The Role of Urban Greenways in Creating an Equitably Resilient City Through An Examination of the Rivanna Trail Network in Charlottesville, Virginia

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On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

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1. Introduction

Urban populations are expected to boom over the coming decades, with the global urban population expected to grow by 150% by the year 2045 (World Bank, n.d.) The growing threat of the climate crisis will hit urban centers especially hard, threatening human lives and causing damage to infrastructure through increased heat extremes, flooding, changing weather patterns, and epidemics. (Lee et al., 2023, World Bank). These adverse impacts will not be felt evenly across urban populations, but will be "concentrated amongst economically and socially marginalized urban residents." (Lee et al., 2023) Incorporating infrastructure into cities to cope with these disasters and adapt to a changing climate is imperative, and it must be done so in a way that is equitable.

The latest report issued by the International Panel on Climate Change (IPCC) placed an emphasis on the importance of green urban infrastructure as a method to combat the effects of climate change in urban spaces, notably for its cost effectiveness and general public support (Lee et al., 2023). Urban greenways have become a common form of linear green infrastructure due to the ecological and social benefits that they provide. Greenways can be defined as linear urban green infrastructure that are designed to provide a number of social and ecological benefits that can work towards creating a resilient urban landscape (Fink, 2016).

The primary methodology of this thesis will be an examination of the existing literature on the topic of equity and resiliency as it applies to the planning and use of greenspace, with a focus and application to greenways specifically. Additionally, this thesis will apply these suggestions to a case study of The Rivanna Trail in Charlottesville, Virginia. The Rivanna Trail system is an approximately 20 mile linear urban greenway that circumnavigates the entire city and is composed of singletrack and paved pathways (Rivanna Trails Foundation, n.d.). Methods and strategies to create equitable and resilient greenways will be applied to the current Rivanna Trail to make suggestions for future improvements and changes to the trail system.

As the impacts of the climate crisis manifest in cities globally, it becomes increasingly important to investigate the role that greenways could play in creating a resilient urban landscape, as well as an equitable one. Through methods such as community stakeholder engagement and equitable spatial planning, greenways have the potential to enhance climate resiliency in urban spaces while providing equitable access to the variety of social and ecological benefits they provide.

2. Background and Significance

With 7 in 10 people projected to live in cities around the world by 2050, the need to develop sustainable and resilient urban landscapes is more pressing than ever before (World Bank, n.d.). Alongside this population trend, escalating global temperatures and a changing climate will pose serious challenges to cities. In 2014, The Intergovernmental Panel on Climate Change reported with very high confidence that urban areas around the world will experience risks including heat stress, water scarcity, drought, and more intense flooding in both coastal and inland regions (Pachauri et al., 2014).

Strategies to adapt to and mitigate the risks of climate change are essential to integrate into urban spaces, and city planners and leaders are turning more frequently towards the implementation of green infrastructure. Greenways, a form of linear urban green infrastructure, have emerged as a powerful tool for creating a resilient urban landscape (Fink, 2016). The use of urban greenways to improve city resiliency has become prominent as they provide a number of ecological services, such as flood protection, temperature reduction, and biodiversity (Martin, 2016). Greenspaces have also been linked with social benefits such as increased health, happiness, and social cohesion (Syamili et al., 2023, Jennings & Bamkole, 2019). The popularity of greenways as a planning technique has gained significant traction since their conception over a century ago, with modern greenway projects such as the High Line and Atlanta Beltway gaining lots of popularity in media ("Here's the Revolutionary Idea Behind America's Urban Trails," 2021, “New York's High Line: Why the Floating Promenade Is So Popular," 2014). There has also been a transition from greenways as a simple parkway towards “multi-objective greenways that go beyond recreation and beautification to address such areas as habitat needs of wildlife, promoting urban flood damage reduction, enhancing water quality,

providing a resource for outdoor education, and other urban infrastructure objectives" (Searns, 1995). Their potential to protect cities against flooding, provide habitat for a variety of plants and wildlife, and reduce urban temperatures make them unignorable in the realm of resilience planning (Martin, 2016).

