Estimating Particulate Matter Exposure Across Populations in Alabama

Lancaster, Elizabeth (School: Alabama School of Fine Arts)

Particulate matter consists of both solid particles and liquid droplets. PM2.5 are particles 2.5 micrometers in diameter or less. Internal combustion engines, coal-fired power plants, construction sites, and unpaved roads are sources of this pollution, and high concentrations are of concern across cities because of human health impacts. These particles are small enough to penetrate the lungs and reach the bloodstream. PM2.5 is linked to decreased lung function, aggravated asthma, nonfatal heart attacks, and irregular heartbeats. People under age five, and over 65 are at a greater risk for these respiratory issues. Annual average PM2.5 concentrations were generated for nine Alabama cities using air quality data from the Alabama Department of Environmental Management (ADEM). City population densities and at-risk populations percentages were determined using 2019 Census population estimates. The 2019 average PM2.5 concentrations were used to generate a map and interpolate the concentrations from these cities across the state. This map represents the average concentration distribution of PM2.5 across the state using only the data collected from these city monitors. We found a positive correlation between the 2019 average PM2.5 and the population density ($r(7)=.85$), $p=0.0038$, and a negative trend between the same year's average PM2.5 and at-risk populations percentages based on age ($r(7)=-.78$), $p=0.14$. This study is limited to finding a relationship between these variables and does not have the bounds to determine causation or to relate to other variables at this time.

Awards Won: