

Environmental sustainability goals drive changes in conference practices ✓

Alternative formats for sharing information and facilitating discussion help scientists lower their carbon footprints.

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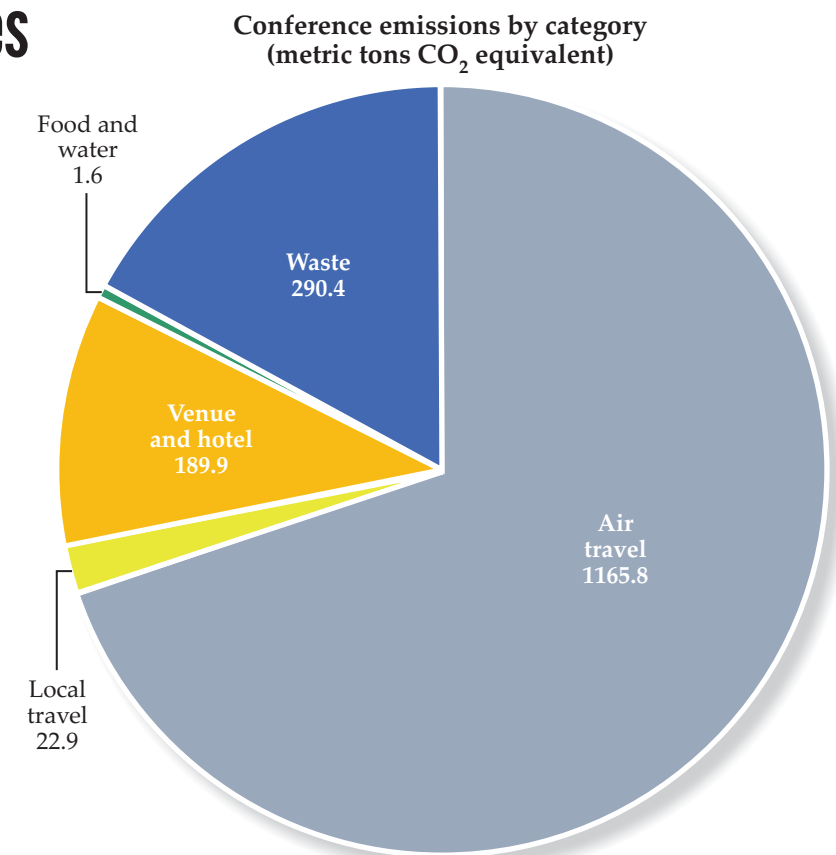
In 2011 Peter Kalmus calculated the carbon emissions associated with his personal and professional activities for his previous year as a postdoc at Caltech. The climate scientist at NASA's Jet Propulsion Laboratory found that his air travel to two international and half a dozen domestic conferences accounted for more than two-thirds of his annual emissions.

Frequent travel is a professional norm in academia. Attending and speaking at conferences is expected of active researchers at all levels—from graduate students and postdocs vying for jobs to senior researchers whose expertise makes them coveted speakers. But as Kalmus found, traveling to attend conferences can greatly expand a researcher's carbon footprint. And according to a 2016 study published by Shahzeen Attari and collaborators in the *Journal of Climatic Change*, the large carbon footprint generated by scientists' travel undermines their ability to convince the public of the urgency of climate change.

A growing community of scientists and other academics is choosing other forms of transportation when going to conferences—or forgoing attendance altogether. Academic departments and in some cases whole institutions are adopting travel policies that discourage flying. But particularly for early-career researchers, meetings remain crucial for networking and professional development. Some conference organizers are responding by reducing the climate impacts of their events through increasing remote accessibility and hosting more environmentally friendly events. Technology is also enabling the development of hybrid formats that preserve some interaction while producing less emissions and increasing participation.