While greenways, and green infrastructure as a whole, can be a powerful tool for urban climate adaptation, access to greenspaces in urban environments, as well as the environmental benefits that follow come with them, is often unevenly distributed across demographics and communities (Mullenbach et al., 2022, Rigolon et al., 2020, Lin & Andersson, 2023). This compounds the fact that the effects of climate change will not be felt evenly across populations. Those living in poverty, as well as other marginalized groups, will bear a disproportionate burden of and experience heightened vulnerability to the adverse effects of climate change (Pachauri et al., 2014; National Institute of Environmental Health Sciences [NIEHS], 2022). Socioeconomic and ethnoracial disparities in both access to green spaces as well as use persist in urban areas, and attempts to resolve these disparities can, in some cases, lead to “green gentrification,” (Rigolon et al., 2020, Kuiper & Infield, 2019). Unequal access to greenspace and the benefits that come with them further exacerbates the social and environmental injustices felt by lower income and minority groups. Tactics for the planning and implementation of urban greenways that work toward equity as well as resiliency in urban spaces are essential as they continue to be a commonly used planning technique to improve resiliency.

Understanding definitions: Equity & Resilience in the context of Urban Spaces

The definition of resiliency is constantly evolving and is often interpreted differently based in different contexts and within different spheres (Keck & Sakdapolrak, 2013). A systems social resilience is determined by three factors: persistability, adaptability, and transformability (Keck & Sakdapolrak, 2013) Ahern (as cited in Fink, 2016) defined resilience through strategies used to create it- a) biodiversity; b) urban ecological networks and connectivity; c) multifunctionality; d) redundancy and modularization; and e) adaptive design.

As with any technology, tactics and definitions of resilience have not been managed to be untouched by the social structures and power relations ingrained in human society. As said by

Adger (2000) “social resilience is institutionally determined, in the sense that institutions permeate all social systems and institutions fundamentally determine the economic system in terms of its structure and distribution of assets” (as cited in Keck & Sakdapolrak, 2013). Resiliency is not detached from social inequity, and neither are the effects of climate change. An overwhelming body of work exists proving that greenspaces, including greenways, are beneficial in a variety of ways, and the lack of equal access to them is an environmental justice issue (Rigolon et al., 2019, Jennings et al., 2012). “Decisions about greening invariably reflect the hierarchy of power and wealth within city bureaucracy” and it is imperative to ensure that future urban greenways do not perpetuate systems of social and economic power as many greenspaces continue to do (Cole et al., 2017 as cited in Mullenbach et al., 2022).

The Rivanna Trail greenway is a linear loop trail surrounding the City of Charlottesville. It consists of over 20 miles of paved paths, more rugged trails, and spur connections shared by city residents and used to hike, run, bike, fish, and access many of Charlottesville’s community assets (Rivanna Trails Foundation, n.d.). The network connects multiple neighborhoods within the city, as well as 6 city parks. This trail system offers a compelling case study due as the city of Charlottesville is racially and economically diverse, with an extensive history of inequality and displacement of minority communities (*Charlottesville 2017 : The Legacy of Race and Inequity*, n.d.).

As the threats of climate change become ever more present, cities need to incorporate green space designs that are not only resilient, but equitable. Through the investigation into literature as well as a case study of the Rivanna Trail network in Charlottesville, this thesis seeks to understand the strategies that can be employed to use urban greenways to create an equitably resilient urban landscape.

