Research Statement

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My research lies at the intersection of environmental, urban, and regional economics. I study how environmental quality and natural amenities influence social and economic outcomes, and how policies can mitigate environmental risks while supporting sustainable development. A central feature of my work is the use of causal econometric methods, combined with novel data sources such as remote sensing, machine learning, and spatial big data. This approach allows me to provide rigorous evidence on how environmental change and policy interventions shape labor markets, health, and community resilience. My research agenda is motivated by two complementary goals: advancing empirical understanding of environment – economy interactions, and generating policy relevant insights for improving welfare and resilience in vulnerable communities.

Dissertation Research

In my dissertation, *Three Essays on Environmental Economics*, I study the economic and social effects of environmental quality through three complementary chapters.

Air pollution and absenteeism: The first chapter, published in *Environmental and Resource Economics*, investigates how air pollution affects chronic school absenteeism, a key predictor of long term educational and socioeconomic outcomes. While prior research has studied general school attendance and short term test scores, little was known about chronic absenteeism, which matters more for long run outcomes. Using a national sample of schools and six criteria pollutants monitored by the U.S. Environmental Protection Agency, I apply an instrumental variable strategy based on wind direction to address endogeneity in local pollution exposure. I find that additional days of poor air quality increase chronic absenteeism even when pollution is well within EPA standards, with stronger impacts for disadvantaged students. These results highlight the hidden costs of sub-threshold pollution exposure and underscore the importance of strict air quality regulation for protecting human capital formation and equity in education.

Greenspace and wages: My second paper examines urban greenspace as an environmental amenity that influence workers' wage decisions. Using Normalized Difference Vegetation Index (NDVI) and county level panel data from 2011 to 2019, I estimate a spatial equilibrium model of compensating differentials, where workers trade off wages to be in a greener city. To address potential endogeneity, I instrument for current vegetation with historical land cover patterns from the 1970s and 1980s. Results indicate that workers are willing to accept lower wages to live in greener cities, while employment and population growth are higher in those areas. These findings demonstrate that greenspace is not merely an aesthetic feature but a driver of urban attractiveness and economic growth. By documenting the economic value of urban greenery, this paper contributes to debates on sustainable urban development and the role of environmental amenities in shaping regional competitiveness.

Agriculture and drinking water: The third paper explores how upstream agricultural practices affect compliance with the Safe Drinking Water Act in downstream communities. Agricultural nutrient runoff, particularly from nitrogen and phosphorus, has long been identified as a major source of water quality degradation, but little is known about its direct impact on drinking water violations. Using county level data from 2006 to 2022, I link cropland data layer to records of public water system compliance. Preliminary results suggest that nutrient runoff is a significant contributor to downstream violations, raising both regulatory and economic

concerns. This paper advances the literature by quantifying the cost of agricultural externalities in terms of drinking water safety, highlighting the limitations of current regulatory frameworks and property rights concerns, pointing toward the need for targeted interventions to protect vulnerable water systems. Together, these papers demonstrate how environmental quality influences outcomes in education, labor markets, and public health, three fundamental domains of human welfare.

Beyond the dissertation, I also conduct research on energy economics. I examine the social and economic costs of new power generation projects in West Virginia, develop long-term greenhouse gas projections under alternative scenarios to explore sustainable energy growth, and study community development paths for regions reliant on declining industries such as coal. This strand of research highlights the intersection of environmental and regional economics with energy transition challenges.

Future Research Agenda

Building on this foundation, I plan to pursue three interconnected domains of research.

Environment and Resilience: I am currently exploring how communities respond to environmental shocks such as wildfires, floods, and hurricanes. Using nighttime lights and cell phone mobility data, I measure population displacement and return to track disaster recovery at fine spatial and temporal scales. This work seeks to identify the policies, infrastructure investments, and migration dynamics that shape the pace and equity of recovery. I also extend my research on human capital by studying how air quality affects student achievement and how investments in school-based mental health resources mitigate absenteeism. These projects contribute to understanding the long-run effects of environmental conditions on education, labor markets, and resilience.

Urban and Regional Dynamics: On the *urban side*, I plan to explore the development of greener cities, focusing on the contributors and predictors of intra-city inequalities in environmental quality and amenities at the neighborhood level. On the *regional side*, I plan to investigate how different types of businesses influence rural economic development, with particular emphasis on their role in promoting tourism and diversifying local economies.

UrbanEye and Data Innovation: A central component of my agenda is **UrbanEye**, an open-source Python toolkit that applies computer vision to Google Street View imagery to generate street-level measures of urban features like greenery, road condition, neighborhood outlook, etc. Unlike coarse proxies such as NDVI or nighttime lights, UrbanEye captures the lived environment at a neighborhood scale. My future plans include training multimodal models to detect a broader set of urban features, enabling systematic comparisons of built and natural environments across cities worldwide. This methodological innovation supports new empirical work on how amenities influence housing markets, migration, and wages.

Conclusion

My research program bridges environmental economics, regional science, and applied microeconomics. By combining causal inference with novel data methods including satellite imagery, computer vision, and mobility records, I provide new evidence on how environmental quality shapes economic outcomes. In the long run, I aim to advance the academic literature while equipping policymakers with tools to promote resilient and equitable communities.