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Ongoing Efforts to Develop Open Climate Change Resources: An Interview with Dr. Tamara Shapiro Ledley

By James Thibeault, Open Educational Resources Librarian, Bentley University



One of the main reasons scholars and researchers advocate for scientific research and resources to be open—that is, free and instantly accessible to the public—is to connect the public to pertinent information in the most effective way. If high-quality, peer reviewed resources are hidden behind a paywall or require months to access, the information may never reach underserved audiences. Open resources can act as a major combatant against disinformation, especially when it comes to climate science. With the prominence of anti-environmental rhetoric online, the necessity to provide relevant, current, and comprehensive resources openly is more paramount than ever. Throughout the course of her notable career, Dr. Tamara Shapiro Ledley has coordinated and developed a vast number of open resources on climate and energy. I sat down with Dr. Ledley to discuss her open initiatives through the years.

Ledley has long studied the effects of climate change—earning her doctorate from MIT in atmospheric science, with a dissertation focused on the climate using energy balance cryosphere

models. However, during her early career, research into climate science was still in its infancy. “When I started my career in climate science research, I was research faculty at Rice University in Houston, Texas,” says Ledley. “And oddly enough, I was in the Department of Space Physics and Astronomy. Okay, so not too much climate science there. The faculty member who hired me as a postdoc studied the evolution of the atmospheres of Venus, Earth, and Mars ... but he was intrigued with my doing climate science research.” Despite being somewhat out of place with her expertise, she connected to another scientist at Rice with expertise in space physics and began to work in science education. Eventually, they received funding to run a teacher professional development program about the Sun in various contexts. “The Sun [appears] in lots of different contexts. The Sun as a star in astronomy, the Sun and energy, the Sun and weather and climate.” Throughout her time at Rice, she received funding to publish her research on climate science. At the same time, her research into climate science helped her discover a new interest: climate change education and the need to provide it openly to the public.

For Ledley, educating the public on climate science was an unanticipated avenue for her career, but it soon became a passion for her. “[Running a teacher professional development program] got me started in climate change education,” says Ledley, “In that project, we had the teachers create activities that got put in a notebook on a shelf, and those teachers could use them. But the availability of resources online wasn't quite there yet [because] the internet wasn't quite there yet.” In addition, Ledley was fortunate enough to have most of her research openly published. “In terms of getting connected to open resources, it was from day one. Basically, I don't think I was ever in a situation in which I had to charge people for the resources that we created.” This was due to her research being funded publicly by the National Science Foundation (NSF), National Aeronautics and Space Administration (NASA), or National Oceanic and Atmospheric Administration (NOAA). In general, government funded resources are often required to be open, that is free and instantly accessible, to the public. “All these federal grants really made [open publishing] necessary. I was really happy with it because I wanted people to be able to

use the resources we created the most effective way possible and not [restricted] because they have to pay something for it.” As Ledley’s passion for climate change education grew, she began to channel more of her efforts into developing open resources. Recognizing the power of freely accessible information, she dedicated herself to creating tools and materials that could be widely used by educators and the public alike.

When instructing students and faculty, Ledley quickly learned that if educational resources lack open accessibility, it can create significant setbacks. “If you’re trying to address students who might become scientists, they’re naturally interested and may be willing to pay to use the resources,” says Ledley. “But if your students are not interested in science you have to help them see that climate science information will be important in many decisions they make. Students that go into work for a company after graduation, people that work for government agencies, or even elected officials have to be able to integrate climate understanding into the decisions that they make.” Eventually, Ledley decided that the best way to further educate the public on climate change was to focus more on developing open resources. “My philosophy is that if I’m creating something that I want to help teachers teach more effectively with, I want them to be able to use it and modify it any way that they see fit.” In 2003, one resource she created was the [Earth Exploration Tool Book](#) (EET), a collection of online Earth science activities for students. “I provided teachers with step-by-step instructions for accessing an online science data set collected by a scientist, putting it in an analysis tool and conducting an analysis. The resource was written to the teacher with the idea that once they got experience with using the data set and analysis tool, they could customize it to fit what they needed to teach.” Soon after, Ledley also expanded [EarthLabs](#) in 2010, an online resource that provides hands-on experiments and data analysis activities to enrich Earth science education in high schools. “[EarthLabs] was intended to address the challenge for college admissions requirements which are 2 or 3 lab-based courses. Earth science was usually not considered a lab course because it didn’t have a laboratory component. EarthLabs was intended to

provide that laboratory component. So we created modules of about three weeks of material on specific topics. We created nine of these laboratory modules. Again, the idea was that teachers could use the modules in any way that works for them.”