Getting around—or not

In 2015–16 two-thirds of the University of British Columbia's (UBC's) carbon



THE SUSTAINABILITY REPORT for the Society for Conservation Biology's 2017 annual meeting in Cartagena, Colombia, showed that air travel made up more than two-thirds of the conference's carbon emissions. (Adapted from the *28th International Congress for Conservation Biology, Event Sustainability Report 2017*, Cartagena, Colombia, 23–27 July 2017, prepared by MCI Sustainability Services.)

emissions came from business-related air travel, according to a 2018 report by Simon Donner, a professor in the university's geography department, and his graduate student Seth Wynes. Conference attendance made up 55% of the air travel emissions; the rest was from fieldwork, collaborations, and the like. Similarly, the University of California, Santa Barbara (UCSB) found that about 30% of the campus's total emissions in 2012 were due to business-related air travel, making it the university's largest source of emissions. At ETH Zürich, air travel in 2016–18 made up more than half of the university's emissions.

Kalmus stopped flying in 2012. He now travels to conferences by car or train; once he even traveled on a container ship. On the website he founded, No Fly Climate Sci, he asks academics and espe-

cially Earth scientists to share personal stories around their decisions to fly less. "If we want collective action," says Kalmus, "we need to shift the culture. One way each of us can do that is by setting a provocative example."

Parke Wilde, an agricultural economist at Tufts University, and Joseph Nevins, a professor of geography at Vassar College, introduced a petition in 2015 that calls on researchers, universities, and professional societies to take steps to reduce academia's carbon footprint. Their "flying less" petition now has more than 600 academic signatories from around the world.

As members of the global collaboration behind the Compact Muon Solenoid experiment at CERN, Fermilab scientists Mike Albrow and Boaz Klima typically videoconference with team members several times a week. Although remote



MARGARET LINDEMAN

communication is instrumental to their work, they note that in-person meetings are invaluable to build relationships, establish trust, and encourage informal, in-depth discussions. Such meetings also provide a broader view of the large, complex experiment outside each researcher's narrow focus.

For a 2017 opinion piece in *Eos*, Judith Totman Parrish, professor emerita in the department of geological sciences at the University of Idaho, estimated the emissions generated by those who flew to the fall 2012 meeting of the American Geophysical Union (AGU). She randomly sampled the meeting's nearly 22,000 attendees to estimate the distribution of distances traveled. Then, using the fuel consumption of representative jets and the emissions from burning jet fuel, she determined the total emissions for those attendees. Her calculation yielded 0.71 metric tons CO₂ per person; other analyses have found comparable results.

For the 2018 AGU fall meeting in Washington, DC, which had about 28,000 attendees, 20 or so researchers from around the country chose to travel by train and used #traintoAGU on Twitter to document their trips. Twelve graduate students from the University of California, San Diego, made the 68-hour train journey despite having to pay out-of-pocket for the additional cost; the university's policy, which applies to all official travel, is to only reimburse up to the equivalent airfare.

GRADUATE STUDENTS SUSHEEL ADUSUMILLI (LEFT) AND SARAH SHACKLETON undertook the nearly four-day train trip to the fall 2018 American Geophysical Union meeting in Washington, DC, with 10 of their coworkers from Scripps Institution of Oceanography at the University of California, San Diego.

Universities and academic departments in Europe have taken the lead in implementing travel policies to reduce their carbon footprints. Ghent University in Belgium, for example, bars air travel to destinations that can be reached within six hours by land and recommends ground travel within eight hours. That range includes major cities in France, the Netherlands, Germany, and even England.

The department of geography at Concordia University in Montreal, the Lund University Centre for Sustainability Studies in Sweden, and others have policies that acknowledge the urgency of reducing academia's climate impact and set out clear guidelines for doing so: Researchers should prioritize travel-free meetings and conferences, use ground transport whenever feasible, and justify any travel they do undertake. To make individuals more aware of their own CO₂ contributions, many policies ask researchers to track their emissions by keeping records of flights and using emissions calculators (see the box on page 31).

Another approach is to compensate for carbon emissions. The University of Maryland's Climate Action Plan 2.0, a 2017 update to their original plan from 2007, acknowledges that "restricting air travel

would hinder important university work." So in 2018 the university began purchasing carbon offsets to make up for its air-travel emissions. The same year, UCLA began assessing carbon mitigation fees on all business-related flights. The fees, which are paid by the traveler's department, feed a fund that will be used for greenhouse-gas-reducing projects on campus.

