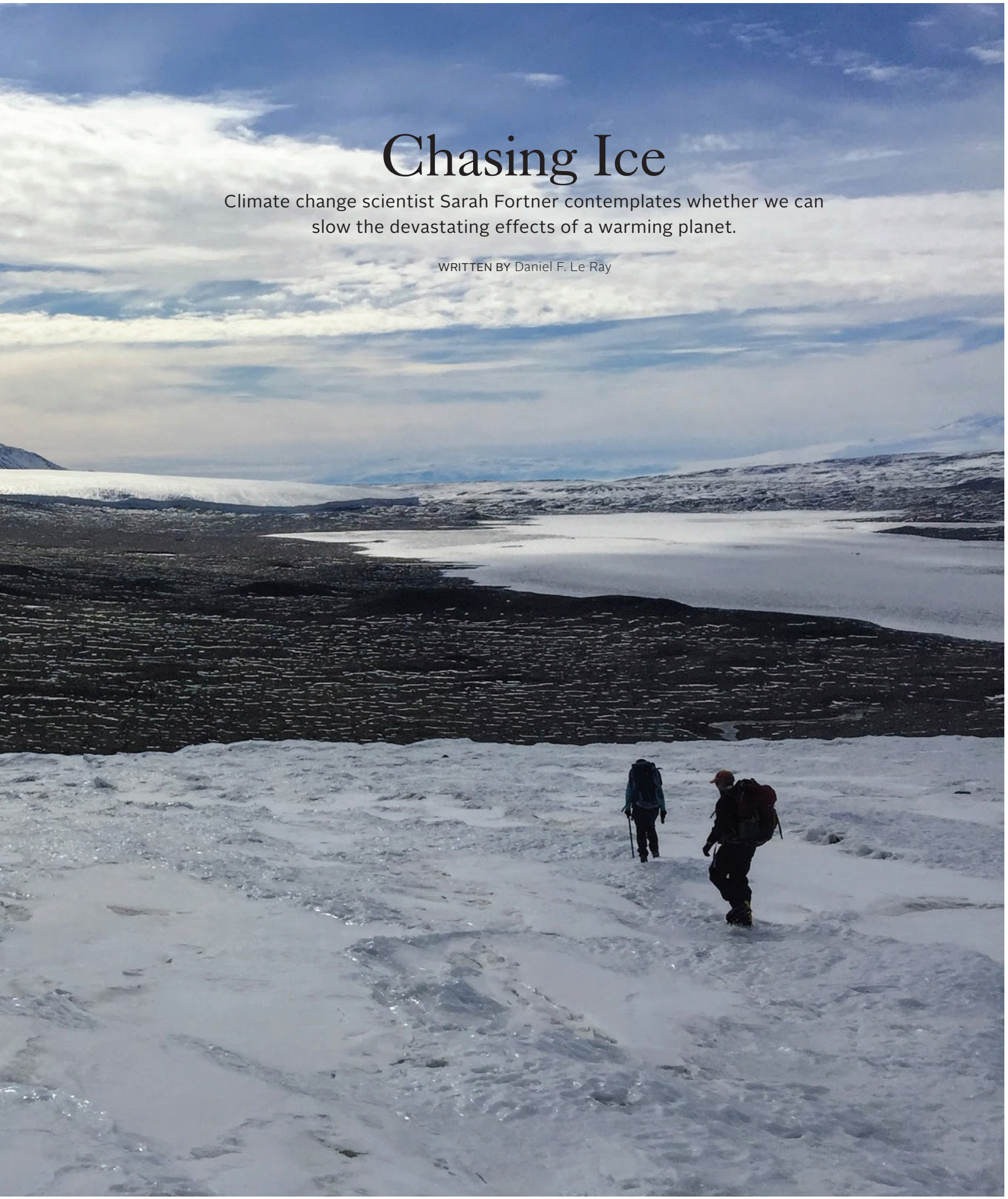
Chasing Ice

Climate change scientist Sarah Fortner contemplates whether we can slow the devastating effects of a warming planet.

