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A-HED

How to Do Scientific Field Work When You Can't Get to the Right Field

Students who planned to do research in the Arctic or forests ended up experimenting in yards or on the sidewalk; 'something emerging from the composting bin'

By [Daniela Hernandez](#)

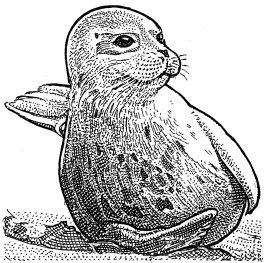
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In July, Gabrielle Piña set out to understand how layers of rock, soil or debris atop the Greenland Ice Sheet affect its melt rate.



While her team drilled ice cores, set up time-lapse videos, and measured the thickness of sediment particles on the frozen terrain there, the 17-year-old scientist built a makeshift glaciology lab with a bucket, ice, thermometers and black construction paper on another wild landscape: a sidewalk in New York City.

Her hypothesis: The more her artificial ice cap was covered in black, the faster it would melt.

People “were giving me weird looks, but at the end of the day it’s New York,” said Ms. Piña, who conducted her field research in Manhattan’s Upper West Side where she lives. “They’ve seen weirder things happen on the street.”



Gabrielle Piña conducted an ice experiment on a New York sidewalk.

PHOTO: GABRIELLE PIÑA

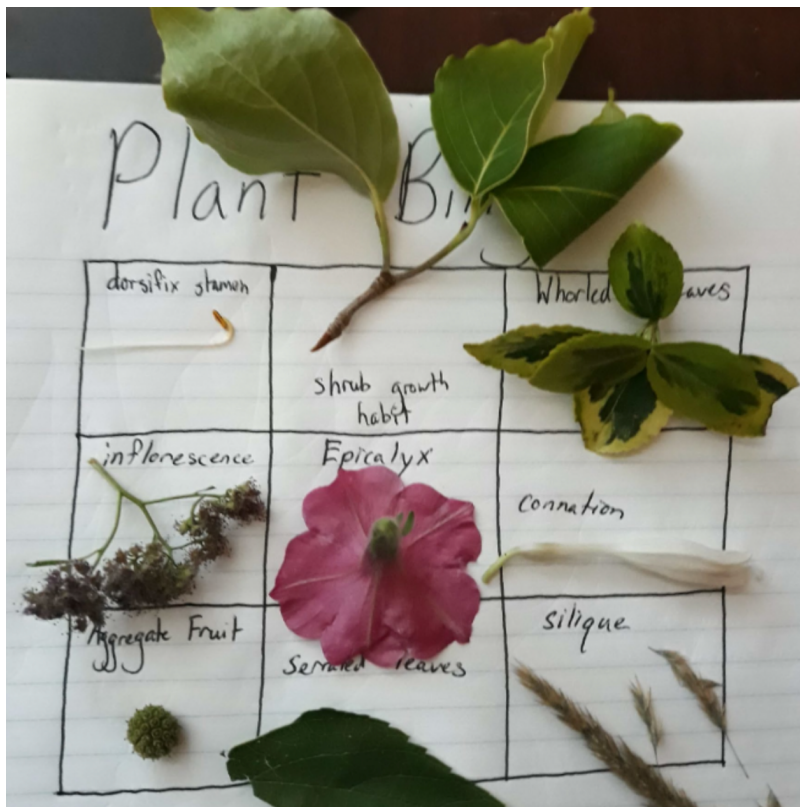
Her research project, which was supposed to take her and other high-schoolers to Greenland, is one of several workarounds for science fieldwork postponed because of the coronavirus. Educators and students had to adapt internships and lab-based coursework in far-flung Arctic regions and remote forests to the virtual world. They relied on pandemic work-life staples, such as conferencing software and text messaging, but also on less-conventional wares, including Tootsie rolls, barbecue skewers, parents' favorite glassware and pet-food containers.

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Have you conducted any science experiments at home? Join the conversation below.

Their experience provides a glimpse into the challenges of hands-on science education as the new school year kicks into gear, in many places only online. It means getting a little creative. Patience and a sense of humor also help, students and educators said.

Instead of congregating at the University of Michigan's Biological Station near Douglas Lake in Pellston, Mich., for a summer botany program, 23 students took to their neighborhood streets, parks, forests and waste bins to collect data.



One of the activities in Charles Davis's course was Plant Bingo, intended to complement online learning with specimens observed near students' homes.

PHOTO: GIGI BROYLES

They were armed with smartphones and an AI-powered app—instead of paper field guides—to help them identify mysterious flora they encountered near their own homes since they couldn't gather in the northern Michigan woods as planned. Normally, they would sleep in lakeside cabins for weeks.

Charles Davis, one of the instructors for the new program, called Plant Biodiversity in the Digital Age, said students were encouraged to get up-close and personal with the plants. That meant snapping super-closeup pictures with their phones and a magnifying glass and uploading them to an app that uses AI algorithms to identify plants ranging from the ordinary Queen Anne's lace to the ultrarare Pitcher's thistle.