A 2019 study by Donner and Wynes in the *Journal of Cleaner Production* pushes back against the assumption that restricting travel impedes researchers. A snapshot of 165 UBC researchers showed no relationship between academic productivity and air travel emissions.

Thinking outside the box

Conferences don't have to look like they do now. "A whole lot of the excitement is in intermediate or hybrid formats," says Wilde. For example, Ken Hiltner, an English professor at UCSB, developed the Nearly Carbon-Neutral (NCN) conference. The emissions from two pilot conferences in 2016 were less than 1% of comparable traditional events.

For an NCN conference, speakers pre-record their talks. During the conference, which typically lasts two to three weeks, participants can visit the conference

ONLINE RESOURCES

- ▶ **No Fly Climate Sci** (<https://noflyclimatesci.org>) and the **Flying Less petition** (<https://academicflyingblog.wordpress.com>) bring researchers together to push for changing the academic flying culture.
- ▶ The **CoolClimate Calculator** (<https://coolclimate.berkeley.edu/calculator>) estimates your carbon footprint based on your lifestyle.
- ▶ **Mozilla Hubs** (<https://hubs.mozilla.com>) provide virtual spaces for remote gatherings.

website, watch the talks, and participate in a written Q&A for each session. The talks for Hiltner's two NCN conferences were prerecorded and closed-captioned for accessibility. He admits that NCN conferences can't replace face-to-face interaction; however, speakers at the 2016 pilot event gave overwhelmingly positive feedback about the experience. And as Kalmus notes, traditional meetings have their own drawbacks. "You have five days of these intense posters and short talks and meeting lots of people. It's really daunting, and my brain gets saturated," he says. "I'm sure we all have different experiences, but I think a lot of us would agree that there might be a better way, which may involve flying less."

Multilocation conferences are another option. The number of locations can vary from a few to dozens, and each hub has both in-person and live-streamed content. It's a compromise that preserves some of the interactions of a typical conference while also reducing travel.

Kim Cobb, a climate scientist at Georgia Tech, is hoping to create a hub in the southeastern US for the International Conference on Paleoceanography this year in Sydney, Australia. Researchers can then remotely attend the conference by watching the live stream together. She will also be the first person to remotely give a keynote address at that conference.

Many large in-person meetings already make some of their talks available online, and attendees often have the option to receive conference materials electronically. The American Astronomical Society is moving toward replacing paper posters with iPosters, which are displayed on large monitors and remotely viewable. Through its eLightning program, AGU had more than 800 interactive electronic poster presentations at its fall 2018 meeting. Many of the presenters also hosted virtual poster sessions with remote attendees. About 1800 people accessed approximately 70 sessions that were available live or on demand

through AGU GO, AGU's remote participation platform.

Blair MacIntyre, a computer scientist at Georgia Tech and research scientist on Mozilla's Mixed Reality team, envisions augmented and virtual reality transforming the remote conference experience as technology improves. Attendees could gather in virtual rooms for talks or poster presentations. Those rooms could be predesigned 3D environments with multimedia elements—such as documents, videos, and models—for visitors to explore. Eventually, in-person and virtual attendees may navigate and interact in the same conference space or even share a virtual beer.

A different vision

"Virtual conferencing right now does not completely replace in-person conferences in a way that satisfies most people," says Wynes. And as long as conference talks are a measure of success, early-career researchers may find themselves penalized if they forgo travel. Cobb, a tenured professor, says, "We really have to put early-career scientists front and center and challenge ourselves, those of us who hold privilege, to lead and really push for those structural changes that need to happen."

Says Wilde, "Currently, it's hard to be a successful researcher, or a successful academic, without being a jet-setter. But that leaves some people out." Through remote conference participation, researchers with less funding and those in the developing world can be brought into the scientific community. Those with caregiver responsibilities—in particular new mothers—can continue their professional development and thrive. Alternative conference models can also increase access for people with mobility limitations. "In a world where there were more options for remote conferencing," says Wilde, "there would also be more variety in successful career paths."

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