

Thesis Project Portfolio

North Grounds Stream Restoration

(Technical Report)

Changing Gears: The Different Approaches of Bicycling Advocates in Richmond, Virginia

(STS Research Paper)

An Undergraduate Thesis

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Sociotechnical Synthesis

The general problem I addressed is that the built environment is not being designed for human and ecological activities to operate in harmony. This is a basic sustainability principle, because human and environmental activities depend on each other to conserve resources and adapt to new challenges. The technical problem is a stream restoration, necessitated after an increase in urbanization and impervious area, and thus stormwater runoff. This increased runoff leads to the stream channel becoming incised via erosion and carrying sediment pollutants downstream. The social problem is car-centric infrastructure and culture, which encourages people to travel via car, which both makes it harder for other people to drive, due to congestion, or take other modes, due to the danger posed by drivers to people outside of cars. The problem at the core of this is short-sighted design that doesn't consider how other systems will be impacted after one component is altered.

The stream restoration consisted of determining the existing conditions, via surveying and water quality testing. This informed us about the movement of stormwater in the channel and the current pollutant levels. Then, our team created a design of pools and riffles that will slow the flow of water and decrease the erosion of the stream banks. My primary task in this project was to meet the needs of one of the stakeholders in the project, the Rivanna Trails Foundation (RTF). The RTF manages a trail that runs along the project site, so they had several requests that were instrumental in creating a plan to reroute trail users during construction and protecting the trail during construction. Our work will earn UVA credits with the Virginia Department of Environmental Quality by stabilizing the banks of the stream and thus decreasing pollutant loads. This will also allow a more ecologically diverse floodplain now that plants are able to take root rather than be swept away with the eroded banks. This will allow natural life to thrive better

alongside human development, allowing humans to enjoy the space and tend to the land in a symbiotic relationship.

The city of Richmond has seen car-centric design and thinking influence it greatly over the past several decades, but several groups are speaking out against this, promoting bicycling as an alternative to driving. I examined the different strategies these groups use to advance their goals, and considered how effective each was, how they could be used to support one another, and where they might work outside of Richmond. Once these groups manage to communicate that a city that is more friendly to cyclists is more friendly to everyone, their goals will have much more broad support. Drivers can support a cycling city because it helps take cars off the roads and alleviate congestion. People with lungs can support a city where more people bike instead of driving gas-powered cars. Children and the elderly can appreciate a city with safer streets to cross. Cycling advocacy is part of a larger movement to support a wider range of transport modes, so that peoples' demands can be met in different ways and not swarm one option making it work poorly for everyone.

I merely scratched the surface of my general problem, but bringing awareness to it is a crucial step that I believe I helped to advance. I think future researchers should explore more examples of systems thinking, where many seemingly unrelated processes influence each other. For specifically the technical problem, researchers should look at the root cause of the problem, excessive stormwater runoff, rather than simply treating the symptom of such. For the social problem, researchers should examine what reservations people may have about a transportation system not centered around cars, and figure out how to demonstrate the benefits of multiple modes without actually having to spend years and millions of dollars to implement them.

On the technical project, I'd like to first thank my team; Karin Brett, Lucas Bushey, Dorian Gaines, Nora Levasseur, and Shayla Utzinger; for all the work they put into this project with me. Their expertise with the software and organizational skills were crucial in achieving the outcome we were able to present. Jonathan Goodall, Brett Long, and Ted Brown were crucial in advising us throughout the project. Jason Castro from the Rivanna Trails Foundation was kind enough to advise me on the intentions of the RTF with this project.

On the social project, Peter Norton and Caitlin Wylie helped tremendously with inspiring my topic and refining my arguments.