WRITTEN BY Daniel F. Le Ray



"When I was really young, I was interested in traveling the world. I always thought I would be a writer and travel that way."

But Sarah Fortner's high school chemistry teacher saw in her the spark of a scientist—and encouraged the 16-year-old to go on the Juneau Icefield Research Program, which takes high schoolers on scientific research expeditions in the Coastal Mountains of Alaska and British Columbia.

"I spent the summer skiing more than 100 miles across the Juneau Icefield, and that really solidified everything I've chosen since then," said Fortner, now an associate professor of geology and environmental science at Wittenberg.

Fortner is currently choosing to promote and research earth resource sustainability—a broad term that covers environmental issues ranging from food security and pollution to soil sustainability and water health.

"When I was born, there were 4 billion people on the planet. By the time my kids are [grown-ups] there will be 9 billion."

Though population growth is slower in the industrialized West, "there's still a lot of pressure on the resources we have on Earth, and we need a plan to use them wisely and to create environments that are healthy and that will last into the future."

Communicating these complex, interrelated issues—and thinking about their potential solutions—is a focus of Fortner's work both in the classroom and in the field.

ANTARCTIC DREAMS

The most important question to ask is: How are we going to manage our resources in a sustainable manner so that we have food, water and diverse habitats to support current and future population growth.

During her graduate studies, Fortner measured and compared glacier chemistry around the world, from the Pacific Northwest to the tropics to Antarctica.

Last winter, she returned to the Antarctic to gather samples from melting glaciers at the McMurdo Dry Valleys Long Term Ecological Research (LTER) site. Fortner hopes these samples will reveal the chemistry at work within that glacier melt. These ice-free desert valleys are one of 30 or so LTER sites in different ecological and physiographic settings around the world.

Getting to Antarctica isn't easy. It takes nearly a day and a half to travel from the U.S. to Christchurch, New Zealand. Then your gear is checked to make sure it meets military standards and weight requirements. Next, you get your issues: "A big red parka and what they call bunny boots—basically they inflate a little bit so there's a layer of air to insulate your feet," Fortner explained.

Finally, around 100 passengers bundle into a Lockheed C-130 for the flight from Christchurch to Antarctica, which takes eight hours—that is, unless you get "boomeranged," or sent back after flying halfway there due to adverse conditions.

The station at McMurdo is a broad community where you get to know mechanics, cooks, fire fighters. Everyone is at the end of the Earth supporting science," Fortner said.

The continent is relatively unchanged since Fortner's first trip in 2001, but some things have changed. In June, multiple news outlets reported that a 120-mile-long crack in the Larsen C ice shelf was growing at such a rate that the shelf was about to break off, creating an iceberg the size of Delaware.

"Climate change manifests in different ways across the Antarctic. In the McMurdo valleys, we see increased wind intensity in the valleys, and that drives delivery of sediments to the glaciers, which then enhances the melt."

But these conclusions alone are not enough to predict patterns of climate change. Comparing ecosystems around the world—in other LTER sites like the Florida Everglades or Central Arizona, for example—is vital, too.

"The complexity of climate change means that you might have multiple drivers of change and multifaceted responses."

AN INTEGRATED APPROACH

Given the complexity of climate science, Fortner takes an interdisciplinary approach to teaching resource sustainability and climate change.

She has been involved with the National Science Foundation-funded InTeGrate project, which supports the teaching of geoscience in the context of societal issues across university and college curricula, since its inception.

"The project as a whole seeks to increase geoscience literacy, especially around these challenges of managing water, climate, soil—these critical issues that are faced by humanity," Fortner explained.

The first step was bringing together faculty members from across the country to design modules that might work at any kind of institution, from a research university to a community college or a liberal arts school.

