



**ALBEMARLE  
COUNTY**

# **Responding to Variations in Life Expectancy**

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## Addressing Variations in Life Expectancy Across Albemarle County

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# Key Terms

**Albemarle County 2044 (AC44):** Albemarle County 2044, which is also known as AC44, is an update to Albemarle County's Comprehensive Plan. This project began in the Spring of 2022 and is expected to be completed by Fall 2024. As the last Comprehensive Plan was completed in 2015, an updated Comprehensive Plan was not expected until 2035. However, one of the reasons cited for this update is that AC44 opens a new window of opportunity to "integrate new plans and policies," as well as the ability to address future growth, especially as new dwelling units continue to be built and household income continues to rise (Albemarle County, n.d.).

**Carbon Emissions:** Carbon emissions in this context refers specifically to the emission of carbon dioxide (CO<sub>2</sub>) through the combustion of fossil fuels. Carbon dioxide is a greenhouse gas.

**Exposure:** Albemarle County defines exposure as the "presence of people, livelihoods, species or ecosystems, environmental functions, services, and resources, infrastructure, or economic, social, or cultural assets in places and settings that could be adversely affected" by the hazards exacerbated by climate change (Albemarle County, 2022).

**Green Roof:** Green roofs, also known as rooftop gardens, are vegetative layers grown on top of rooftops that have the ability to provide shade, remove heat from the air, and reduce the temperatures of the roof surface (EPA, 2014).

**Greenhouse Gas (GHG):** Greenhouse gasses (GHGs) are gasses, such as carbon dioxide and ozone, that absorb and re-emit solar radiation, thereby keeping Earth's atmosphere warm. Although many of these gasses are naturally occurring, human activities – like the burning of fossil fuels – can emit them at higher rates, hastening climate change.

**Greenspace:** The definition of greenspaces differs across the literature (Taylor & Hochuli, 2017). For the purpose of this report, greenspace refers to community areas that are partly or completely covered with trees, shrubs, grass, or other vegetation.

**Hazard:** To use Albemarle County's definition, hazards are defined as "the potential occurrence of a natural or human-induced physical event or trend... that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, ecosystems, and environmental resources" (Albemarle County, 2022). While Albemarle County's Climate Vulnerability and Risk Assessment has identified five key hazards that are exacerbated by climate change – extreme heat, drought, wildfire, flooding – this report primarily focuses on the risks posed by extreme heat.

**Mitigation:** Mitigation refers to actions taken to reduce long-term risk to human life and property (Thomas Jefferson Planning District Commission, 2023). In this context, this would refer to directly reducing the amount of greenhouse gas emissions that the County is producing.

**Resilience:** Resilience is the ability of a community to "anticipate, absorb, accommodate, or recover from the effects of a hazardous event in a timely and efficient manner" (IPCC, 2012). In this case, resilience focuses on a community's ability to recover from hazards driven by climate change, such as extreme heat.

**Urban Heat Island (UHI):** Urban heat islands are areas of relative warmth that occur in cities when compared to the surrounding rural areas (IPCC, 2012). This is due to the replacement of natural land cover – such as grassy terrain or forests – with pavement, densely concentrated buildings, and other surfaces that absorb heat. This can result in increased energy costs, air pollution, and heat related illnesses (EPA, 2024).

**Vulnerability:** Albemarle County's definition of vulnerability can be summarized as "sensitivity or susceptibility to harm" and whether or not one has the ability to cope or adapt (Albemarle County, 2022).

# Executive Summary

As of April 2024, Albemarle County is in the midst of revitalizing its comprehensive plan. This effort, known as the AC44, allows for new windows of opportunity for implementing local climate action, allowing the County to work towards its goals of reducing its greenhouse gas emissions. More specifically, the County seeks to reduce its greenhouse gas emissions by 45% from 2008 levels, with the ultimate goal of achieving zero net emissions by 2050.

In keeping with Albemarle County's overall vision, the Climate Action Team seeks to achieve these greenhouse gas emission targets in ways that not only protect the local environment but also benefit the health of all residents within the County. Currently, Albemarle County features stark discrepancies in life expectancy between communities along census tracts, with the largest gap between average life expectancies across neighborhoods reaching up to 11.6 years (The Equity Center, 2023). While Albemarle County has a collection of documents that outline the reasons for these potential variations, such as the Albemarle County Equity Profile completed in conjunction with the University of Virginia Equity Center, the link between life expectancy and climate action has not yet been explicitly made in Albemarle County Reports.

Much of the inspiration for this report – especially as it relates to equity – comes from the Albemarle Climate Vulnerability and Risk Assessment, which is designed to help the community “identify climate change impacts in Albemarle County” (Albemarle County, 2022). This document highlights the need for action that targets populations particularly vulnerable to the risks associated with climate change, such as extreme heat. While not building off of that exact line of work, this report does seek to evaluate policies that increase the expected life expectancy at birth for populations for census tracts that are often particularly vulnerable to threats from climate change. This problem definition was refined from questions outlined by the Albemarle County Climate Action Team.

In order to begin tackling that issue, this report begins with a background section that discusses in the Albemarle County Climate Action Team, the link between climate action and health outcomes, and the context of Albemarle County as it relates to climate equity, as well as present disparities. I propose three policy options that have the potential to begin addressing these disparities in life expectancy across census lines:

- 1. Working towards improving existing transportation infrastructure;**
- 2. Implementing community gardens in existing community centers;**
- 3. Reducing the amount of impervious surface across the County while also bolstering the urban tree canopy.**

These alternatives are evaluated on the basis of three criteria: equity, potential to reduce greenhouse gas emissions, and health impacts.

The purpose of this report is not to provide one singular recommendation. To do so would be very difficult, as the Climate Action Team faces budgetary constraints, leading to obvious limitations in terms of action items. Instead, this report seeks to provide the County with potential actions, all of which could have some impact on the overall longevity of the County's population, while specifically targeting those that seem to be experiencing the largest disparities. While this analysis does not formally calculate cost nor evaluate feasibility, it does consider these factors in a comparative way relative to each alternative.

With that in mind, **I would recommend considering community gardens** as a way to begin addressing the disparities in life expectancy across Albemarle County.

The implementation section addresses ways for Albemarle County to begin looking at the creation of community gardens around the community. Ultimately, this report recommends looking at existing community centers as places to begin, while also partnering with existing nonprofit organizations in the community to begin pinning down the specific needs of residents.

# Problem Statement

This report assesses specific climate actions that may help to increase the County's life expectancy. **Currently, Albemarle County features discrepancies in life expectancy between communities along census tracts, with the largest gap between average life expectancies across neighborhoods reaching up to 11.6 years (The Equity Center, 2023).** This gap is between the Oak Hill and Old Lynchburg Road area, which has a life expectancy of 75.5 years, and the North Garden tract, which has a life expectancy of 87.1 years (Figure 1). **Multiple determinants are contributing to these geographic disparities, requiring a multi-sector approach.** More specifically, this report pulls from various areas of interest – such as transportation infrastructure, urban agriculture, and food security – to begin assessing this problem from multiple angles.

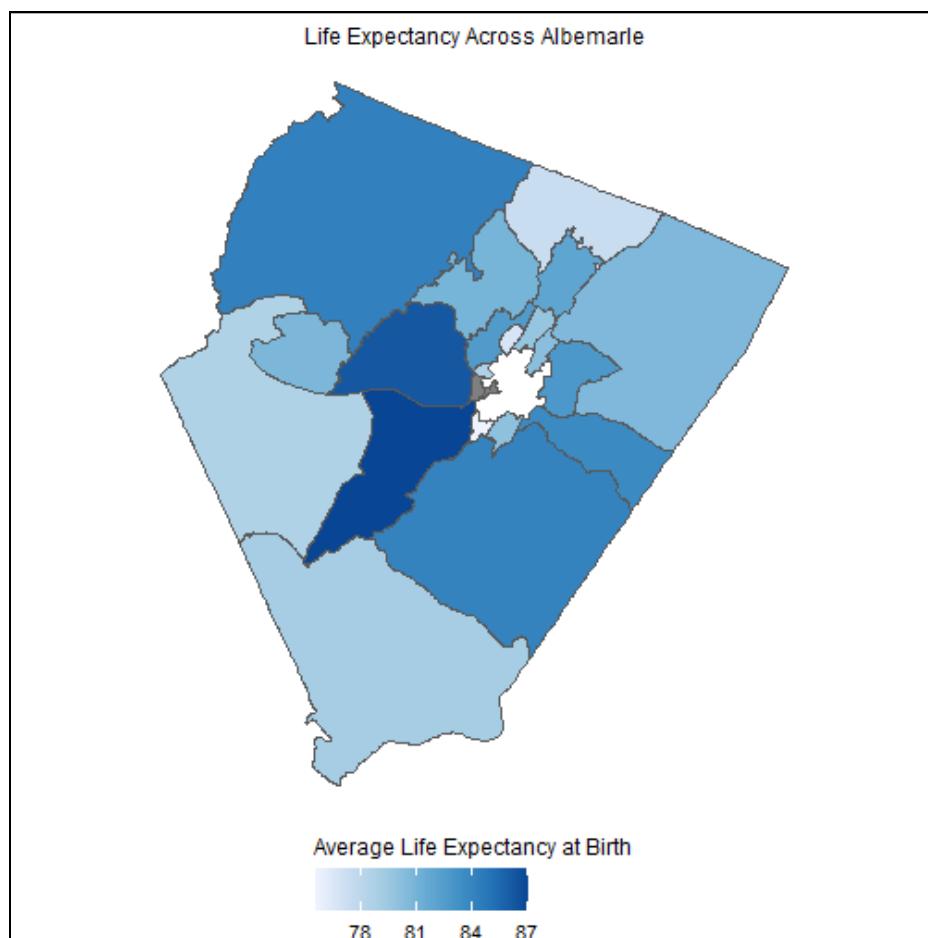
While there is little empirical research that estimates the effect of climate change – more specifically, the effects of climate change such as variations in rainfall and temperature – a panel study conducted by Roy in early 2024 finds that a 1° C increase in average annual temperature is associated with a .44 year decline in life expectancy. Additionally, Roy uses a novel composite climate change index that utilizes the geometric mean of temperature and rainfall to provide a quantitative way to measure whether or not GHG mitigation efforts are effective over time. The negative association between this composite climate change index and life expectancy implies the urgency of treating climate change as a public health crisis. Mariani et al. compile several studies from medicine and epidemiology that show the causal link between life expectancy and environmental quality, showing that factors like water pollution, depletion of natural resources, and other environmental factors are capable of decreasing longevity (2009). Recognizing the inherent link between emissions, climate change, and health outcomes is instrumental for Albemarle County's policy approach.

There is a connection between many actions that help to lower GHG emissions and those that increase overall life expectancy at birth. Many measures that help to reduce GHG emissions – which we would define as a facet of mitigation – oftentimes have substantial ancillary health benefits. For example, improving access to affordable, clean energy can contribute to a reduction in the risk of climate change-driven health effects (Haines et al., 2009).

The reason why the County has chosen to focus on actions directly connected to GHG emissions is because these emissions drive the overall trajectory of climate change. The impact of these emissions on global temperatures intensifies the frequency and severity of climate-related hazards, thereby heightening health risks that affect life expectancy.

