

Doctoral graduate works to regrow the desert's 'living skin'

Ana Heredia-Velasquez is graduating with PhD in microbiology

By Risa Aria Schnebly, ASU News
December 10, 2025

Editor's note: This story is part of a series of profiles of notable [fall 2025 graduates](#).

Much of Sonoran Desert is covered with a “living skin”: biocrust. Biocrust tends to look like an extra clumpy patch of soil, making it easy to miss. But really, it is made up of whole interwoven communities of cyanobacteria, mosses and lichens that hold dryland soil in place and enrich it with important nutrients like carbon and nitrogen.

“The interaction between these microbes, how they fix their nitrogen and carbon, and how they can hold these soil particles together even though they’re so tiny — I don’t know, it’s just amazing,” said Ana Heredia-Velasquez, who’s graduating with her PhD from Arizona State University's School of Life Sciences microbiology program this December.

Much of the biocrust across the world’s drylands has been degraded or destroyed, leaving drylands like the Sonoran Desert susceptible to erosion and dust storms and resulting in important potential consequences for the ecosystem.

For the last decade, researchers have been trying to restore the desert’s biocrusts, often by salvaging some from areas targeted for development or “growing” it in labs or greenhouses, then placing it out on degraded areas of desert. They’ve found success in some small regions, but not at a large enough scale to truly help an ecosystem.

But over the course of her PhD, Heredia-Velasquez has been looking into ways to scale up those successes.

One of the constraints researchers have faced, she explains, is that growing biocrusts in the lab or greenhouse settings is very labor-intensive and requires a lot of space. Because of that, restoration efforts have only focused on small scales so far.

As a solution, Heredia-Velasquez was part of a team that showed the viability using solar farms as a biocrust nursery, a method the lab she’s in calls “crustivoltaics.”

“Solar panels create partial shade throughout the day,” Heredia-Velasquez explains. “This decreases the temperature from the soil and also allows the soil to remain wet for longer periods of time, which is fundamental for these biocrust to grow, because they are only active and growing when they’re wet.”

In addition to an issue of space, though, it’s also hard to move biocrust from one spot to another because the communities of microorganisms are often not well adapted for whatever new location they’re being transplanted to, and some of it can be lost due to wind and water erosion before it can get established. To address that, Heredia-Velasquez also investigated ways to help biocrusts more easily become established in a new spot.

To do that, she first worked to figure out how the microorganisms in biocrust interact. Cyanobacteria — or photosynthetic bacteria — play a particularly important role, gathering a microbial community around them by exchanging nutrients: The cyanobacterium gives other microbes carbon, and those microbes give nitrogen back. Heredia-Velasquez investigated how the other microbes delivered nitrogen — a nutrient that all sorts of plants and microbes need — to the cyanobacterium. She found that they hide the nitrogen from other organisms by transporting it at very low levels in a compound called urea, which only the cyanobacteria pick up.

After finding that, Heredia-Velasquez experimented with adding urea to biocrusts in the lab when trying to help it grow. Using biocrust she collected as part of the [Jornada Basin LTER graduate research fellowship program](#), she found a significant difference in the spread of biocrust when using the urea than without it, a finding that she hopes can help increase the success of such efforts.

Restoration efforts are essential to protect not only the Sonoran Desert, but drylands across the world, Heredia-Velasquez says.

“Currently, up to 20% of the world’s drylands are degraded. That’s a huge number, and climate change could keep these numbers (rising).”

Climate change is especially a threat for biocrust, as it will change the temperature and precipitation patterns that the microorganisms have adapted to live at.

“(Biocrust microbes) are good at living at high temperatures especially when dried, but if temperature increases, they might not be well-adapted and will just die,” she says.

In addition to their ecological importance, Heredia-Velasquez also just finds biocrusts fascinating. Having grown up in tropical Guatemala, she hadn’t even heard of them before graduate school. But when she started looking for graduate microbiology programs, she found labs at ASU doing soil microbiology research. Biocrusts, in particular, caught her eye.

“I didn’t know what (biocrusts) were, but after reading a little, I realized that they are amazing.”

This story originally appeared on [ASU News](#).

Main image



Ana Heredia-Velasquez samples biocrust that's growing on a solar farm.

Text image(s)



Ana Heredia-Velasquez