

Sociotechnical Synthesis

(Executive Summary)

Developing a Flood Warning System and Strategies to Ensure Environmental Infrastructure will Promote Environmental Justice Instead of Producing Environmental Gentrification

Paradoxically, marginalized communities face a disproportionate number of challenges from both natural disasters and the sustainability initiatives that were meant to protect them. Hazardous weather events increase in frequency and severity every year, flooding is currently the most frequent natural disaster in the United States and causes significant damage and loss of life. The combination of climate change and inadequate flood control strategies can bring many social and economic dangers, especially for vulnerable populations. With the rise of climate change, environmental technology such as flood mitigation systems are rapidly being built across the nation. Green infrastructure and urban greening projects are often hailed as a means of protecting cities against climate change impacts, however, when implemented incorrectly, these projects can lead to gentrification, that is, the rise of housing prices and the displacement of residents, particularly low-income and minority residents.

In the technical portion of my thesis, I worked with a group of students to develop a flood warning system to provide users with the ability to monitor and understand real-time flood conditions. Additionally, this system has the capability to notify residents and county officials if flooding is detected. To demonstrate the system, a proof-of-concept of the design was created for a flood prone watershed in Albemarle County, Virginia. Various Internet of Things sensors were placed in four locations in Albemarle to continuously collect water level data. An interactive

graphical user interface was created to display visualizations and utilized to send out warning notifications to users based on water level readings. A demonstration of the system and our methods were presented to members of the Albemarle County Environmental Service Department. The flood warning system can benefit community residents by alerting them to flooded areas ahead of time and potentially reducing damage, loss of life, and inconvenience from floods. Flood mitigation technology should benefit everyone, however, it often leads to unforeseen consequences for the most vulnerable populations.

In my STS research, I discovered that in order to reduce the possibility of reinforcing environmental gentrification, the implementation of green technology must set policies that protect existing residents from gentrification. Case studies were conducted through the perspective of Actor-network theory (ANT) to illustrate the social implications of environmental initiatives and what can be done to prevent gentrification. Environmental initiatives can enhance gentrification by driving up property values and displacing low-income residents. When creating and implementing environmental technology in communities, it is paramount that the potential negative consequences of these projects are thoroughly understood and strategies are put in place to ensure environmental justice for all residents. My research finds that the development of sustainable projects must include planners that are motivated to create infrastructure that benefits all residents and who are given the institutional capacity to implement these designs.

Additionally, agencies that plan and develop large environmental infrastructure should implement the Affordability First method which creates plans for preserving affordable housing before other aspects of the project are considered. Using this approach, planning starts with creating a set of tools to protect existing residents from surges in rent and property taxes along with providing long-term affordable housing. These investments can help ensure that green

infrastructure will protect vulnerable residents from both climate change impacts and displacement stemming from environmental gentrification.

The technical portion of my thesis on developing a flood warning system and the STS portion on environmental gentrification greatly enriched each other in the forming of this project. The STS research enhanced the technical project by providing insights into the occurrence and prevention of environmental gentrification, while the technical project enriched the STS research by presenting an understanding of how an environmental project might be created and implemented. By completing both sections instead of only one, I was able to gain a better understanding of the entire process of going from the creation of a green project to gentrification and attained a wider range of knowledge on environmental gentrification as a sociotechnical system. This project as a whole illustrates the importance of looking broadly for potential consequences of engineering creations and the professional responsibility engineers hold to not only do no harm to others, but to foster justice.