The impacts of climate change are already being felt here in Virginia, and as such, Albemarle County has already directed its attention to risks like soaring temperatures, sporadic periods of heavy rainfall, increased drought, and shifts in seasonal weather patterns (Albemarle County, 2022). Strategically targeting emissions reductions aligns with a comprehensive effort to tackle the escalating health risks posed by a changing climate, thereby fostering a healthier, more resilient community in the face of environmental challenges.

**Figure 1:** Variation in life expectancy across Albemarle County. The gray area represents the University of Virginia.



**Source:** Author calculation using the U.S. Small-area Life Expectancy Estimates Project (USALEEP) data. Modeled after the Albemarle County Equity Profile (The Equity Center, 2023).

# Client Overview

Climate action and public health outcomes are inextricably linked. The UN Framework Convention on Climate Change has stated that mitigation measures against GHGs bringing about societal benefits – such as increased health outcomes – should be prioritized (United Nations, 2017). By focusing on matters of public health, it becomes significantly easier to attract support for action to fight climate change, as many of these actions result in positive externalities arising from the result of environmental interventions (Haines et al., 2009). This helps to mitigate the rampant politicization of actions against climate change at the local level, given that the benefits of fighting climate change become something much more tangible.

To see how the Albemarle Climate Team fits into this problem at the local level, one requires an additional bit of context regarding Albemarle County's planning process, especially as we look to the future of the County. Currently, the County is in the midst of updating its comprehensive plan through a project known as Albemarle County 2044 (AC44). Two of the primary focuses of the plan are resiliency and equity, both of which are fundamental components of the Albemarle Climate Team's work. These two priorities set in the plan allow for a window of opportunity for the Climate Team to better incorporate matters of environmental justice, equity, and climate work into this newly updated plan. The Climate Protection Team seeks to improve public health outcomes through climate action in order to move forward with a more equitable Albemarle.

## ***Climate Protection Program Goals***

- **Benefit the health of all residents;**
- Protect the local natural environment;
- Stimulate the creation of green jobs to support a thriving local economy;
- Promote education on climate action for youth and adults; and
- **Contribute to a more equitable community, with the benefits of climate action programs easily accessible and affordable for every resident regardless of socio-economic status.**

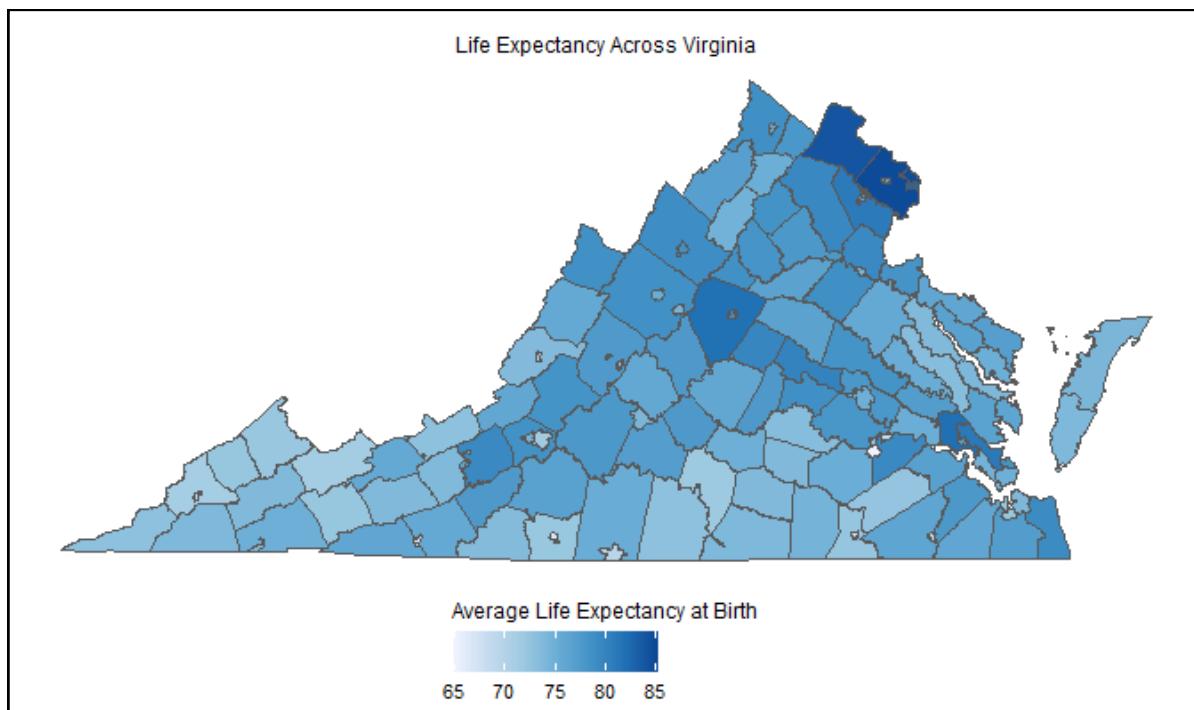
Additionally, the Climate Action Team is currently carrying out a multi-phase, long-term effort to combat climate change here at the local level. The first step in that process was creating the County's Climate Action Plan (CAP), which was adopted in 2020. This plan outlines various strategies -- called actions -- to combat the effects of climate change here in the County while specifically focusing on mitigation. They currently focus on five sectors – transportation and land use, buildings, renewable energy sourcing, sustainable materials management, and landscape, natural resources, and agriculture. The plan itself outlines a number of potential action items that the County could undertake to potentially address matters of mitigation in a way tailored to the local community. Albemarle County would like to focus on larger actions – not just those that would influence the actions of an individual, such as education campaigns – to address these public health disparities through climate action.

# Background

## ***Context for Albemarle County Health Statistics***

Compared to the rest of Virginia, Albemarle County's overall life expectancy is higher than the average (Figure 2). Virginia's average life expectancy at birth is 78.1 years, while Albemarle's is 81.9 years (Population Health Institute, 2024). 2024 data from the Population Health Institute also shows that across counties in Virginia, disparities in expected life expectancy at birth have reached up to 20.4 years.

**Figure 2:** Average Life Expectancy at Birth across Virginia.

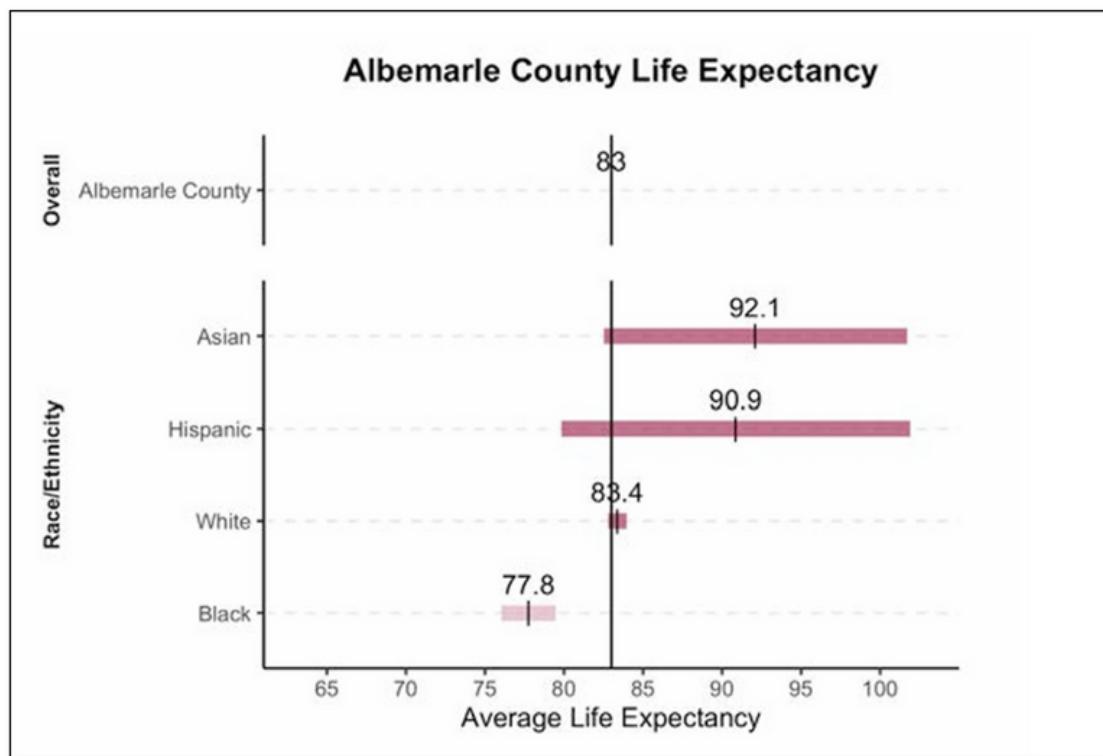


**Source:** Author calculation using the Population Health Institute's 2024 average life expectancy data for Virginia.

Compared to these data, the state of the problem may not seem as stark; in Albemarle County, the disparities between census tracts has reached up to 11.6 years. However, while Albemarle County has experienced better health outcomes than many places in Virginia, there is still room for improvement within the community, especially when considering the needs of historically underserved areas, such as low income communities.

There is a racialized component to this problem. A study published in the Proceedings of the National Academy of Sciences found that across the United States, the gap in life expectancy between Black and white Americans has dropped (Huber, 2021). Research shows that in 1990, Black Americans lived around 7 years fewer than white Americans. By 2018, that gap shrank to 3.6 years. However, research from the University of Virginia's Equity Center shows that the gap is 5.6 years in Albemarle County. While white residents have an average life expectancy of 83.4 years, Black residents have a lower life expectancy of 77.8 (Figure 3). There is also data on Asian and Hispanic populations in the County, but these samples are relatively small and therefore, there is less certainty about the validity of these data. Figure 3 provides a broad range of possible values for life expectancy across racial and ethnic groups across Albemarle County (The Equity Center, 2021).