EET and EarthLabs were not only popular open online resources for educators and students but were also praised by the scientific community. In 2011, the journal *Science* awarded the Science Prize for Online Research in Education (SPORE) to Ledley for developing EET. In addition, Ledley and her team won the Journal of Geoscience Education Outstanding Paper of 2012 Award for “A Model for Enabling an Effective Outcome-Oriented Communication Between the Scientific and Educational Communities,” which described the process through which the activities in the EET were developed. Ledley's commitment to accessible education and her innovative approach to creating open resources significantly impacted the field of climate science education. Building on the success of EET and EarthLabs, she embarked on an even more ambitious project: CLEANet.org. This new project aimed to further enhance public understanding and engagement with climate and energy science by providing a comprehensive collection of vetted educational resources in those fields.

The [Climate Literacy and Energy Awareness Network](#) (CLEAN) hosts, organizes, and reviews high-quality climate and energy science educational resources. Ledley was one of the founding designers of CLEAN, which aims to support those who are committed to improving climate and energy literacy. “There were a lot of educational resources out there in various websites, various agencies, and professional societies that had all been developed, reviewed, vetted, and freely available. But they were scattered all over the place,” says Ledley. “So what we did was to institute a rigorous review process where educators and scientists reviewed the resources through a two-step process. In the first step, individuals review the resource, then a panel of scientists and educators review it. The panel determines which resources pass the review process and become part of the online collection of educational resources.” Launched in 2010, CLEAN is led by the Cooperative Institute for Research in Environmental

Science (CIRES) at the University of Colorado Boulder and the Science Education Resource Center (SERC) at Carleton College. Throughout the years CLEAN has been funded by grants from NOAA, NSF, the Department of Energy, and NASA. The entire collection is also syndicated to NOAA's Climate.gov portal in the Teaching Climate section. Ledley served as chair of the CLEAN Network from 2008-2016 and is now a member of the CLEAN Network Leadership Board.

In general, CLEAN is the gold standard when it comes to open repositories; the collection is relevant, accessible, and frequently updated to provide the latest resources and information on climate change and energy innovations. The entire collection is also syndicated to NOAA's Climate.gov portal in the Teaching Climate section. CLEAN has also received numerous awards, such as the Friend of the Planet Award from the National Center for Science Education in 2017 and the Goldin Foundation Excellence in Education Exemplary Project in 2018.

Ledley has for decades developed and assisted with the curation of open resources, but creating these resources can be challenging. For example, while it is great for CLEAN to be funded by government grants, not all open resources have the luxury of being financially supported. "How do you make these things financially sustainable?" says Ledley. "You want to reach kids in underserved communities, so you can't charge them a lot. So where does the money come from? The funding is a very, very difficult challenge." Especially for resources on climate change—which is always evolving—the material needs to be updated often. "Funding is really the most difficult thing because I think everybody really wants to make their resources available. However, having the staff to create and support their use is expensive. Maintaining the resources is also extremely important. Our understanding of climate science constantly evolves so resources must be updated or replaced." However, despite the challenges, innovative and determined individuals like Ledley continue to design valuable educational resources for the public to use.

Ledley's commitment to open resources has left an indelible mark on the field. Her innovative projects, such as EET, EarthLabs, and CLEAN, have supported educators and students alike, making high-quality climate science education accessible to all. As Ledley aptly puts it, "Education is the key to enabling or creating public will about addressing climate change and feeding the workforce around climate change." Her work serves as a beacon of inspiration, reminding us that accessible education is crucial for a sustainable future.

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