3. Methodology

3.1 Systematic Review

In order to understand how to create equitable and resilient urban greenways, a literature review was conducted to provide context for understanding this thesis’ investigation into equitable urban greenways. In order to collect literature to lay a foundation for this research, the

UVA Virgo search engine was used to find papers. Primary words used in this search included “greenways”, “equity”, “resilience”, “green space”, and “accessibility”. Journals that were of particular use include Landscape Architecture and the International Journal of Environmental Research and Public Health. Studies that primarily focused on greenways were prioritized, however those that discussed green space on a broader scale have also been included as the concepts and planning strategies are very similar. Papers published in peer-reviewed journals were prioritized, however online searches using similar keywords were also conducted to find relevant articles or projects not contained in scientific journals. These pieces of literature proved to be very beneficial as they include new ideas of how to consider equity in the context of urban greening. Papers and case studies located in the United States were used primarily, with an acknowledgment that the issues of inequity that exist are unique to the history and social structure of the country. Findings from the literature review were divided based on 5 general topics of discussion - Spatial Distribution, Community Engagement, Stakeholders, Placemaking, and Gentrification. Planning documents such as the Charlottesville Comprehensive Plan and Urban Rivanna River Corridor Plan provided information on the strategies concerning resilience and equity employed by the Rivanna trail currently.

4. Literature Review

Spatial Distribution

Proximity to greenways has been the most common measure of accessibility and subsequent measure of the benefits of the greenspace to the surrounding populations (Lin & Andersson, 2023, Lindsey et al., 2001). Spatial patterns of greenway networks can work to create a resilient urban landscape, however “there is still a lack of research on the role of their spatial pattern in guaranteeing equal social access” (Valente et al., 2022). However, according to Valente et al., to reap the benefits that greenspace can provide, two factors must be considered - green space abundance and spatial arrangement (2022). Significant current literature indicates that spatial planning of urban green spaces “can be highly unequal, with low socioeconomic status and ethnic minority communities having access to fewer acres of parks.” (Lin & Andersson, 2023) It is often the case that lower income and high percent minority communities, which are

the most vulnerable to the effects of climate change, lack access to green spaces (Kuiper & Infield, 2019). However, other research has produced inconclusive results or shown that high-percent minority and lower income communities have increased spatial proximity to parks (Engelberg et al., 2016).

One way to increase access of lower income and minority populations to greenways is to adopt the use of an equity lens rather than an equality lens (Rigolon et al., 2020) This promotes a transition from a central focus on physical distribution to a focus on need based distribution (Lindsey et al., 2001). Even still, discrepancies, and often unevenness, in the distribution of green space among vulnerable populations calls for careful investigation into other factors influencing greenway equity.

Community Engagement in Planning

While spatial planning of greenways is undoubtedly an important part of creating greenways for all to access, other factors influencing accessibility must be considered as well. Even in urban areas where access may be present, patterns of greenway use are not consistent across demographics and socioeconomic strata (Lindsey et al., 2001). Physical access does not necessarily directly equate to greenway use (Lin et al., 2014).

To approach the social disparities surrounding use and access to green spaces Mullenbach et al. calls for the use of the 3 aspects of the environmental justice framework to guide the antiracist and anticolonial planning of new urban greening - distributional justice, recognition, and procedural justice (Mullenbach et al., 2022) Rigolon et al. lays out how to use these three factors in green space planning- “parks should be equitably distributed across socioeconomic and ethnoracial groups (distributional justice); decision-making processes to design new or renovated parks should meaningfully involve the most marginalized groups (procedural justice); and parks and recreation programs should provide culturally appropriate and welcoming environments for the most marginalized populations (interactional justice)” (Rigolon et al., 2019) Approaches with these mindsets work to center the planning phase around the community.

Urban greening projects have continued to push a White vision of nature. (Mullenbach et al., 2022) By directly centering community members in the planning process of greenspaces can

allow voices to be heard and can ensure that the diverse perspectives and needs of the community are placed at the forefront rather than continuing to perpetuate systems of power (Martinez et al., 2022, Rigolon et al., 2019). The Brooklyn Greenway Initiative (BGI) recently released their plan for a Coalition-Driven Path to an Equitable City-Wide Greenway, which centers their Greenway planning around a unified greenway vision based on community input and identified needs (Urban Land Institute New York, 2022) Community involvement initiatives in the planning phase should work to ensure that a greenway will fit the needs of the residents, integrate community values, and reflect the community culture of marginalized groups to promote feelings of welcomeness in the space. (Jacoby-Garrett, 2021, Urban Land Institute New York, 2022). Ways to actively engage communities, assess their needs, and prioritize diverse perspectives to create a strong sense of placemaking in green spaces are further explored in a number of pieces of literature (Jacoby-Garrett, 2021, Rigolon et al., 2019, Urban Land Institute New York, 2022).