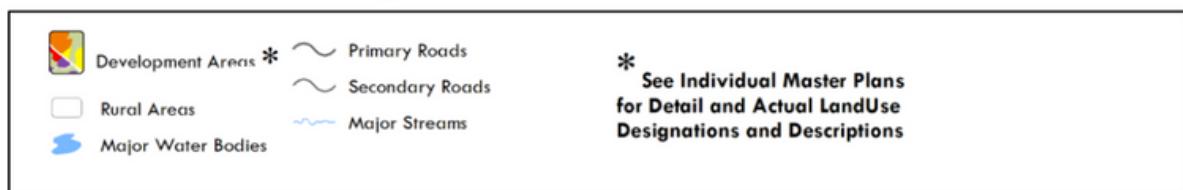
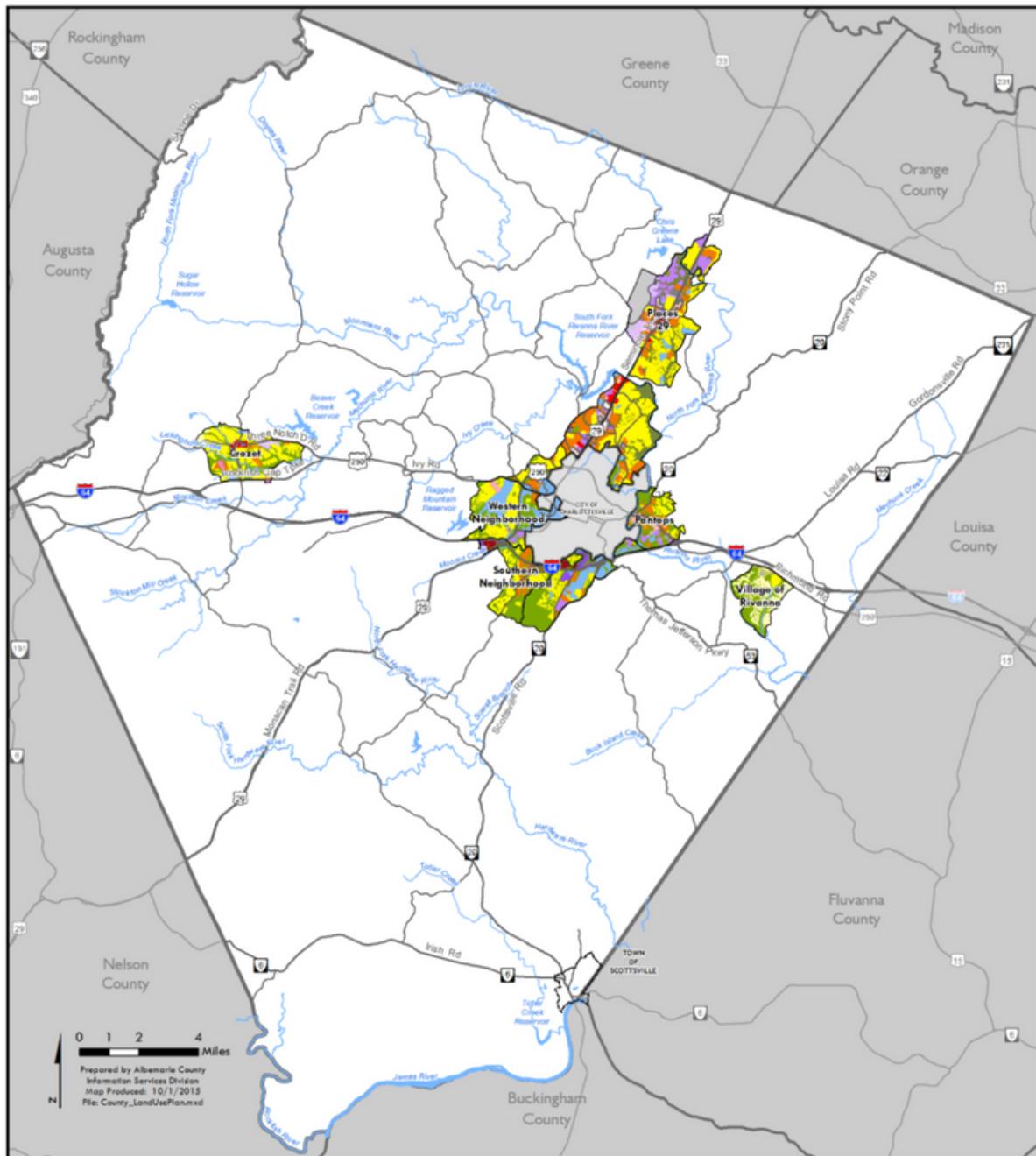
**Figure 3:** Average life expectancy across Albemarle County broken up by race and ethnicity.



**Source:** Albemarle County Equity Profile (The Equity Center, 2021).

Despite a generally high overall life expectancy, Figure 1 shows that this is not consistent across census tracts of the County. Albemarle County is divided into five Development Areas and a Rural Area (Figure 4). According to the current Comprehensive Plan's Growth Management Policy, new development should occur in these five areas, which make up about 5% of Albemarle's land. The Rural Area is designated for agriculture, natural resource protection, and some homes (Albemarle County, 2015).

**Figure 4:** Albemarle County's Five Development Areas.



**Source:** Albemarle County Comprehensive Plan (2015).

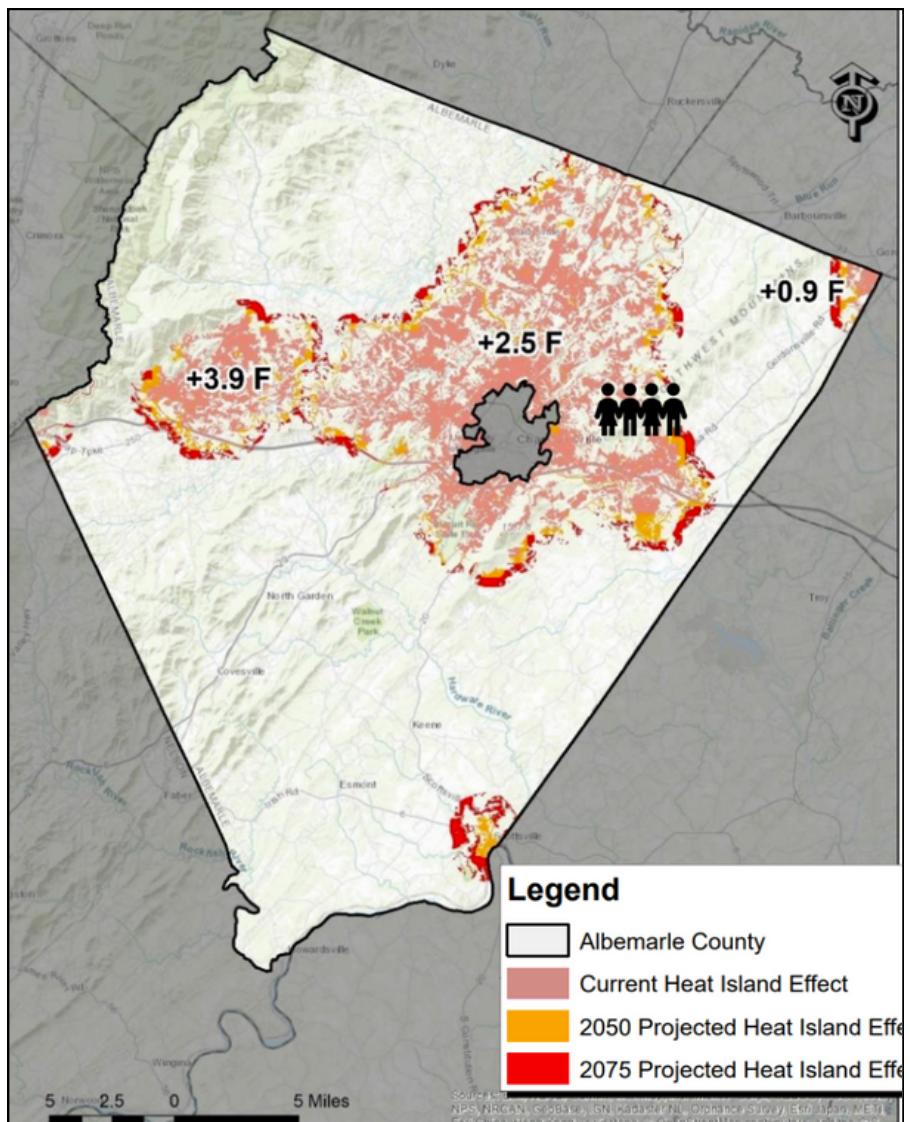
The two neighborhoods with the lowest life expectancies – The Old Lynchburg Rd and Oak Hill area and the Hydraulic Commonwealth area – are both firmly situated within Albemarle’s Development Area. These tracts are located in the more urbanized ring along the outskirts of Charlottesville’s city limits. There are also lower life expectancy rates in certain rural areas of the County. As much as 50 percent of individual health is explained by “social, economic, and environmental factors, such as racism, discrimination, education, and housing” (CDC, 2023). Looking at these factors, the Albemarle Climate Team has the opportunity to focus on the environmental factors, given the inextricable link between racism, the lived environment, and overall health outcomes.

## ***Consequences: Climate Equity in Albemarle County***

Albemarle County has defined risk as the “potential for consequences where something of value is at stake and where the outcome is uncertain ... often represented as the probability of occurrence of hazardous events or trends multiplied by the impacts if these events or trends occur” (Albemarle County, 2022). Hazards, exposure, and vulnerability all factor into risk. According to the International Panel on Climate Change, climate change can exacerbate hazards, while socioeconomic processes affect exposure and vulnerability (2014). It is known that temperatures in Albemarle County will continue to increase over the following decades, leading to the increased frequency of potential hazards, such as extreme heat.

This has larger equity implications, like the question of which populations are most vulnerable to the risks associated with these hazards. For example, take the urban heat island effect. Urban heat islands (UHIs) are areas where impervious surfaces like pavement or buildings have replaced natural land cover, like trees or shrubs (see Key Terms). This results in the UHI effect, which is when these surfaces absorb and retain heat, driving up temperatures. This can result in increased energy costs, air pollution, and heat related illnesses (EPA, 2024). The effects of the UHI effect are felt differently across Albemarle County (Figure 5). Albemarle’s Black, Asian, and Latino residents were exposed to the UHI effect to a greater extreme than their white neighbors, with 97% of the County’s Asian population living within the heat island effect areas (Albemarle County, 2022).

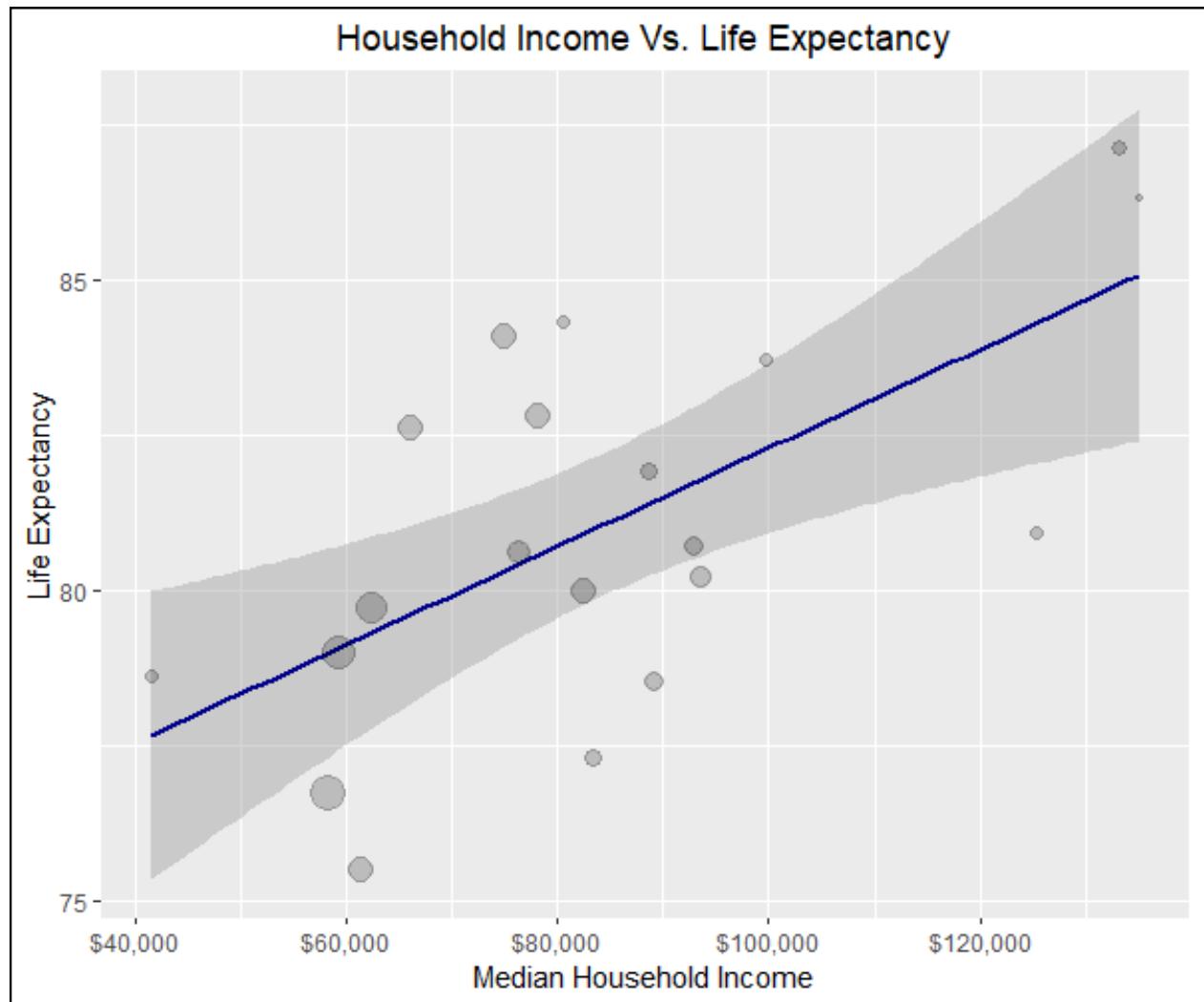
**Figure 5:** Urban Heat Island Effect across Albemarle County.



