ABSTRACT
The number of chemicals that we are using for producing goods and services is increasing rapidly, while our understanding of their environmental and human health impacts improves slowly. Life cycle assessment (LCA) is one of the tools that evaluate environmental and human health impacts of chemicals. Traditional LCAs often rely on the models that represent broad spatial boundaries at regional, national, or global scales. However, the use, release, fate, and transport of chemicals, which are collectively referred to as biophysical processes, may vary substantially within those boundaries. This misalignment in spatial attributes between LCA models and the biophysical processes that determine environmental and human health impacts is one of the major sources of uncertainties in LCA. This dissertation is an attempt to close the gap between the spatial resolutions of the models used in LCA and the biophysical processes relevant for understanding the environmental and human health impacts of chemicals. This dissertation covers four topics: (1) measuring spatial variabilities in life cycle inventory (LCI), (2) understanding the potential drivers of spatial heterogeneity in pesticide use, (3) modeling the fate of chemicals in the environment at the spatial resolution that matches with the underlying biophysical processes, and (4) building a systematic release framework to estimate chemical releases that supports the fate modeling.

BIO
Mengya Tao is a PhD candidate at the Bren School of Environmental Science & Management at the University of California, Santa Barbara, specializing in life cycle assessment and risk assessment. She has published research in accredited journals and frequently presented her work at international conferences. In 2018, Mengya won the People’s Choice Award at the UC-wide Grad Slam and the Championship of the UCSB Grad Slam. During her PhD, Mengya has been a core researcher and back-end developer of the Chemical Life Cycle Collaborative (CLiCC) tool, a web-based tool to rapidly evaluate chemical life cycle impacts and human health and ecological risks. Mengya was elected chair of the Gordon Research Seminar on Industrial Ecology, which she served in 2018. She also chaired the Bren School PhD Student Symposium in 2017. Mengya earned a Master of Art (MA) in Applied Statistics in 2017 and a Master of Environmental Science and Management (MESM) at the Bren School in 2014. She received a Bachelor of Science in Environmental Science at Tongji University, China.