Engagement of Stakeholders

While physical proximity to a park and social implications can pose a barrier to access for marginalized groups, funding allocation can be unequally distributed as well and lead to differences in green space quality, acreage and safety after the construction of the greenway (Engelberg et al., 2016, Lin & Andersson, 2023). This can lead to green spaces facing "neglect or lacking maintenance of existing green spaces may reduce their attractivity or functionality" (Nassauer & Raskin, 2014 as cited in Lin & Andersson, 2023). Ways to advocate for funding and plan its distribution should be a part of greenway planning to ensure that the greenway does not fall into disrepair. BGI's plan lays out the need to create a model to distribute funds "beyond the point of generation (typically wealthy neighborhoods in the current environment)" and lays out two options for how funding could be distributed (see Fig. 1) (Urban Land Institute New York, 2022).

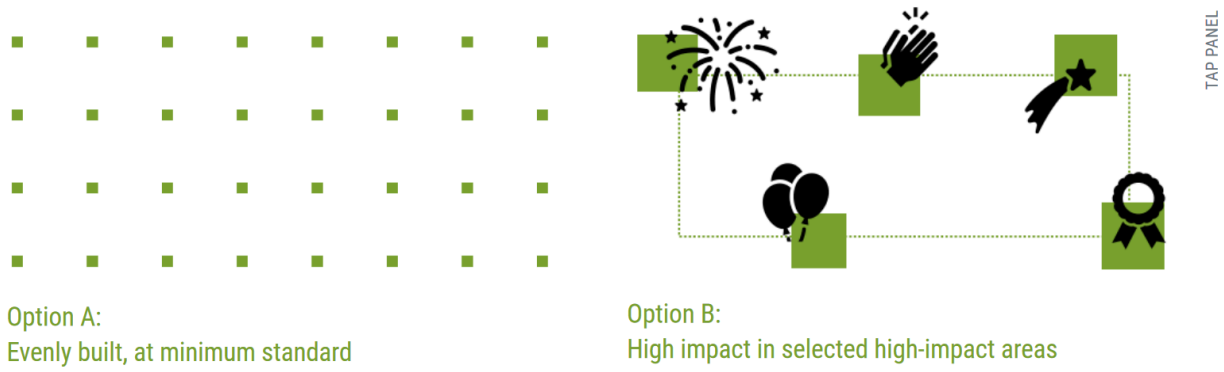

Fig. 1. Brooklyn Coalition-Driven Path to an Equitable City-Wide Greenway Funding Distribution Options

Creating Space: Placemaking in Greenways

Inequality in urban green space does not cease to exist after their inception. Programming and community activities can have an impact on how welcome residents feel in a green space and their retention (Rigolon et al., 2020) Additionally, demographics that are "disconnected from social networks or estranged from democratic processes and decision-making" may feel less encouraged and invited into green spaces (Berney, 2010 as cited in Rigolon et al., 2019) Urban greening has been ingrained with social dynamics and hierarchies, and has often emphasized a white ideal of nature (Mullenbach et al., 2022) By increasing the range of programs and services provided by the space, planning can begin to alter the perception of relationships between individuals in certain communities and the green space environment, working to ensure that underrepresented groups feel welcome and engaged by green spaces (Lin & Andersson, 2023). The recognition of social structures that affect placemaking, legibility, and attractiveness of certain spaces to different social groups should be integral in the planning of green space programming and decision making (Lin & Andersson, 2023). By creating spaces where the values of different communities and cultures are represented, greenways can be used to create social connection and improve community resilience.