Sometimes the bot botanist was stumped, so students discussed their finds on Slack to help sort out the samples' true identities, said Dr. Davis, who is also a professor and curator of vascular plants at the Harvard University Herbaria.

Finding specimens in local settings posed challenges. While on walks in Cambridge, Mass., Dr. Davis sometimes craned his neck over fences to spy on plants or stood for 15 minutes outside people's homes staring intently at their yards' plant life.

“They were looking out the window [wondering] who is this person and what is he doing?” he said.

Nature didn't always bloom in time for class.



Rogério Maruyama in Brazil in 2019. This summer, he participated in a University of Michigan botany program remotely.

PHOTO: ROGÉRIO MARUYAMA

“I waited for the weeds around me to try to flower. Some of them flowered in the course of the course, some of them did not,” said Rogério Maruyama, a 29-year-old botany student who joined the program from Salvador, Brazil, where it was winter instead of summer.

One day, during an outing near his apartment, he recalls seeing “something emerging from the composting bin,” he said. “I thought, ‘This might be an observation, so I’ll wait for it!’”



Rogério Maruyama photographed a flower growing in a compost bin.

PHOTO: ROGÉRIO MARUYAMA

Roughly two weeks later, he finally spotted a blue flower and banked six pictures. “It’s a very common weed for me in Brazil,” he said of *Commelina erecta*, or whitemouth dayflower, but the other students “were amazed by it.”



Caterpillars camouflaged as bird droppings as photographed by Rogério Maruyama, who joined a University of Michigan program from his home in Brazil.

PHOTO: ROGÉRIO MARUYAMA

He also found a plant with a caterpillar on it that camouflages as bird poop. He posted a picture to the group's "#check_this_plant_out" Slack channel. It was a real crowd pleaser.

"It's an amazing adaptation," said Susan Fawcett, a co-instructor for the course.

Sometimes technology lets science down. "One day, my internet was down so I had to use my phone, and it shut down," said Khuyen Nguyen, a 17-year-old rising senior from San Jose, Calif., and aspiring environmental scientist who was also supposed to head to Greenland in June. Her phone had overheated from streaming lectures.

Her tech didn't melt down, however, when she had to record her performance in a dance video intended as an icebreaker to get the 35 students in the Greenland program to bond.

"Science is not all just data, but also interacting with the people," said Ms. Nguyen. "Each group had to do a dance of their own." Her troupe was dubbed the Polar Bears, while others included the Caribou, Seals, Arctic Hares and Mosquitoes.



Khuyen Nguyen conducted experiments near her home in California.

PHOTO: KHUYEN NGUYEN

Lauren Culler, a Dartmouth Institute of Arctic Studies environmental scientist and co-chair for the Greenland summer program, said the program had to pivot from cold-weather gear lists and flights on military planes to Greenland to devising Arctic science-related experiments that would work even in tropical climates.

Students have “very different access to the outdoors,” said Dr. Culler. “We had students in high-rises in New York City or quarantined in Miami.”

Instructors brainstormed with students on household items that could stand-in for traditional labware. They mailed out materials so each student could design their own mini ice-drilling machines to learn how they worked.

Anna Roodnitsky, 16, who lives in Des Moines, Iowa, engineered an ice-core drilling rig with a pulley system that moved a magnet to pick up a metal tube, the stand-in for an ice sample. The pulley system was supported by a structure of wooden barbecue skewers.

Like with a real rig, she had to make sure her prototype could be moved from one sampling location to the next. One of the tests was “pulling the structure across the glacial ice sheet—which was the chair” it was on, she said. It survived the move.



Miniaturization at play: An ice drilling operation in Antarctica during the 2013/2014 field season. A tabletop ice drilling simulation in 2020.

PHOTO: PETER REJCEK/NATIONAL SCIENCE FOUNDATION; JOINT SCIENCE EDUCATION PROJECT

Roman Shirodkar's homemade drilling rig suffered a different fate.

"My dog ripped it apart because it was made out of Tootsie Rolls," which held the wooden components together, said Mr. Shirodkar, 17, who lives in Plainview, N.Y.

After he retired his chewed-up contraption, he took to hiking trails near his home to collect soil samples, with a shovel and a plastic container he typically uses to house the crickets he feeds his pet lizard. The fieldwork was part of a project he was doing with other students to assess if there was a relationship between the amount of precipitation and biodiversity. They didn't find any, but, he said, "we can't say that for a fact because we had a small sample size."

By the end of the experiment, that wasn't the only thing that was unclear. Mr. Shirodkar used one of his Mom's decorative glass jars to hold some of the soil he collected and forgot to clean it out.

"The dirt stained it," he said, "and the whole jar is kind of yellow."

"My decorative Mason jars, they're no longer decorative," said his mom, Jennifer Shirodkar.

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