



The promise of agrivoltaics

by Bruce E. Beans

When the Philadelphia region baked in high heat last July, lettuce and spinach growing in an open field at Temple Ambler withered away. However, the same plants grown nearby, underneath the shade of solar energy panels, thrived—with just half the water.

Such is the potential for agrivoltaics—an emerging field that Sujith Ravi is pioneering. “It doesn’t work well with every climate and crop,” said Ravi, an associate professor. “But where it’s either too hot or there’s too much sunlight, we’re experimenting to determine if growing plants underneath solar panels can expand both growing seasons and the range of agriculture.”

Since joining CST in 2014, Ravi and his team of researchers and students have explored co-locating solar energy devices with crops and/or biofuels, grazing and/or pollinator-friendly native plants in the United States, India, Indonesia and Nepal. The team has produced more than 10 influential publications, including some of the earliest U.S. studies and collaborated with the National Renewable Energy Laboratory to write the first U.S. Department of Energy agrivoltaics technical report.

Caroline Merheb, a doctoral student in geoscience, is the lead author of a recent paper on the global state of agrivoltaics in the highly prestigious *Nature Sustainability* journal. Pralad Phuyal, another doctoral students, conducts research related to agrivoltaics in Nepal.

Ongoing studies at eight 40- to 100-acre solar power plants in Minnesota are yielding good results when sheep periodically graze on dozens of deep-rooted pollinator-friendly plants. Underneath the solar arrays, the plants are storing more carbon and nutrients, microbial activity has improved and less water is needed.

Since 2023, Ravi’s team at Temple Ambler has been analyzing two 50-meter-square test plots—Pennsylvania’s only such dedicated site for crop production.

“Our study presents the first evaluation of agrivoltaics in an urban context, demonstrating that while early-season yields may decline due to light reduction in temperate climates, productivity rebounds during periods of extreme heat, extending harvest windows and enhancing crop resilience,” said Ravi. “As cities seek climate-adaptive infrastructure, converting just a fraction of vacant land and rooftops to urban agrivoltaics can yield significant co-benefits, generating renewable energy for

thousands of households while supplying fresh produce across multiple growing seasons.”

The site is a focus of education and outreach. High school students, undergrads and Philadelphia STEM teachers have been trained there. A non-governmental organization group from Kenya, researchers from Indonesia and many horticultural groups have also toured the site.

Ravi soon hopes to test newer solar panels that transmit only red and blue light wavelengths, which particularly affect plants’ photosynthesis. His team plans to research agrivoltaics in open areas in South Philadelphia. “We can design community gardens,” he said, “that produce both food and electricity in areas that coincide with food deserts, where people don’t have access to fresh produce.”



BEADLING WILL BE A LEAD AUTHOR FOR IPCC REPORT

by Greg Fornia

Assistant Professor Rebecca Beadling has been selected as a lead author for a chapter of the Intergovernmental Panel on Climate Change’s Seventh Assessment Report (IPCC-AR7). Beadling will author Chapter 6, “Global projects on Earth system responses across time scales.”

Considered the most authoritative source on climate science, “Assessment Reports,” produced by the IPCC every five to eight years, evaluate the current state of knowledge on climate systems, climate change and associated impacts.

“My role will be to work with the chapter team to synthesize material from peer-reviewed research, providing a comprehensive expert assessment of the relevant literature,” explained Beadling.

Chapter 6’s review of Earth system responses is wide ranging. “For example, how ocean circulation patterns are projected to evolve under various potential future emission scenarios, how global carbon sinks will evolve, and how the cryosphere—sea ice, glaciers and ice sheets—will respond as the climate warms,” explained Beadling.

“Being a lead author on a report that will serve as the authoritative source on climate science and climate change to governments around the world is a huge responsibility,” said Beadling. “I’m looking forward to diving into the science and collaborating with an international team of experts.”

RECENT GRADS EARN NSF FELLOWSHIPS

Maxwell Finnegan, CST ’25, and Sean Becker, CST ’25, both received a National Science Foundation Graduate Research Fellowship.

NSF’s graduate fellowship program recognizes and supports outstanding graduate students who are pursuing full-time research-based master’s and doctoral degrees in STEM fields. The five-year Fellowship “provides three years of financial support, including an annual stipend of \$37,000.”

Finnegan is earning a PhD in environmental engineering at the University of California, Los Angeles (UCLA). An environmental science major with a concentration in hydrology, Finnegan said the fellowship “has completely changed the trajectory of my career.”

At UCLA, Finnegan will study the effect of salinity on PFAS (Per- and Polyfluoroalkyl Substances) transport within green stormwater infrastructure.

Sean Becker, who earned both a bachelor’s and master’s in geology at Temple, will pursue his doctorate in geoscience here at CST.

“I’ve had a great time at Temple,” said Becker, “but more importantly I am really excited about the research I’ve been doing here.”

Working with his faculty advisor Associate Professor Alix Davatzes, Becker conducts research on impact events that occurred during the Archean Eon, and the ejecta deposits associated with those events.

For Becker, the NSF fellowship is life changing. “The fellowship has provided me with a lot of opportunities to continue doing the research I care about, while also giving me the resources to really focus on that work,” he said.



PHD STUDENT LEAD AUTHOR IN NATURE SUSTAINABILITY PAPER

by Greg Fornia

Caroline Merheb, a doctoral student in geoscience, is the lead author of a paper on the global state of agrivoltaics, which combines solar and agriculture, in the prestigious *Nature Sustainability* journal.

With years of quantitative and qualitative data from previous agrivoltaics research, the goal of “Synergies and trade-offs of multi-use solar landscapes” was to search for trends, such as increases in energy/food productivity; highlight the benefits agrivoltaics have over separate systems for solar and food production; and identify challenges to collocation scenarios and what could be done to improve the integration of these systems.

“*Nature Sustainability* is one of the most influential platforms for interdisciplinary work that advances understanding of the complex interactions between natural, social and technological systems, with a focus on addressing global sustainability challenges and informing policy,” said Sujith Ravi, associate professor and Merheb’s faculty advisor. “Publishing a data synthesis review paper there is relatively rare and extremely difficult.”

“It’s a great honor,” said Merheb, “there is an exceptional satisfaction for the hard work invested during the first year of my PhD progress to make this research paper happen.”