The Green Paradox: Greenways & Gentrification

One method used to address gentrification surrounding urban greenways is the tactic of creating a space that is "just green enough". This approach includes 4 strategies - "small scale… scattered sites", policy to preserve affordable housing, giving voice to marginalized residents to

ensure their interests are included, and lastly a commitment to the community needs rather than the creation of "tourist-oriented parks" (Rigolon et al., 2020, Curran and Hamilton, 2012). This method of urban greening emphasizes smaller scale projects centered around resident use and community driven designs to avoid the "urban green space paradox" and avoid urban environmental gentrification. (Kuiper & Infield, 2019). Without proactive housing policy to protect against gentrification around a new greenspace, "environmental gentrification is inevitable". (Rigolon et al., 2020) A literature review conducted by Horte and Eisenman found that there were few studies done on green space gentrification and displacement of residents in surrounding areas and identified this area of research as a gap in the literature surrounding greenway planning (Horte & Eisenman, 2020).

5. Discussion and Results

By incorporating equity and environmental justice as a priority in the greenway planning process, greenways have the potential to become a powerful tool to bring the resilience benefits of green space to vulnerable populations in an equitable way. Equitable greenway planning should involve strong community involvement and the creation of a unified vision and plan for not only greenway creation, but for stakeholder engagement and funding distribution, continued placemaking, and greenway maintenance for the future. This ensures that the issues of equity are not distilled to simple physical accessibility to greenways, and that the complexities and nuances of the problem are acknowledged.

The City of Charlottesville, Virginia has a deep history and patterns of racial injustice (Dukes, 2019). Strategies to create a resilient Charlottesville must take special care to not perpetuate systems of power existing from this history and further marginalize low income and minority communities. From this understanding gained in this review, it is possible to envision an equitable and justice oriented greenway plan for the Rivanna Trail Network in Charlottesville. The current Charlottesville Comprehensive plan includes environmental justice specifically as an initiative under their Tree Canopy goal. Within the Goals for Parks and Recreation, Equity and Opportunity is included as a Related Guiding Principle (City of Charlottesville, 2021). The newest draft addition to the Comprehensive Plan focuses on the Rivanna Corridor, and equity is mentioned only once, and is in regards to public transportation and bike/ped connections

(Thomas Jefferson Planning District Commission, 2022). While the Rivanna Corridor plan acknowledges the need for recognition of the history of the space, there is no mention of minority, vulnerable or low income communities, socioeconomic status, affordable housing, or gentrification is included in this plan.

It is imperative to include environmental justice framework and tactics into the greenway planning in the City and include a focus on creating greenways that reflect the diverse communities that create the Charlottesville social landscape. The current plans for the city of Charlottesville do not include priority discussions of minority communities in their parks and recreation plan. While the answer of how to plan equitable greenways may not be entirely answered, it is necessary for equity to be a priority consideration in the vision and planning phase of urban greenways. Charlottesville's goal of becoming a Green City should prioritize environmental justice strategies in future plans. The design of any greenway programming should welcome marginalized populations and focus on the residents, rather than attracting tourism. Brooklyn Green Initiative serves as a prime example of a greenway planning process that lays out a plan for incorporating an environmental justice framework into the procedures of planning a greenway and could be used as an example model.

6. Conclusion

Disproportionate access to urban greenways is an environmental justice issue as marginalized communities that are more vulnerable to climate change do not have equitable access to greenways, and subsequently lack access to the resilience benefits they provide. An understanding of green spaces and their interaction with community dynamics must be gained so that greenways can play a role in the growth of equitable and resilient green cities. The current Charlottesville Comprehensive Plan and Urban Rivanna River Corridor Plan lack significant discussion of the inequalities of urban green spaces and greenways. An environmental justice framework for the planning of equitable greenspace is needed in Charlottesville.

As greenways become a more common form of green infrastructure, ways to further incorporate urban resiliency into the design of greenway networks should be investigated. The incorporation of educational programming to increase climate literacy as well as the ability for

greenways to leave space for the changing needs of users and of urban spaces under the context of a changing climate provide unique opportunities for research. Most importantly, ways to further increase social accessibility and sense of welcomeness in greenspaces for all racial and socioeconomic groups must be explored**.**

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