**Source:** Albemarle County Climate Vulnerability and Risk Assessment (2022).

There's also an income component involved when evaluating various climate risks. The County has taken a number of poverty indicators into account when considering social vulnerability to climate risks, including median annual household income, whether a household is below the poverty level, whether a household is using SNAP benefits, whether a household has received public assistance income, whether a household has access to a vehicle, and whether or not housing costs take up 30% or more of a household's income. All of these indicators are used to specify which populations are most vulnerable to which hazards, as these vulnerabilities do vary (Albemarle County, 2022). That said, across Albemarle County, there is a correlation between income and life expectancy (Figure 6).

**Figure 6:** Association between household income and life expectancy in Albemarle County. The size of each point represents the proportion of Black households in a census tract.



**Source:** Author calculation using the 2018 U.S. Small-area Life Expectancy Estimates Project (USALEEP) data and ACS income data.

It's impossible to disentangle the effects of climate hazards on life expectancy, as there are many other factors at play that affect life expectancy. However, we see marginalized populations, such as low income and Black populations, at particular risk for some of the hazards – like extreme heat – posed by climate change. This serves as a motivating factor for the County to take climate action.

There's also a question of whether or not Albemarle County programs are being effectively communicated about, or whether there's enough trust in local governments for people to look towards them for help (Nelson and Brooks, 2016). It's important to focus on the history of climate action planning across the County. Albemarle County has had an explicit focus on climate action since 2009, albeit with a pause between 2011 and 2017. Many developments have been made since 2018, with the creation of the Climate Action Plan (2020), a climate risk assessment (2022), and community grant funding (2023). The most recent development has been the announcement of Resilient Together, which is a collaborative effort between both the County and Charlottesville City to create two complementary plans addressing specific climate hazards like extreme heat, flooding, and drought (WINA, 2023).

# **Criteria & Methodology**

Each of the proposed policy options will be evaluated on the basis of the criteria outlined below. The ultimate goal of this report is to provide guidance on the potential outcomes that the proposed policies may generate. The following criteria have been selected in accordance with Albemarle County's current goals.

## ***Equity***

Equity is one of the key facets of this problem that Albemarle County would like to focus on. Equity is defined as the process of removing disparities along demographic lines to improve outcomes for all members of a community, and should therefore be measured for specific populations “for whom there is a relevant and reasonable past or current disparity in treatment” (Martin & Lewis, 2019).

Although equity is an incredibly complex issue, using a racial equity tool is one way of beginning to operationalize it. In order to more effectively measure equity, one must take a multifaceted approach in which measurement is not reduced to a single construct. In other words, it’s possible to measure equity, but not be one metric alone (Nelson & Brooks, 2016).

In keeping with this ideal, equity in this report is measured on the basis of three of the Urban Institute’s State of Equity Measurements. The first of the three facets is addressing historical legacies, which is based on the idea that current perceptions of equity implicate past disparities, and so there must be acknowledgement of the past. The second is awareness of populations, meaning that measurements should identify and focus on demographic groups that have historically been treated unequally. Finally, there is access discrimination, which states that one facet of equity is different groups’ ability to become aware of and access a service. There should be action taken to rectify these disparities in access.

## **Greenhouse Gas Emission Reduction Potential**

This project focuses on direct emission reduction, meaning that these solutions do not only focus on changing community members' behaviors, but instead provide direct ways to reduce and mitigate the effects of greenhouse gasses. Greenhouse gas (GHG) emission reduction has been a priority for Albemarle County for several years now, with the Board of Supervisors setting the goal to reduce community-wide GHG emissions by 45% from 2008 levels by 2023. Albemarle County's Climate Action Plan (CAP) already provides a framework for how Albemarle County will achieve this goal, showing that there has already been an internal commitment to achieving this goal. More specifically, the CAP features what is called a GHG-focused impact score, which is derived from two variables: an action's Drawdown Score, and that Drawdown Score's goodness of fit.

Drawdown Scores come from Project Drawdown, a nonprofit organization dedicated to reducing the overall amount of carbon dioxide (CO<sub>2</sub>) in the air. The score is equivalent to the estimated number of gigatons of CO<sub>2</sub> that a specific policy – or what Project Drawdown refers to as a solution – is expected to either reduce or sequester. Each solution has two Drawdown Scores based on two growth scenarios, or the extent to which a specific solution is adopted. One scenario takes into account higher growth, while the other, less. Albemarle County takes the average of these two scores and uses it in the calculation of their GHG-focused impact scores. These scores can be scaled down to the likely impact on CO<sub>2</sub> emissions that a specific solution may have in Albemarle County. In other words, a solution's average Drawdown Score will not give the exact expected reduction in GHG for Albemarle County specifically. Rather, these show the potential impact that a solution might have on emissions relative to other actions.

Not every Drawdown Solution is a good fit for Albemarle County. Project Drawdown assumes implementation at a global scale, but not every facet of every solution can be implemented in Albemarle County. To address this, Albemarle County uses a Goodness of Fit score, which reflects how well a specific Drawdown Solution aligns with an action in the CAP. A Goodness of Fit score of .5 denotes a weak alignment, while a Goodness of Fit score of 1 denotes a strong alignment. Having a weaker fit and therefore, lower score, means that the estimated GHG emission reduction of a specific CAP action may not be as substantial as the initial Drawdown Score suggests.

GHG-focused impact scores come from multiplying a solution's Goodness of Fit Score by its average Drawdown Score. This value is then divided by the CAP action that already has the largest average Drawdown Score. Dividing every score by this value – which happens to be 105 in the current CAP action document – places every GHG-focused impact score on a 0-1 scale. This allows for even comparison and holistic weighting for every action. Every action referenced below has an associated CAP action. Their GHG-focused impact scores have already been calculated in the current CAP action document.

## ***Health Impact***

The final criterion is public health outcomes, as these policies must have outcomes associated with an overall positive impact on longevity. This criteria would be deeply tied to equity, given the disparities seen across neighborhoods.

The most obvious way to begin measuring this would be to use the life expectancy data for Albemarle County – which was last publicly released in 2018 through the U.S. Small-area Life Expectancy Estimates Project– and track how it changes over time. However, this would need to be tracked over time, meaning that it's impossible. One can instead look at the likelihood that an alternative has an impact on overall life expectancy. This can be further broken down by looking at the potential impacts on high blood pressure prevalence, high cholesterol prevalence, physical activity prevalence, and poor physical health prevalence.

# Policy Alternative:



## *Improving Transportation Infrastructure*

To improve overall transportation infrastructure, I propose the implementation of both Complete Streets (CS) policies for both the Rural and Development Areas and improved public bus infrastructure, meaning a readjustment of current routes and stops to best meet community members' needs. These two proposals are deeply intertwined with each other, as CS are instrumental to improving the overall public transportation system.

## Description

Complete Streets (CS) policies are transportation guidelines that aim at creating roads “designed for the comfort and safety of all road users.” CS policies center on serving all road users, regardless of the method of transportation, while taking the needs of individuals into account. For example, these policies may call for the construction and maintenance of streets that feature sidewalks, crosswalks, and accessible public transportation stops. The American Planning Association has identified a number of key benefits to CS implementation: safety, health, sustainability, accessibility for special populations, and community growth and revitalization (McCann and Rynne, 2010). These directly tie back to both climate and physical health outcomes, given the link between the built environment and physical activity as people choose to use other modes of transportations instead of a personal vehicle (Frank and Kavage, 2009).

Such CS-focused policies have seen success in other areas of Virginia, such as Arlington County, with limited retrofits to existing streets having already been implemented, and additional considerations currently in the planning phase (McCann and Rynne, 2010). Such policies have already been proposed and implemented in areas of Albemarle as well, as with the Rio29 Plan (Albemarle County, 2018). This policy alternative also aligns with the policy objectives outlined in Albemarle County's 2015 Comprehensive Plan, which expects roadways in the County's Development Areas to be complete streets (Albemarle County, 2015). However, there is no mention of these policies in the County's Rural Areas.

Access to opportunities is often unequally distributed, with this lack of access often attributed to two intertwined challenges: spatial mismatches and transportation mismatches (Burnett et al., 2020). A spatial mismatch is the idea that people don't live near places that they need to travel to – such as schools, places of employment, or grocery stores – while a transportation mismatch is the idea that transportation systems don't always rise to meet the needs of community members. For example, insufficient transportation infrastructure does hinder peoples' ability to travel to available food sources, both in urban and rural communities (Mui et al., 2021). Public transportation may be one way of beginning to address these mismatches, thereby improving the overall accessibility of factors directly related to life expectancy, such as access to healthy foods and areas of employment.

Of the proposed alternatives, this is likely to be the most expensive, even if the County tries to go about it in ways better suited to rural areas, such as only expanding shoulders. As a result, it's likely to be the least feasible.

## Evidence in the Literature

CS policies may have larger implications for physical activity. Frank and Kavage argue that the built environment is an enabler or disabler of physical activity, and the concentration of development within existing urban areas supported by transit can support physical activity (2009). Sallis et al. conducted a study across eleven countries, including the United States, to study the environmental correlates of physical activity. It was found that three of the five correlating factors were aspects of CS implementation: sidewalks, transit stops, and the presence of bike facilities (2009).

There are additional benefits as well. The previously outlined aspects of CS-integrated design also contribute to improved community design, with compact development and better access to goods and services (McCann and Rynne, 2010). This includes food; the literature seems to suggest that proximity is one major setback when it comes to accessing food. A lack of public transportation often means that residents have poor access to healthy foods, as the closest stores available are often smaller convenience stores that prioritize processed goods, resulting in unbalanced meals (Brown & Burns, 2007; Baek, 2016).

