

# ASSOCIATIONS BETWEEN SOCIAL VULNERABILITY AND ENVIRONMENTAL QUALITY IN THE SOUTHEASTERN UNITED STATES

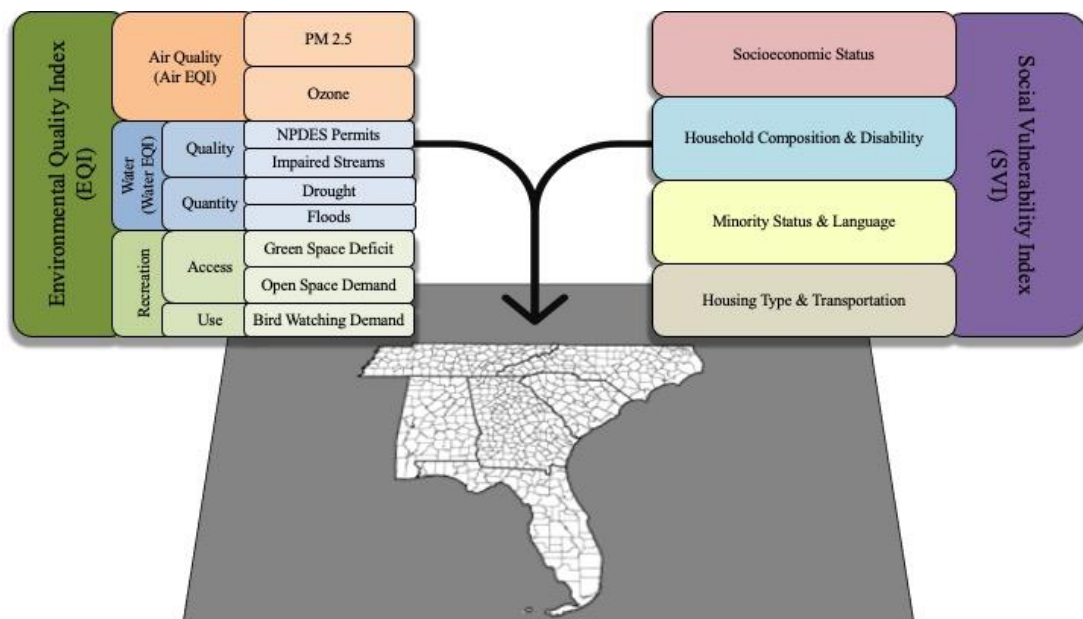
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## CONTEXT

Environmental quality is often directly linked to human health and wellbeing, with poor environmental quality being a major contributing factor to death worldwide (27). While the effect of environmental quality on health has been extensively researched, studies that examine which sociodemographic communities are most negatively affected by poor environmental quality are relatively rare. Yet this is an essential factor to ensuring that environmental management actions alleviate rather than exacerbate societal inequities. While it is common to examine the impact of individual components of environmental quality on communities (e.g., the effect of air pollution on minority communities), more holistic analyses examining how multiple aspects of environmental quality impact communities are less common. As the environment and natural landscape continue to change, it is imperative to understand if more at-risk communities are adversely affected by these changes.

