Saving PennDOT's plants from deadly road salt

by Jonny Hart

PHOTOS: JOSEPH V. LABOLITO

An interdisciplinary team of researchers is investigating the impact of road salt on the plants in bioretention basins along I-95. The project aims to optimize plant health and improve stormwater management.

CST's Laura Toran, a hydrogeologist, is overseeing the Temple research team, which includes faculty and students from CST, College of Engineering and Tyler School of Art and Architecture. To fix the problem of dying plants, Tyler's Josh Caplan and fellow researchers identified the culprit as deicing salt used to treat roads in winter. The Pennsylvania Department of Transportation (PennDot) uses pipes to direct water from I-95 into bioretention basins, and during heavy winters this water becomes highly concentrated with salt.

Temple researchers traced sodium from stormwater through the basin soil and into plant tissue, establishing road salt as the root cause of poor plant health. Plants are the most visible component in bioretention basins, so their health is important for aesthetic reasons. But the basins and their plants also play a key role in the city's stormwater management.

Salt tolerance goes a long way in helping plants survive conditions in the basins. But salt tolerance in plants isn't straightforward.

Working with PennDOT, the team incorporated a test of salt-tolerant species, like hardy hibiscus and seaside goldenrod, used in a redesign of a bioretention basin in Philadelphia's Fishtown neighborhood.

Researchers, including CST's Jonathan Nyquist, are also gathering data on survival, growth and leaf chlorophyll content for more than 450 salt-tolerant plants. That data will help them understand which plants are best suited for bioretention basins.

The researchers hope the new data will help PennDOT build basins that are better suited for their role in managing city stormwater. "Putting green infrastructure in a city where you've already built your buildings is hard, and that's why people are looking at what we're doing here," Toran said.

PHOTO: CONNOR MCVAIL

RENDEZVOUS BRINGS GEOSCIENCE EDUCATORS TO TEMPLE

by Greg Fornia

The EES Department hosted the 2024 Earth Educators' Rendezvous, attracting 250 participants from across the country. This year's conference—the first held on the East Coast—included opportunities to explore new pedagogical tools, discuss challenges in the field such as recruiting enough geoscience students to meet the demand of jobs in the next decade, and learning more about Temple's expertise and resources in geoscience and environmental education.

Alexandra Davatzes, associate professor, helped organize the conference, co-led a workshop on understanding the power of feedback loops with regards to environmental challenges and solutions, and co-hosted a field trip for attendees to the Temple Ambler Field Station.

"With the rendezvous on Main Campus, many of our own faculty and students were able to participate and further develop their own teaching practices," explained Davatzes, who is also CST's director of Diversity, Equity, Inclusion and Belonging. "By demonstrating the excellent facilities within CST and showing how we are at the forefront of geoscience education practice, I am hopeful that many of these faculty from around the U.S. will encourage their students to come to graduate school at Temple."

RESEARCH ASSISTANT EARNS AGRIVOLTAICS DESIGN AWARD

by Greg Fornia

Caroline Merheb, a geoscience PhD student, won the 2024 student design competition at the AgriVoltaics World Conference, where participants develop concepts that address community sustainability challenges across the food-energy-water nexus. Merheb works with Sujith Ravi, associate professor, at the agrivoltaic test site at the Ambler Campus.

Agrivoltaics is agricultural production, such as crop or livestock production, underneath solar panels or adjacent to solar panels. Merheb's design focused on three targets: help cities mitigate the effect of urban heat islands, help poor neighborhoods access fresh food produce and improve the aesthetics of artificial surfaces. The design integrated innovative approaches using vertical farming to enhance the cooling effect of panels from plants and hybrid modes of farming to satisfy the needs of urban farmers.

"The Ambler site represents one of the first pilot projects to investigate the success of combining urban agriculture with urban agrivoltaics design layouts in a temperate climate," explained Merheb. "If the system proves to be productive, urban agrivoltaics has the potential to protect urban crops from extreme heat events, produce decentralized and sustainable energy, secure more diverse job opportunities and generate more revenues."

USING ROBOTS TO EXPLORE MELTING ICE SHEETS

by Bruce E. Beans and Jonny Hart

Glaciologist Atsuhiro Muto is part of MOTHERSHIP, a $1.5-million project developing swarms of underwater robots to be sent around the coast of the Antarctic ice sheet to gather vital data.

Ice sheets store roughly two-thirds of the planet's fresh water. Muto says the Antarctic ice sheet holds enough ice to raise the global sea level by nearly 200 feet if it all were to melt.

"It is very unlikely to completely melt," Muto said. "But if a small portion of the ice sheet melted, say, enough to raise sea level by a foot or two, it would inundate much of earth's coastal areas and displace many millions of people."

Muto says most of the current melting of the ice beneath Antarctica is caused by changes in ocean circulation that bring warmer waters to the ice sheet. "Those ocean circulation changes are caused by some human-induced warming in the upper ocean and in the atmosphere, but also by natural climate events such as El Niño," Muto said.

The three-year, NSF-funded MOTHERSHIP project will help determine if marine robots operating in ocean waters underneath Antarctic ice shelves could answer questions about sea-level rise.

One question regards the shape and size of ice cavities underneath the ice shelves. Caused by ocean currents and rising water temperatures, these cavities are miles away from the open ocean and more than 1,000 meters deep, making them difficult to access.

"If successful," says Muto of MOTHERSHIP, "it could enhance our understanding about what is occurring at this critical intersection between the ice sheet and ocean—and provide invaluable data to address global sea-level rise concerns."