Looking at where, many of the places where such policies have been implemented are more urban leaning. These policies might be easier to begin implementing in more urban areas that don't feature things like sidewalks or bike lanes, such as the areas around the Belmont neighborhood. Calloway and Faghri recognize the unique challenges posed by suburban and rural areas, and provide recommendations of their own that specifically address the need to increase physical activity (2020). They consider implementing better walking trails, which – while not necessarily “completing streets” – does create equity for different modes of transportation, which is especially relevant in Albemarle given the number of trails that already exist. If certain locations permit, it might be possible to connect residential areas with recreational areas and stores to offer the choice of active transportation.

The Federal Highway Administration (FHA) has a bicycle and pedestrian program that is designed to provide guidance to various sorts of communities while acknowledging the unique characteristics that communities may have that would likely fit best in Albemarle. They explicitly set up resources for rural and suburban communities, along with more realistic strategies – such as widening road shoulders for bikers – that take into account the limited resources that smaller communities may have. The Virginia Department of Transportation (VDOT) also has multiple resources to guide the development of Complete Streets, such as their Policy for Integrating Bicycle and Pedestrian Accommodations and their Road Design Manual, both of which were specifically designed with accessibility in mind (VDOT, 2005; VDOT, 2023).

## Evaluations

### ***Equity: Medium***

Disinvestment in transportation infrastructure is directly linked to “adverse social conditions” that contribute to underlying health disparities in low-income communities of color (Ingram, 2020). Complete Streets (CS) policies and improved public transit can be implemented in such a way that focuses on and explicitly promotes equity to address systemic barriers.

Looking at historical legacies, one can see that the populations most affected by a lack of transportation infrastructure are those who have been historically disadvantaged. Work by the University of Virginia's Equity Center states that some of the populations most burdened by transportation barriers include low-income, disabled, elderly, rural, and minoritized populations (Burnett et al., 2020). Dialogues with community members reveal that transportation is a top priority for both the larger community and the University of Virginia, which serves communities near the school with its University Transit System (UVA Community Working Group, 2019).

As previously mentioned, access to opportunities is often unequally distributed, with transportation systems not always rising to meet the needs of the residents that they serve (Burnett et al., 2020). For example, there are issues in regard to accessibility, especially in the Southern regions of Albemarle, in which community members expressed concern over a lack of access to medical care due to transportation concerns (AC44 Rural Area Event, 2024).

There are ways in which CS policies can be implemented in ways that promote overall equity through addressing this disparate access. One facet of these policies is that they take transit vehicles into consideration, as well. For example, the literature shows that transportation time expenditures are also a major factor in whether or not community members have access to healthy foods. Swayne and Lowery find that despite distances by car and public transit being quite similar, travel times between the two are highly variable, as transit times are statistically significantly higher than traveling by private vehicle (2021). A major reason why there is such a stark difference is due to the increased time spent waiting associated with public transit, which is time taken from other activities (Fan & Machemehl, 2002). Conversations with community members reveal similar concerns regarding access to medical care, in which on-demand systems like Jaunt aren't able to effectively provide reliable transportation due to high wait times (AC44 Rural Area Event, 2024).

Additionally, there may be issues in which those who cannot use a personal vehicle for whatever reason may have to walk longer distances to reach the nearest transit stops, which becomes especially challenging for certain demographics, such as the elderly or those who use the transit system to make larger purchases, such as groceries.

However, in keeping with the Urban Institute's State of Equity Measurements, a more equitable CS policy would need to begin at the formulation stage, in which there must be continuous, respectful outreach to communities that prioritize respect. Equitable policies must take the needs of the community into account as early as the formulation stage to prioritize what is most valuable to community members.

### **Emission Reduction: High (GHG-Focused Impact Score of .16)**

In 2018, emissions from the transportation sector in Albemarle County came out to about 730,320 metric tons of carbon dioxide equivalent (CO<sub>2</sub>e) (Albemarle County, 2021). This accounts for about 52% of total community-wide emissions in the County. Given that this alternative includes a multitude of actionable solutions, there are multiple Drawdown solution numbers that should be taken into consideration.

Walkable cities have an average Drawdown potential of 3.17 gigatons of CO<sub>2</sub>e reduced or sequestered between the years 2020 and 2050 (Jones et al., 2024). This number was calculated by using the fuel consumption and indirect emissions associated with the production with cars that would potentially be removed through walking. It's important to note that walking can be other modes of transport, such as biking or bussing, more attractive.

Improved bicycle infrastructure and electric bicycles, policies both associated with Complete Streets, have an average Drawdown potential of 3.68 and 1.47 gigatons of CO<sub>2</sub>e reduced or sequestered between the years 2020 and 2050 respectively (Becqué et al., 2024). A literature review conducted by Pucher et al. suggests a link between transportation infrastructure interventions and levels of bicycling (2009). Like with the walkable cities Drawdown calculation, this Drawdown score was calculated using data from personal vehicles. This is also considered a high priority Drawdown solution.

These actions are found within Albemarle's existing CAP Action list as actions T.1.2 and T.1.3, with a total GHG-focused impact score of .16.

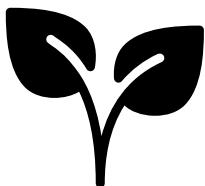
### **Health Outcomes: High**

Residents in communities that adopt CS policies have noticeable increases in physical activity, as is shown in Portland and Boulder (Moreland-Russell et al., 2013). The literature seems to support the link between the built environment and community engagement in physical activity; A study by Saelens et al. showed that residents from higher-density communities with greater land use mix tended to report higher rates of walking and cycling than those that did not (2003). By increasing the accessibility of other forms of transportation, CS policies could lead to increased health outcomes due to the overall increased accessibility of walking trails. Something of note is that there is empirical evidence that a modal shift from cars to public transit may contribute to one's volume of physical activity, as community members can walk to and from bus stops (Morency, 2011). However, this poses a potential drawback: as previously mentioned, commuters may face difficulty reaching their destinations from transit stations once they are at their closest stop, posing an equity concern.

*Regarding food security, there is conflict in the literature that access is the primary factor holding people back from consuming healthier foods (Zepeda et al., 2014). For example, Martinez et al. find that there are no significant associations between diet and personal vehicle ownership (2019). However, they found a significant association between personal vehicle access and a decreased risk in food insecurity. An and Strum don't find a strong correlation between California childrens' food environment and their dietary decisions, either (2012) It's important to note that while these studies take the location of one's residence into account, they do not consider the commuting behavior that was previously described. Additionally, these studies address built environments while having access to personal vehicles, and do not focus on public transit.*

*On the other hand, Baek finds that there is a negative causal effect of public transportation accessibility on food insecurity – which directly impacts health outcomes – and an extra bus-equivalent vehicle per 10,000 people decreases the probability of food insecurity in households by 1.6 percent (2016). She finds that this impact is particularly prominent among low-income and low-income Black households. This is backed up by research by Blanchard and Lyson, who demonstrate that the location of “supercenter” grocery stores like Walmart have effectively distanced low-income rural communities from low-cost grocery stores (2002)*

# Policy Alternative:



## *Community Gardens*

To increase the overall accessibility of healthy foods and reduce food insecurity across Albemarle County, this alternative suggests establishing community gardens in existing community centers. This can be achieved through partnering with nonprofit organizations in the community already doing this work to begin pinning down the specific needs of residents, as well as providing stipends as compensation for this work.

## Description

Community gardens are plots of land, oftentimes found in urban areas and run by volunteers, collectively maintained for the explicit purpose of growing fruits, vegetables, and herbs for the purpose of self-consumption (Egli et al., 2016). When people move into urban areas, they are less likely to produce their own food and instead consume food that has been transported long distances, such as unhealthy, highly processed goods (Guitart et al., 2012). The process of manufacturing and transporting this food also contributes to carbon emissions through processes like transportation and packaging (Poore & Nemecek, 2018).

As of right now, there are only two known community gardens in Albemarle that are run independently from nonprofits: one maintained through Albemarle High School and one located at the Yancey School Community Center. This means that there is one in the development area and another in the rural area, but these two are not necessarily enough to cover the entirety of Albemarle. In order to remedy this, Albemarle would have to enable and promote community gardens, especially in areas in which there are higher rates of food insecurity. As with the two existing gardens, it would likely be beneficial to start the garden at an existing community center where there is land available. For example, other schools or libraries may serve as potential sites.

Community gardens have a relatively low startup cost compared to infrastructural changes. Additionally, there is a relatively wide availability of grant funding, making this a more feasible alternative, especially in the short run when budget constraints are present.

## Evidence in the Literature

According to the World Bank, there are four main dimensions of food security: physical availability of food, economic and physical access to food, food utilization, and stability of the previous dimensions over time (World Bank, 1996). In other words, food security is when a household has access to sufficient safe and nutritious foods at all times, allowing for an active and healthy life. Access to cheap calories is not enough – food security allows the capability to lead a long and healthy life (Carolan, 2013).

Pastor and Morello-Frosch (2014), as well as Algert et al. (2014), have shown that community gardens can reduce food insecurity and increase food self-sufficiency among certain populations. Community gardens have the potential to produce substantial amounts of produce as well, with community garden projects in South Dakota yielding an average of 138 pounds of food, with one garden in particular yielding 770 pounds of produce (Stulka et al., 2019).

However, not only are they a more accessible source of nutrition within urban food deserts, but community gardens also offer a wider range of benefits, including community building and promoting health (Guitart et al., 2012). Gardening has been positively associated with community involvement and overall life satisfaction (Blair et al., 2012). The physical act of gardening also results in moderate to high-intensity physical activity, showing further health benefits outside of pure food consumption (Park et al., 2014).

These community gardens have shown overall positive effects on health outcomes. In a population-based survey involving 438 residents in Denver and Chicago, Litt et al. showed that fruit and vegetable intake were significantly associated with community gardens (2011). Community gardeners in Denver consumed fruits and vegetables 5.7 times per day, compared to nongardeners, who consumed vegetables 3.9 times per day. In their literature review regarding urban horticulture – which includes community gardens in urban environments – Cruz-Piedrahita et al. found that 36 studies conducted in the global north have found dietary benefits from participation in urban horticulture, including an increase of childrens' intake of healthy foods like fruits and vegetables, as well as an increased willingness for children to try new foods (2020).

