



# Dissertation Defense

## Kanaan Hardaway

Ph.D. Candidate  
SEE/ESE Student



Kanaan is seeking a Ph.D. of Sustainability Engineering and Environmental Engineering with affiliation in Interdisciplinary Ecological Sciences and Engineering. Kanaan has been both an Andrews Fellow and a Bilsland Fellow at Purdue. He received a 2025 Estus H. and Vashti L. Magoon Award for Excellence in Teaching, the 2025 Ecological Sciences and Engineering Outstanding Teaching Award, and a 2025 Teaching Academy Graduate Teaching Award. In 2020 he earned a B.S. of Biological and Agricultural Engineering from the University of Arkansas.

**Dr. Brady S. Hardiman**

**Dr. Roshanak Nateghi**

Advisors

## Biophysical drivers of urban temperature and human health impacts: US Regional and National Patterns

Urban areas concentrate heat and materials, leading to phenomena such as urban heat island (UHI) and urban pollution island (UPI). These “islands” have ill-effects on health, particularly cardiovascular and respiratory systems. UHI and UPI emerge from built infrastructure and human activity. Tree canopy often is employed as a useful infrastructure for mitigating both UHI and UPI. Tree canopy is intertwined with a myriad of other infrastructure, including social and other hard infrastructure, which all can shape human health and analyzing them together can enable a more holistic understanding of urban systems.

The first chapter of this dissertation assessed the influence of a variety of biophysical drivers on urban temperatures and human health using a structural equation modeling framework. The second chapter focused on the “climate-safe” refuge of the Great Lakes Basin to consider both elevated temperatures and air pollution levels mediate human health effects in conjunction with urban biophysical drivers. Investing in infrastructure, such as tree canopy, requires advanced planning, so the last chapter estimated how adding tree canopy to the cities of the Great Lakes Basin will impact the proportion of census tracts exposed to high temperatures over the next 75 years.

The results of this dissertation allow for more nuance in the creation of social infrastructure guiding urban development. Employing a structural equation modeling framework helps incorporate the multiple partial effects urban systems experience. Addressing the effects of the environmental stressors UHI and UPI on human health is possible to some degree through the design of cities. Future work should continue to combine multiple infrastructures when evaluating the parameters of urban systems.



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