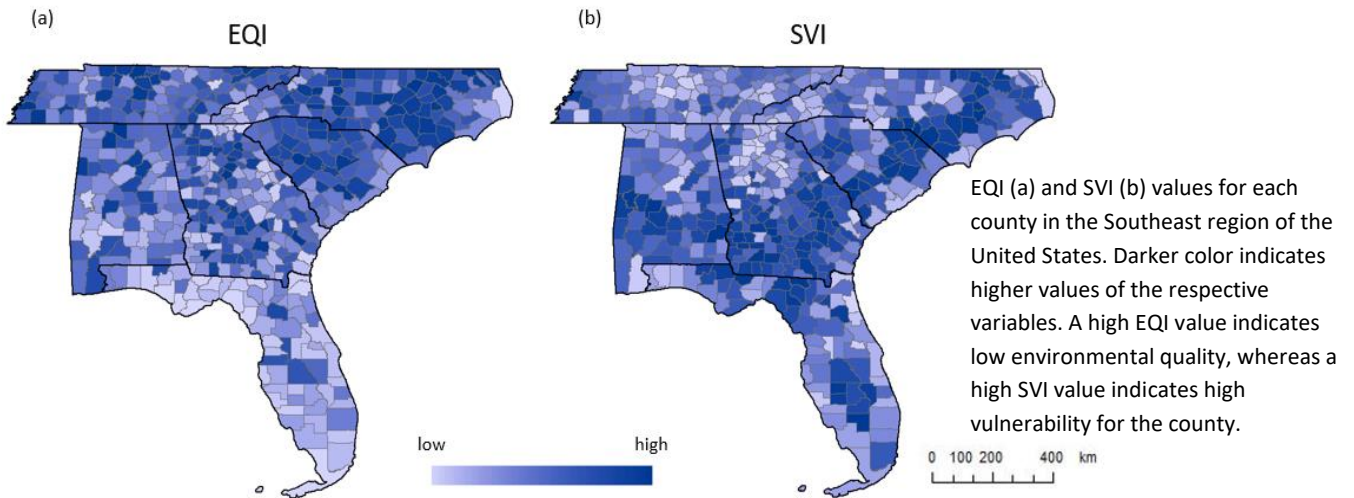
## MEASURES OF ENVIRONMENTAL QUALITY AND SOCIAL VULNERABILITY

We utilized the Social Vulnerability Index (SVI) from the Center for Disease Control (CDC) and indicators of environmental quality from the Environmental Protection Agency (EPA) to examine spatial correlations between sociodemographic characteristics of human communities and air quality, water quality and quantity, and recreational benefits across six states in the southeastern United States. Our overarching goal was to explore the spatial relationship of environmental quality and socially vulnerable populations across counties within the southeastern United States (Figure 1). Specifically, we ask (1) how the SVI correlates with environmental quality and (2) how particular components of SVI and environmental quality correlate with one another.



## OVERALL PATTERNS

By bringing together the two indices (EQI and SVI), we are able to assess whether counties that have high vulnerability also have low environmental quality. The correlation between overall SVI and EQI is  $-0.115$ , suggesting that counties with higher social vulnerability also have higher environmental quality, given the orientation of the two indices (Figure 2). This negative correlation between the SVI and EQI can be attributed to the fact that many, socially vulnerable, rural counties experience higher environmental quality than do more urban areas.



## INDIVIDUAL INDICATORS OF ENVIRONMENTAL QUALITY

Examining correlations between particular components of environmental quality and social vulnerability reveals a more nuanced picture. Sometimes we find the same pattern as revealed when considering the overall scores, namely that more socially vulnerable counties experience higher environmental quality (Table 1). But there are also situations where the pattern is reversed. For example, even though minority status showed no association with overall EQI, it did show associations with particular components of EQI, such as the number of NPDES permits issued in a county. The significant, positive correlation here indicates that there are more NPDES permits being issued near communities that include a greater percentage of minorities. A full description of the different spatial patterns we find and what they imply can be found in the full project report ([link below](#)).

## CONCLUSION

Our results highlight how environmental monitoring could benefit from incorporating indicators describing impacts on different human communities, such as the SVI indicators. Doing so would allow decision-makers and practitioners to explicitly consider who benefits most from improved environmental quality and how they benefit, in addition to broadening future environmental monitoring efforts. Future studies should expand the examined indicators to gain a more-comprehensive view into the geographic patterns. In particular, including ecosystem services more directly could aid in mapping services that overlap with environmental quality and the Social Vulnerability Index. This could, in part, demonstrate more clearly which populations derive the most benefits from ecosystem services and if the presence or absence of ecosystem services contributes to social vulnerability.

Table 1. Spearman’s Rank Sum Correlation values between social vulnerability indicators and environmental quality indicators. Significant positive correlations indicate that more socially vulnerable populations tend to have lower environmental quality with respect to the components that the indicators represent. Negative correlations indicate the opposite. Significance levels: \*\*\*\* p<0.0001, \*\*\* p<0.001, \*\* p<0.01, \* p<0.05.

VARIABLES	EQI	Air EQI	PM2.5	Surface Ozone	Water EQI	Impaired Streams	NPDES Permits	Drought	Flood	Open Space Access Demand	Green Space Deficit	Bird Watching Demand
<i>SVI</i>	-0.11 **	-0.07	-0.04	-0.29 ****	-0.06	-0.24 ****	-0.20 **	-0.23 ****	-0.26 ****	-0.12 **	0.05	-0.42 ****
<i>Socioeconomic Status</i>	-0.06	0.01	0.06	-0.17 ****	-0.12 **	-0.28 ****	-0.39 ****	-0.14 **	-0.33 ****	-0.21 ****	-0.09 *	-0.51 ****
<i>Household Composition</i>	-0.05	0.03	0	-0.11 **	-0.02	-0.22 ****	-0.22 ****	-0.08	-0.22 ****	-0.03	0.07	-0.37 ****
<i>Minority Status</i>	-0.02	-0.15 ***	-0.15 ***	-0.26 ****	0.09 *	-0.05	0.28 ****	-0.21 ****	-0.22 ****	-0.03	0.23 ****	0.15 ****
<i>Housing and Transportation</i>	-0.22 ****	-0.10 *	-0.14 *	-0.31 ****	-0.05	-0.04	0.03	-0.27 ****	-0.08	-0.12 **	0.01	-0.24 ****



This analysis was supported by the Southeast Climate Adaptation Science Center as part of a suite of case studies investigating the application of ecosystem services mapping in support of regional partner needs. More information can be found at [secasc.ncsu.edu/resources/ecosystem-services-case-studies/](https://secasc.ncsu.edu/resources/ecosystem-services-case-studies/). In addition, a full report describing the project can be found at [https://secasc.ncsu.edu/wp-content/uploads/sites/14/2021/09/UT\\_EQI\\_SVI\\_Association\\_Full\\_report.pdf](https://secasc.ncsu.edu/wp-content/uploads/sites/14/2021/09/UT_EQI_SVI_Association_Full_report.pdf)