# Evaluation

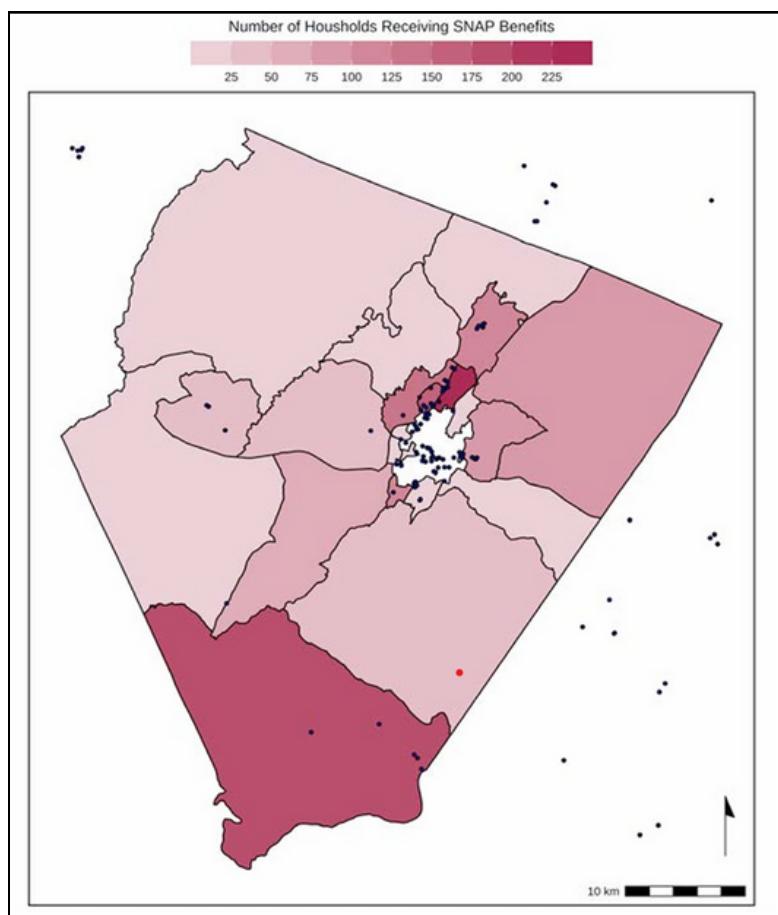
## ***Equity: High***

As previously stated, local food production through systems like community gardens can help increase food security of resident populations, especially those who may not have access to the necessary transportation needed to fresh food hubs, like farmers markets (Pastor & Morello-Frosch, 2014; Algert et al., 2014). Low-income residents lacking access to an automobile must either utilize public transportation networks or depend on smaller convenience stores that are more likely to be within walking distance. However, produce at these stores are often of a more limited selection, lower quality, and sold at a high markup (Campbell, 2004).

In 2018, Albemarle had an overall food insecurity rate of 8.4 percent, which is still lower than the 2018 national average of 11.1 percent (The Equity Center, 2021; USDA, 2018). With that said, in 2018, only 4 percent of Albemarle residents received SNAP benefits, even though 39 percent of Albemarle's population was below the income threshold for SNAP benefits (The Equity Center, 2021). It's important to note that this data does not include university students, as University of Virginia census tracts were intentionally left out of the data. Like with life expectancy, these disparities are not equally distributed, and there appear to be variations along geographic lines (Figure 7).

This brings up questions of affordability and the need for accessible sources of foods that target these communities. One potential avenue would be looking at neighborhoods where income is lower than the County average, as there appears to be a correlation between income and food insecurity. This would be inextricably linked to rural neighborhoods, especially in the southern side of the County, which face additional challenges to getting fresh food, such as a scarcity of food retailers relative to more developed areas in the County, making existing programs like SNAP less accessible. There is also a lack of public transit, with many residents relying on systems like Jaunt and facing higher commutes as a result, which was previously discussed in the context of transportation infrastructure. Like CS policies, community gardens have the opportunity to make a tangible impact in disadvantaged communities in order to ensure more equitable outcomes, resulting in overall better health outcomes.

**Figure 7:** Households receiving SNAP benefits and retailers accepting SNAP benefits in the Albemarle County Area.



**Source:** Albemarle County Equity Profile (The Equity Center, 2021).

### **Emission Reduction: Low (GHG Focused Impact Score of .09)**

Community gardens are listed as having an average Drawdown potential of 19.17 gigatons of CO<sub>2</sub>e reduced or sequestered (Eichler, 2024). However, this number is derived from the Drawdown solution of regenerative annual cropping, as there is no Drawdown solution that explicitly focuses on urban agriculture. Regenerative agriculture is defined as having at least four out of six regenerative practices: compost application, cover crops, crop rotation, green manures, reduced tillage, and/or organic production (Eichler, 2024). Some of these are feasible to carry out in the context of a community garden, such as composting, which is already a common practice. However, this solution is primarily focused on large agriculture, meaning that there's a question of how accurate this overall assessment is. This is due to the lower goodness of fit calculation, which comes down to a .5.

That's not to say that community gardens wouldn't have an impact on GHG emissions. Agriculture is a source of GHG emissions through multiple means, including livestock, equipment fuel, and fertilizers. Additionally, food often has to travel long distances before arriving to consumers. Additionally, food processing, packaging, retailing, and disposal are all negative environmental effects associated with consumption (Kulak et al., 2012).

One other potential Drawdown solution that could be considered for this alternative but was not addressed in the County's CAP Action Prioritization document is that of plant-rich diets, which has an average Drawdown score of 90.72 gigatons of CO<sub>2</sub>e reduced or sequestered (Accuardi, 2024). This score – which is significantly higher than any that have been previously discussed – is coming from the decrease in cattle raising and animal feed production. However, there are more questions of applicability, as this number assumes that between 50 and 75 percent of people would adopt a plant rich diet by 2050. It's also not addressed by Albemarle. However, like community gardens, this would also have a lower goodness of fit score, and so the total GHG-Focused impact score would come out to about .43.

In Albemarle's CAP Action Prioritization document, community gardens are listed as action L.5.2 with a GHG-focused impact score of .09.

### ***Health Outcomes: Med-High***

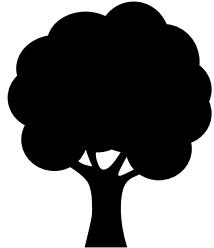
Community gardens are associated with overall positive effects on health outcomes. As shown in the Litt et al. and the Alaimo et al. studies, community gardens are associated with increased fruit and vegetable intake for those who actively participate in the cultivation of the garden. For example, in Chicago, Litt et al. showed that fruit and vegetable intake were significantly associated with community gardens (2011). Community gardens were also associated with an increased willingness for children to consume and try new foods (Cruz-Piedrahita, 2020). Zick et al. find that community gardening tends to be associated with lower body mass indexes (2012).

That said, there is limited research that community gardens can actually cause an increase in the consumption of fruits and vegetables. Rather, we only see a correlation between the two factors. Al-Delaimy & Webb highlight this, stating that while all of the available literature on community gardening points out the relationship between the consumption of healthier foods among gardeners versus non-gardeners, there are no intervention-based studies that have been conducted to evaluate this behavior (2017). Individual lifestyle preferences may serve as a confounding variable and there is therefore uncertainty surrounding these findings. This limitation is explicitly addressed by Zick et al., who discuss the threat of selection bias inherent to their study design (2012).

As previously mentioned, community gardens are associated with community building, community involvement, and overall life satisfaction (Guitart et al., 2012; Blair et al., 2012). In other words, community gardens have the capacity to enrich both the nutritional and social environments. In a literature review evaluating the effects of community gardens on both physical and social health, Egali et al. found that community gardens can have such effects like building up a sense of ownership and pride, urban beautification, and community cohesion, all of which are correlated with potential health outcomes (2016). McCabe – one of the authors cited by Egali et al. finds that chronic poor health in places like inner cities are usually the result of health disparities that are exacerbated by factors like poverty (2014). McCabe argues that community gardens can address health challenges through fostering neighborhood stability, cutting down youth violence, and providing “building blocks” to deal with poor nutrition and other health risks.

Additionally, there are many health benefits associated with the physical act of gardening, given that it requires regular physical movement(Park et al., 2014). These gardening tasks can be considered moderate to high intensity physical activities.

# **Policy Alternative:**



## ***Reducing Impervious Surfaces and Bolstering Tree Canopies***

This alternative calls for reducing impervious surfaces – hard surfaces like pavement that absorb heat and prevent water from penetrating into the ground – and instead increasing the overall number of trees in the County, especially in the Development Areas.

### **Description**

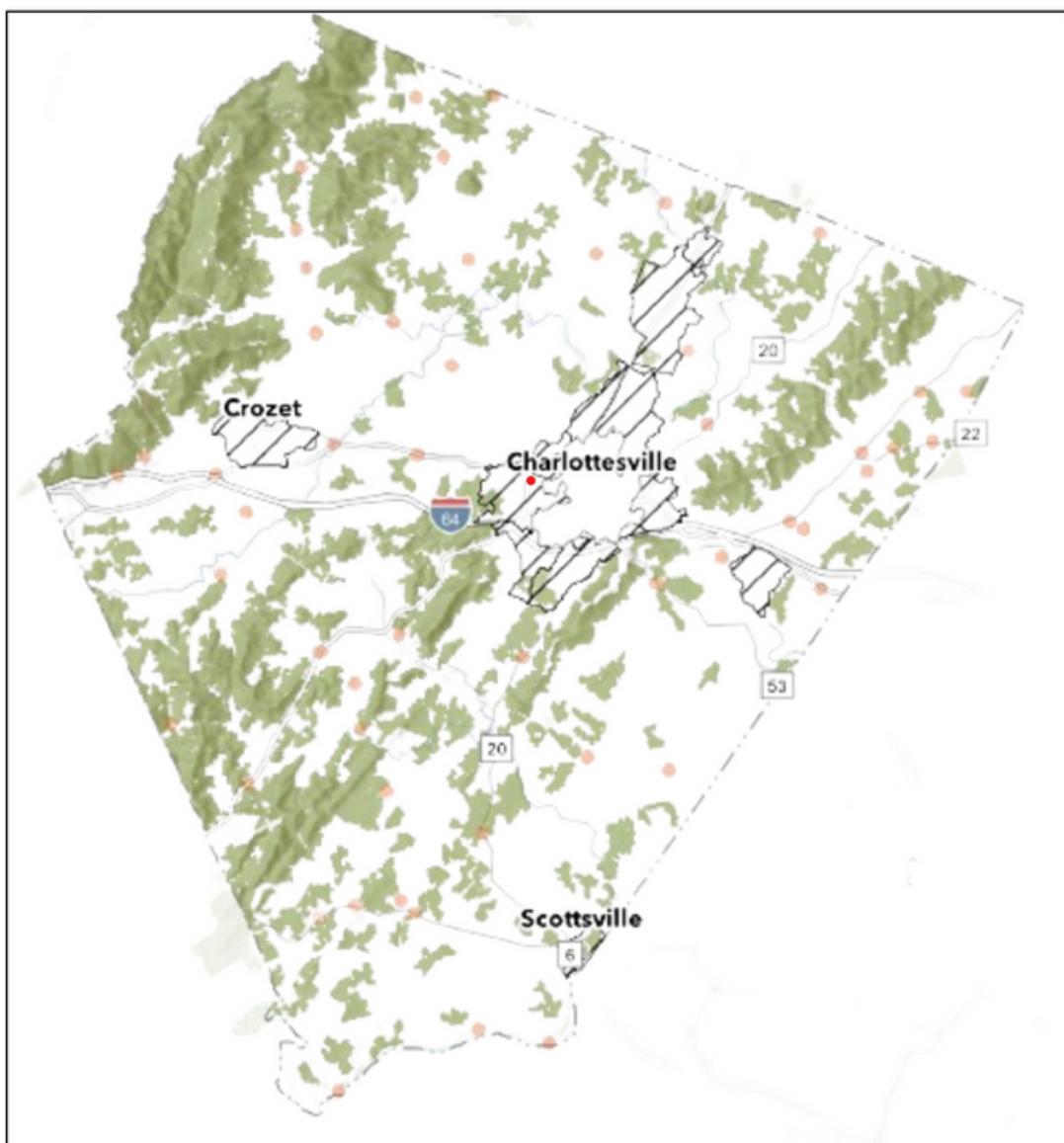
Reducing impervious surfaces may look like minimizing paved surfaces, such as streets, parking lots, dark roofs, and driveways (Southeast Michigan Council of Governments, 2008). As these types of surfaces tend to absorb more heat, they can lead to significantly higher temperatures in urban centers, leading to what is called the urban heat island (UHI) effect (see Key Terms).