Fortner partnered with Martha Murphy, environmental science adjunct instructor at Santa Rosa Junior College, and Hannah Scherer, research assistant professor at Virginia Tech. The trio created an agricultural sustainability module that concluded with students writing a factsheet "with recommendations for local farmers on how to address climate change challenges into the future at their farm—how to reduce erosion that is accelerated by climate change, that kind of thing."

The next step was leading the implementation of InTeGrate modules into Wittenberg's curriculum. Fifteen departments and programs took part, ranging from political science to geology, business to chemistry, with Fortner's team building complex issues of food, water, climate and mineral resources into

classes across campus. The project has doubled the number of sustainability course offerings at Wittenberg and created a first-year activity.

Some of the outcomes included an analysis of CO2 levels in campus buildings with Associate Professor of Biology Michelle McWhorter; and designing a sensory garden at a local elementary school with Assistant Professor of Education Amy McGuffey.

That kind of local connection became even more prominent as the project progressed.

"I ask my students which place they want to explore, because caring about a place makes the exploration more meaningful," Fortner said.

The principal investigator for the InTeGrate project is Cathryn Manduca, director of the science education resource center at Carleton College.

"Living sustainably and justly on the planet is one of the most fundamental challenges facing civilization today," Manduca said. "A liberal arts education aspires to prepare students to be engaged and informed citizens ready to tackle challenges like this one."

Manduca called Fortner—who received the Lou Laux Environmental Sustainability Award—"an inspiration."

"She is passionate about working with her students and her colleagues to make the world a better place," she continued. "She thinks all of the time about how she can engage others in working with her to have a big impact."

FINDING THE SPARK

Fortner is helping to plan sustainability curricula for science programs across the U.S., so that students get more exposure to the kinds of challenges the planet will face as our population grows and our resources shrink.

A personal mission is reaching students from groups that are traditionally underrepresented in the sciences. In 2006, she co-led the wilderness science education program Girls on Ice with its founder, glaciologist Erin Pettit.

"Girls on Ice specifically seeks students for whom the experience will be most transformative, rather than students that already have some of that skill set that would make them ideal for doing glacier research," said Fortner.

"To specifically seek to be transformative is important to me, and I choose students to work in my research group that have a spark. They do not have to be the best; they have to be excited."

And one of the perks of working at Wittenberg is that she sees the effect that mentorship can have.

"It's [exciting] to see where students go immediately after graduation, and to see them take on these meaningful roles in communities right away."

One of Fortner's research students is coming back to the area to start her Ph.D. at Wright State. Her name is Lindsay Starr '14, and as an undergraduate she attended the Juneau Icefield program on Fortner's recommendation.

"While the trip was intimidating before I left, I gained confidence in myself and conducting science, which I attribute to Dr. Fortner's recommendation," Starr said.

"She is a wonderful mentor, and I would not be where I am today without her. I am forever grateful for her constant support, philosophies and expert advice to a fellow woman in science."

THE BRIGHT SIDE

At the moment, Fortner is analyzing samples from her field season. And while moving science forward is important, so is communicating the science in a way that affects policy.

"Thinking about how long we've known about climate change and how little action there's been has been really frustrating," she said.

In InTeGrate project modules and in other classes led by Fortner, students must understand the science, but they are also challenged to think about policy and "current political issues that are being discussed and voted upon," Fortner said.

"Students are asked to think about the science behind policy and what policy is most important to advocate for?"

At the end of the last semester, for example, her students wrote an op-ed using climate change data to support climate-related policies that should be implemented at the government level.

"I'm happy nerding out on data, but now it feels like I can publish another paper or I can try to move certain policy forward before [climate change is irreversible]. And I don't think I'm being alarmist," she added.

But with the Larsen ice shelf breaking apart and the U.S. withdrawal from the Paris climate agreement, how does Fortner avoid the despair of climate change inaction?

"I think that you have to have hope. And that when you're teaching [the science behind climate change], you have to focus on solutions."