the United States."

In order for scientists to effectively educate the public about geohazards, they must be able to speak in terms that are relatable and easily understood. The most straightforward advice: avoid jargon. However, Mahta emphasized the importance of respecting one's audience when communicating science by not "dumbing it down." Instead, she recommends using other phrases, such as a "simplified, shortened, or three-sentence" version of one's work. Robby also advises scientists to remember that "everyone is an expert in something," meaning that it is important to respect your audience's intelligence when educating them about concepts that happen to be new to them, rather than you.

STEM research and education needs broader representation

In addition to avoiding jargon, another major problem scientists face when trying to connect with the public is to demonstrate how scientists are also people, and, more importantly, there is not an archetype for how a scientist should behave or look (such as an absent-minded, bespectacled or white-haired man in a lab coat). One likely source of this disconnect is the fact that science was historically a field dominated by men from European and Anglo-American cultures. Fortunately, the scientific community is rapidly diversifying as scientific knowledge, tools, and education become accessible to more people. "Representation matters," says Mahta. She then emphasizes that when minorities from the LGBT community or racial minorities feel comfortable presenting their whole selves to the general public, children and adults from those same backgrounds will see themselves represented and aspire to become future scientists.

Mahta states that, as a female scientist from Iran, she came from "a place where there is systemic gender discrimination against women, especially in STEM fields" and emphasized the importance of pushing back against this discrimination. In the geosciences, Mahta urged women to "be each other's rock, help each other out and have each other's back." In fact, "the men in our field can have a great impact and help us put light on the problems we're having," such as discrimination or sexual harassment.

Similarly, Carrie discussed the importance of providing mentors for women in science who can both "guide [them] with the science and help [them] balance being a woman and a scientist." She adds that

“it’s really important [that scientists] are able to be mentors and help younger students, particularly in elementary, middle and early high school, because I think that’s a really critical time,” especially to educate people and inspire them to do science. “There are a lot of outreach programs that specifically target those ages,” she states, including Scripps’ beach tours, which bring students from inland regions of San Diego to see the beach, sometimes for the first time in their lives, and learn about coastal science.

Robby shared how his academic mentor, Dr. Trish Gregg,[2] strives to ensure that all scientists have advocates in their profession. He explains, “she has worked very hard to ensure that there’s an ongoing dialog about increasing diversity in the geosciences, and that it’s not just one more box to check off during an interview conversation or grant application.” Dr. Gregg writes of her own lab, “Our team champions diversity and firmly believes that the most exciting scientific advancements come from tackling a problem from different perspectives.”

Scientists cannot provide their unique perspectives to a problem, however, if they do not feel their identity, and the perspectives that come with it, are fully appreciated. As Robby shares, “as a gay scientist who was closeted to many of my colleagues, I felt that my sexual orientation had no place in my day-to-day work, with its focus on objective analysis of physical, rather than societal, phenomena. Unfortunately, this kept me from feeling comfortable enough to bring my full self to my scientific work, which negatively affected my ability to put forward my best work as a scientist.” In fact, an article published in July 2019 in the American Geophysical Union's *Eos* magazine explains how LGTBQ+ people in Earth science, engineering, math, and psychology felt less open around their colleagues than people in the life, social, and physical sciences.[3]

“Science,” Robby explains, “involves creativity. In a way it is an art. There are open-ended questions that you have to figure out how to address within a certain period of time. In the process of coming to terms with my identity as a whole and not worrying about stereotypes, I’ve actually been able to have more passion in my work, and that has helped me do more work that I’m satisfied with.”

Robby concludes, “In order to understand the world we live in, we have to understand the experiences of the people who live in that world…. If we just have people coming from one portion of society (to conduct science), that doesn’t really serve to benefit science (as a whole).”

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For more information, search #talkgeohazards[4]
See also: “Living with Volcanoes Fact Sheet” https://pubs.er.usgs.gov/publication/fs20183075
Volcano hazards can include: Tephra/ash fall, lava flows, lahars/mud flows, volcanic gas, pyroclastic flows, volcanic landslides, earthquakes.[5]
Mark your calendar: May is “Volcano Awareness Month” in Washington State, and this year marks the 40th anniversary of the 1980 eruption of Mt. Saint Helens![6] To commemorate, the USGS Cascades Volcano Observatory will be hosting a public Open House on Saturday, May 9, 2020 from 10 am to 5 pm.

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[2] https://volcanolab.web.illinois.edu/team/
[3] https://eos.org/articles/shining-a-spotlight-on-lgbtq-visibility-in-stem
[4] https://www.unavco.org/education/professional-development/short-courses/2019/comm-geohazards/comm-geohazards_outcomes.html
[5] https://volcanoes.usgs.gov/vhp/hazards.html
[6] https://volcanoes.usgs.gov/observatories/cvo/cvo_news_archive.html

If you plan to be in Vancouver, WA, stop by to learn about the famous Mt. Saint Helens eruption and see thermal imaging equipment, real-time volcanic earthquake data, a robotic arm, and much more!

Mahta Ansari (she, her, hers)
PhD student, Geology, University of Illinois Urbana-Champaign

Mahta is a hydrogeologist who studies groundwater contamination. She is specifically interested in source-tracking heavy metal isotopes in groundwater in order to parse out anthropogenic contamination from geogenic ones. Mahta grew up in Tehran, Iran, and moved to the U.S. for grad school.

Carrie McIntosh (she, her, hers)
PhD student, Geology, Scripps Institution of Oceanography, University of California San Diego

Carrie is a geologist and geochemist who studies volcanism on Earth and other planetary bodies to better understand how planets form and evolve. She's completed fieldwork on Kīlauea, the Columbia River flood basalts, and Yellowstone. Carrie grew up in South Carolina and moved to San Diego for her PhD.

Robby Goldman (he, him, his)
PhD student and NSF Graduate Research Fellow, Geology, University of Illinois Urbana-Champaign

Robby is a volcanologist who studies how forces acting within volcanoes affect the underground movement of magma. He also studies how scientists communicate natural hazards to the public. Robby grew up in Los Angeles, CA, and recently moved to Portland, OR to begin an NSF Graduate Research Internship Program (GRIP) project at the U.S. Geological Survey's Cascades Volcano Observatory in Vancouver, WA.

Camille Nava (she, her, hers)
B Sc, Science, Minor Writing, Portland State University

Camille is an early-career journalist who also writes creative nonfiction. She focuses on issues with a lens on social and education justice, and science and environment communication. She has called the Pacific coast region home for many years.