This might take multiple forms, such as the implementation of green roofs. Green roofs, also known as rooftop gardens, are vegetative layers grown on top of rooftops that have the ability to provide shade, remove heat from the air, and reduce the temperatures of the roof surface (EPA, 2014). Additionally, Albemarle County may also look towards permeable pavement in new development projects. These pavements are designed to absorb rainwater and enhance evaporation, leading to lower surface temperatures than conventional pavement (Liu et al., 2018). While this report primarily focuses on extreme heat hazards, permeable pavement is effective at reducing local flooding through the infiltration of stormwater (EPA, 2021).

Looking across the County, we see wide variations in community assets and infrastructure that are correlated with various outcomes. For example, the percentage of tree cover varies across the County, which aligns with the divide between the Development and Rural Areas (Figure 8). However, this variation in tree cover is also correlated with mean surface temperature (Figure 9). This holds true for cities across the United States (Ziter et al., 2019).

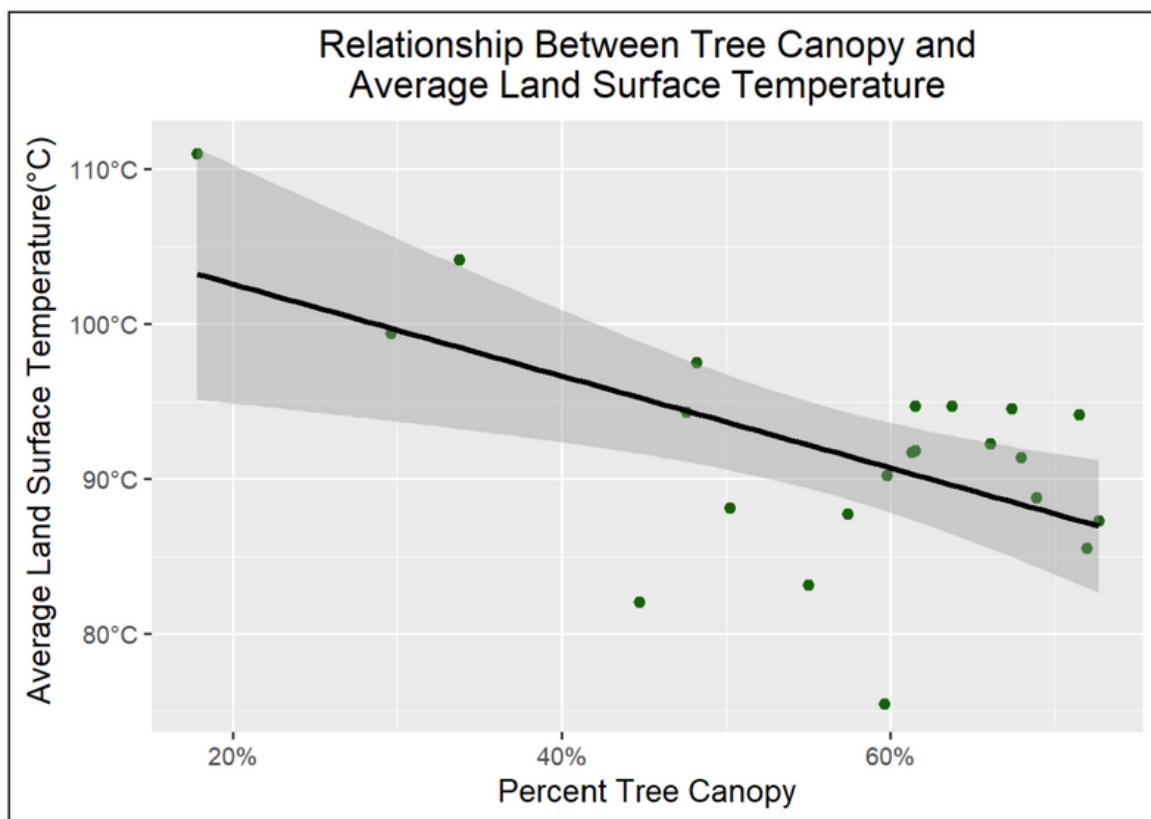
The cost of this alternative would depend on the extent to which it is utilized. There would be questions of replacing existing pavement versus only utilizing it for new constructions. There are also questions of where it would be most feasible, such as residential areas versus non residential areas.

**Figure 8:** Forest cover across Albemarle County. The green represents forest cover, the striped areas represent the Development Areas, and the orange dots represent rural communities.



**Source:** Piedmont Environmental Council's Albemarle County Rural Area – PEC Interactive Map.

**Figure 9:** Correlation between tree canopy and average land surface temperature across Albemarle Census tracts.



**Source:** Author calculation using USGS Landsat 8 C2 L2 Surface Temperature data.

## Evidence in the Literature

Climate change is likely to increase health risks due to the urban heat island effect. For example, a study in Shanghai found that the UHI effect was directly responsible for worsening the adverse health effects of heat exposure, as areas around the city that were exposed to higher temperatures faced higher rates of heat-related mortality (Tan et al., 2009). Surface temperatures have implications for public health, such as affecting the risk of heat stroke. Both social and physical vulnerability affect the risk of heat-related mortality, and this risk will continue to increase as climate change increases the frequency and intensity of heat waves in Albemarle County (Kovats & Hajat, 2008; Albemarle County, 2022).

One way of reducing the UHI is through reducing impervious surfaces. Yuan and Baur find that there is a strong linear relationship between land surface temperature (LST) and the percent of impervious surfaces for all seasons (2006). Morabito et al. found that in a study of ten Italian cities, the UHI rose significantly in intensity when the density of impervious surfaces increased (2021). The literature is consistent with these findings across various regions and climates of the world, including Japan, Italy, and Canada (Chithra et al., 2015; Morabito et al., 2021; Leal Filho et al., 2017). In Glasgow, a study found that a 20% increase in green spaces above the current level could eliminate at least a third of the city's expected UHI effect in 2050 (Emmanuel & Loconsole, 2015).

In order to address these concerns, one potential alternative would be to reduce the number of impervious surfaces and increase the number of green spaces, even if the green spaces are relatively small. These could be both polygonal green spaces, which are green spaces that are defined by distinct boundaries like a park, and mixed-type green spaces, which incorporate both natural and built elements and tend to be integrated into the larger environments. Park et al. found that both polygonal and mixed-type green spaces caused a city clock's UHI to decrease in a linear fashion when the area and volume of the green spaces increased (2016). Wong and Yu find similar effects, with their study indicating a strong correlation between decreased temperatures and the appearance of large green spaces in an urban environment like Singapore (2004). Shahmohamadi et al. argue for the use of both horizontal and vertical green spaces on buildings and roofs (2011).

That said, green spaces should not be the only criteria assessed to address the urban heat island effect; Sun and Chen argue that greater focus on protecting natural forests in cities might provide greater benefits for climate mitigation (2017). Yuan and Baur similarly discuss that vegetation may not have as strong of an effect at mitigating increasing LST as previously thought, although impervious surfaces still play a role in increasing LST (2006). Park et al. find that the UHI effect decreases in a linear fashion when the area and volume of various types of green spaces increases (2016). Wong and Yu find similar effects, with their study indicating a strong correlation between decreased temperatures and the appearance of large green spaces in an urban environment like Singapore (2004).

# Evaluation

## ***Equity: Medium***

Studies show the UHI effect having increased health risks in more urban areas, with a disproportionate impact on marginalized groups (Heaviside et al., 2017). This holds within Albemarle as well, as previously discussed (see Background section). Albemarle's Black, Asian, and Latino residents were more likely to be exposed to the UHI effect than their white neighbors (Albemarle County, 2022). Work done by the County in their Climate Vulnerability and Risk assessment shows that neighborhoods in the development areas directly north of Charlottesville score high on household vulnerability to the UHI effect due to the larger number of residents over the age of 65, grandparents taking care of grandchildren -- who are physically vulnerable -- and residents who don't have a high school diploma (2022).

Many studies have found that green spaces tend to be disproportionately located in white and more affluent areas, leading this unequal distribution to be recognized as an environmental justice issue (Wolch, 2014). While some U.S. cities have implemented strategies to increase urban green spaces due to their public health benefits, these strategies may ultimately lead to gentrification and displacement. There is empirical evidence for this support from places like New York City, where the gentrification effects differed depending on the type and characteristics of the green spaces (Kim & Longfeng, 2021). To that end, the health benefits of further "greening" an urban or suburban area can only be fully understood relative to its social and political contexts (Cole et al., 2017). In fact, some studies find that marginalized communities often use green spaces less often, although the research is limited (Jelks et al., 2021).

## ***Emission Reduction: Medium (GHG-Focused Impact Score of .14)***

In Albemarle's CAP Action Prioritization document, the reduction of impervious surfaces are listed as having an average Drawdown potential of .76 gigatons of CO<sub>2</sub>e reduced or sequestered (Metz, 2024). This number poses a similar problem to the Drawdown potential for community gardens, in the sense that this alternative isn't exactly the same thing that Project Drawdown is suggesting. The Drawdown solution that this technically falls under is green and cool roofs, which only encompasses a very small percentage of impervious surfaces. In other words, it's not a great fit, as green roofs explicitly refer to green spaces on rooftops and cool roofs refer to roofs designed to reflect sunlight.

*This falls under CAP Action L.2.6, and has a GHG-Focused Impact score of .00 due to its focus on resilience rather than mitigation and its poor goodness of fit.*

*Tree canopy maintenance is included as a separate solution, under L.2.2. There are Drawdown solutions that relate to tree canopy cover, like additional forest protections, temperate forest restorations, and tree plantation on degraded land, with an average Drawdown score of 29.70. However, these solutions are focused on more widespread deforestation, and the need to repair damaged forests.*

*For this reason, tree canopy maintenance has a goodness of fit calculation of .5 and a GHG-focused impact score of .14*

### ***Health Outcomes: Medium***

The UHI effect can directly affect health, as high temperatures place additional stress on human physiology (Shahmohamadi, 2011). Additionally, the UHI can have varying impacts on urban and suburban infrastructure by affecting patterns of settlement, energy use, transportation, and environmental quality (Shahmohamadi, 2011). Aside from the direct health effects of increased heat exposure, the UHI may actually exacerbate air pollution (Ulipiani, 2020). Higher temperatures have the ability to speed up certain atmospheric chemistry cycles, which may lead to increased levels of ground-level ozone and evaporated volatile organic compounds (Elsayed, 2012; Bretz et al., 1998). This solution seeks to directly mitigate that effect. Gunawardena et al. argue that tree-dominated green spaces offer the greatest heat stress relief when it's most needed, as their analysis shows that the evapotranspiration-based cooling influences of green spaces is especially relevant for urban canopy layer conditions.

More generally, the literature shows a consistent negative association between urban green space exposure and mortality, and a consistent positive correlation between urban green spaces and physical activity (Kondo et al., 2018). However, this literature is relatively limited as this has not been studied to a large extent. There are links to be made between intense heat and human health, but it would be more difficult to make definitive claims about the inherent outcomes resulting from this alternative.

# Recommendation

The overall purpose of this Applied Policy Project is not necessarily to provide Albemarle County with a concrete final decision of what they should be doing in the immediate future. To do so would be very difficult, as the Climate Protection Team faces budgetary constraints, leading to obvious limitations in terms of action items. Instead, this report seeks to provide the County with potential actions, all of which could have some impact on the overall longevity of the County's population, while specifically targeting those that seem to be experiencing the largest disparities.

