

2023 UC Merced Climate Action Research Seed Fund Competition

California has a waste problem: organic waste in landfills accounts for 20% of the state's methane emissions (methane is an extremely potent greenhouse gas (GHG)). Limiting GHGs from decomposing organic waste is a top priority of the state: Senate Bill 1383 calls for a 75% reduction in organic waste by 2025 and mandates food waste composting.

The Black Soldier Fly (BSF) can help California win its fight against organic waste. BSF larvae consume nearly any organic material and in the process significantly reduce waste biomass and limit GHG emissions. There are two limitations to effectively using BSFs: 1) domestic flies have limited genetic diversity, making it difficult to develop strains with optimal traits, and 2) the role of gut bacteria (the gut microbiome (GM)) in organic waste processing is incompletely understood. We will use an interdisciplinary approach to vastly improve the waste conversion and GHG reduction power of BSFs. This will be accomplished in two aims: Aim 1 - expand the genetic diversity of domesticated BSFs and select novel strains with optimal waste conversion traits and Aim 2 - fully define the larval gut microbiome and establish techniques that maintain optimal GM-dependent waste processing.

In parallel to laboratory experiments, we will establish a BSF food waste composting operation on the UC Merced campus. This will immediately benefit the campus community and help meet SB 1383 requirements. Over time, our small-scale research and large-scale food waste efforts will inform each other and result in optimal "real world" applications. A guiding principle of this work will be development of resources that can be adopted by Californians broadly, across diverse communities and scales (from backyard composting to large agricultural operations). We will prioritize inclusion and accessibility within our team of student researchers and in community interactions, with the goal of engaging people who may not otherwise have a voice in climate action research and policy.

This project addresses SB 1383 mandates and will help establish equitable access to an effective composting method. This project also aligns with Cal EPA's "Short Lived Climate Pollutant Reduction Strategy" and its prioritization of systems that reduce greenhouse gases while generating beneficial products like soil amendments. Finally, this project addresses the "Build a Climate Resilient Economy" priority of the California Climate Adaptation Strategy, particularly the goal of "climate resilience in the agricultural sector": BSF composting has great potential to mitigate climate impacts from agricultural waste. With these priorities in mind, we aim to produce tangible climate action benefits for all Californians.