That said, of these options, I would recommend pursuing community gardens while providing some sort of additional compensation for volunteers' labor. This may seem like it runs counter to my previous analysis, especially given the number of benefits associated with improved transportation infrastructure. Improved transportation infrastructure would likely lead to increased physical activity, and significantly reduced GHG emissions through the increase of community members utilizing walking and bike paths, as well as public transit. Although the link between reduced impervious surfaces and increased canopy cover isn't entirely clear, the health benefits of this alternative are more direct, in that it's fighting against the increasing risk of extreme heat, and the overall negative health impacts that accompany it. Although there are more questions about equitable ways to implement green spaces, transportation infrastructure could be more targeted, leading to more equitable access to essential services, like medical care.

This recommendation is primarily coming from an implementation and feasibility perspective, as community gardens appear to be an effective solution at a significantly lower cost. Like transportation infrastructure, it can effectively target communities that need it the most, which also seem to be communities that are experiencing disparities in life expectancy outcomes. Additionally, this is a solution that has been tried in Albemarle before, meaning that the overall feasibility of it is significantly higher, and it's unlikely to face internal resistance because there would be fewer County actors involved. There are also a number of funding opportunities available for the County to look into that would help cover start up costs.

# Implementation

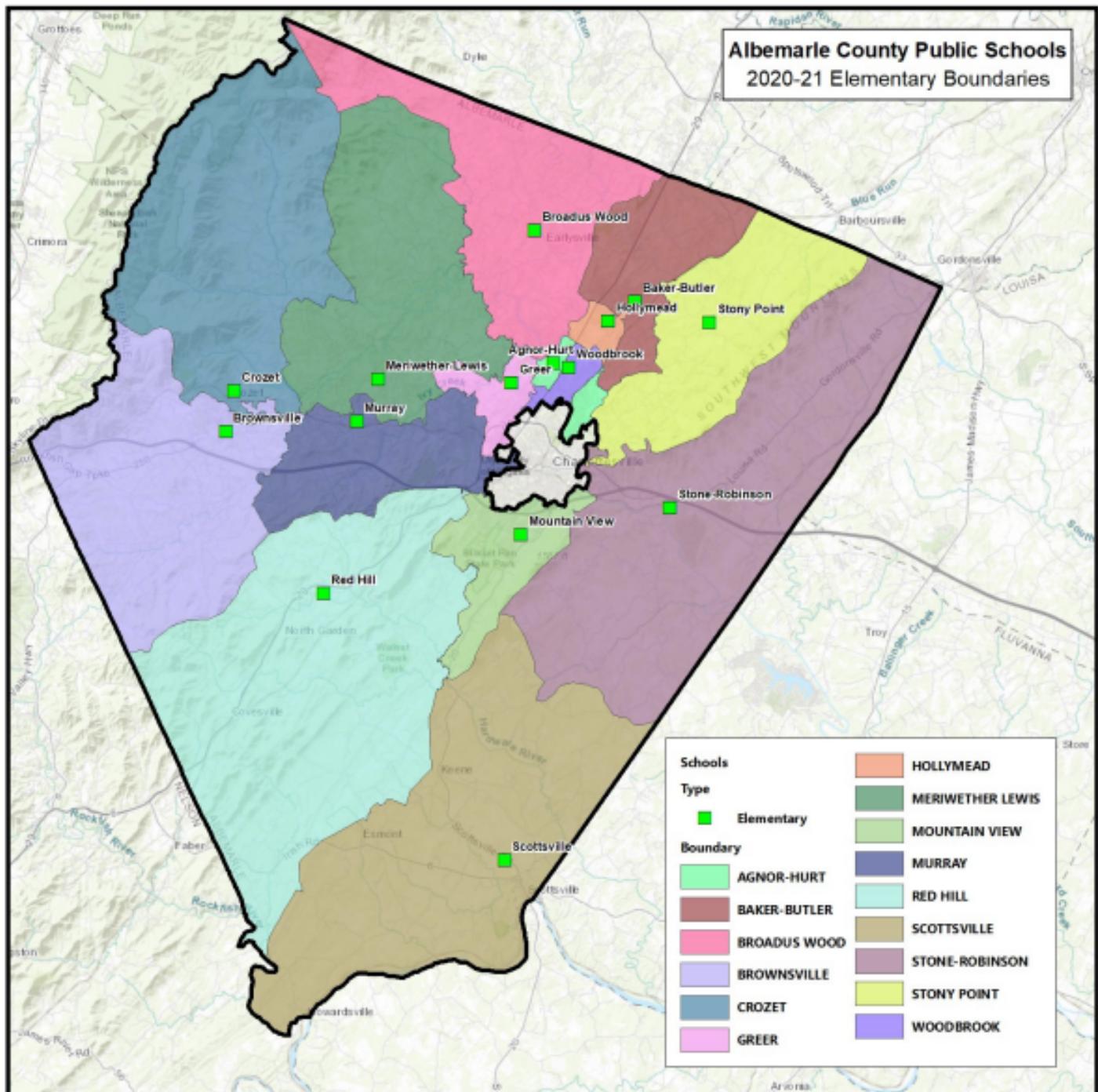
In her paper, *Growing What You Eat: Developing Community Gardens in Baltimore, Maryland*, Corrigan states that places hoping to implement successful community gardens need a dedicated community, a dedicated leader, knowledge of gardening, and a willingness from local governments and community organizations to support the garden. To that end, a bottom-up approach for the garden is typically the most successful (2011).

Like other established gardens in the Albemarle Area, community members should be the ones to take the lead. This may begin through locating the garden at an established community center, much like how the Yancey Community Garden in Southern Albemarle is located at the Yancey Community Center. In keeping with this established precedent, local schools may serve as suitable locations for such gardens (Figure 10). Other existing gardens run by nonprofit organizations include the New Roots Garden, which is located near Azalea Park. Similarly to schools, parks may serve as existing community centers.

Albemarle County should look into established networks of community members and volunteers, as well as potential community partners who are aware of the resources available within the community. For example, the Yancey Community Center has worked with Piedmont Master Gardeners, which is a program designed to provide agricultural and horticultural support (Piedmont Master Gardeners, n.d.).

Of course, there are other considerations to keep in mind in terms of implementation steps, such as purchasing materials like soil and seeds, as well as recruiting volunteers. Albemarle has already acknowledged that there may need to be changes to the County Code that would more easily facilitate community gardens, as well as the need to promote such a program. Right now, zoning ordinances do not permit gardening as a primary use of properties outside of the Rural Area; in the Development Areas, gardening is only allowed as an accessory use if a residential use already exists on a property (Albemarle County, 2015). To allow greater access to opportunities for community gardeners, changes would need to be made to this ordinance. Given the Albemarle County's Board of Supervisors' past willingness to address zoning policies in the name of climate action, these changes are relatively feasible.

**Figure 10:** Locations of elementary schools and their respective zones across Albemarle County.



**Source:** Albemarle County Public Schools: Subdivision Yield Analysis (Cooperative Strategies, 2021).

## **Stakeholders**

A number of stakeholders are involved with moving this recommendation forward. One of the biggest stakeholder groups, as previously mentioned, are community members. The role that they play is twofold, in that they would be the ones who manage the gardens, and they would be the primary beneficiaries of the produce that is subsequently grown and consumed. Given the County's focus on equity for this project, these gardens should be placed in areas of the County in which life expectancy is lower, as life expectancy is correlated with income and subsequently, food security. In other words, the program would be directly accessible to stakeholders who face the greatest need for accessible, healthy foods.

Other stakeholders include government officials, including the Board of Supervisors, who would be responsible for allocating funding to the Climate Action Team. Additionally, there is room for collaboration within the County through the Environmental Services Division, which is the greater department that the Climate Action Team belongs to. The County has undertaken other agriculture-related projects, such as increasing native plants around the County. This means that there may be some internal level of expertise. Additionally, the Climate Action Team may want to work with Community Outreach to get the word out about the program, both for those who may want to volunteer and those who would benefit from the produce.

Other important stakeholders include small businesses, as the County may want to focus its purchasing efforts on locally-owned businesses. A number of businesses have collaborated with Piedmont Master Gardeners through their Plant Northern Piedmont Natives Campaign, such as Fifth Season and ProTech Farm and Nursery.

Finally, there are a number of local organizations that are also involved with community gardening, which opens the door for more opportunities. For example, Cultivate Charlottesville's Urban Agriculture Collective and New Roots are both programs that focus on strengthening community resilience in the face of food insecurity. Both organizations also place heavy emphasis on equity. There could be room for collaboration, which would involve establishing communication channels, establishing common goals, and organizing ways to begin sharing expertise. However, there may be questions over power dynamics and historical inequities that have been perpetuated by government action.

## **Stakeholder Perspectives**

Given the focus on underserved communities, it doesn't appear that community gardens would be particularly controversial among community members on their own. There might be resistance that the County could focus its efforts elsewhere, but this would likely be in regard to time and manpower; community gardens are a relatively low-cost alternative compared to other potential policy alternatives. However, the bigger issue would be with getting volunteers on board. A study by Ohmer et al. found that across community gardens in Pennsylvania, some of the most important reasons for community garden involvement were to beautify and give back to the environment and to support the conservation of green space (2009). These may be values to highlight in the recruitment process.

Given the Albemarle Board of Supervisors' history of positive climate action, they are also likely to be on board with similar proposals, although questions of funding are extremely limited given the County's budget. This may mean that even though the Climate Action Team may have support for the proposal, that support may not translate to financial gain. Additionally, because funding is so tight, more money for the Climate Action Team would mean less money for other departments, which might raise resistance.

While small businesses would likely support this project given that they benefit directly through purchases, other organizations may not be as supportive. This is because of questions about whether or not local governments can effectively serve underserved community members given that Albemarle has not always historically done so. This is especially true for New Roots, who works with refugee and immigrant populations. There are also questions of local government crowding out these actors, limiting the effectiveness of these community institutions that have been in place for longer. However, this is less likely to be a problem given documented issues of community garden recruitment.

## **Potential Challenges**

There are two primary things that could go wrong, both of which are relatively likely and equally important to consider when thinking about implementation. The first is that there simply isn't enough funding available in the county budget to fund community gardens. Although they are relatively low cost, it can still cost several thousand dollars in start-up costs. That said, the Climate Action team is aware of this issue and has turned their attention to grants in the past. Grant programs for community gardens exist, such as the Urban Agricultural Resilience Program.

The other issue to consider is that there may not be enough volunteers to work the garden. Although there is existing gardening expertise in the county and throughout the region, it's difficult to actually attract volunteers, regardless of management effectiveness (Gilbert et al., 2020). This is where collaboration would be of critical importance, as the county may need to reach out to existing networks of volunteers, or they may need to participate in extended outreach.

## Conclusion

Although Albemarle County has higher health outcomes relative to the rest of Virginia, there is still more work that can be done to address disparities in life expectancy at the local level. While climate action is not the only approach that could be used to tackle this, it could prove to be highly effective at both targeting census tracts facing lower life expectancies while promoting improved health outcomes for the County as a whole.

Through programs like expanded community gardens in neighborhoods could be one way to pinpoint the specific needs of community members, such as increasing access to affordable healthy foods, this is not necessarily the only option on the table.

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