MITIGATING FOOD INSECURITY IN SOUTHWEST VIRGINIA

Recommendations for Expanding Food Access Programming

April 2025

APPALACHIAN sustainable DEVELOPMENT

UNIVERSITY of VIRGINIA
FRANK BATTEN SCHOOL of LEADERSHIP and PUBLIC POLICY

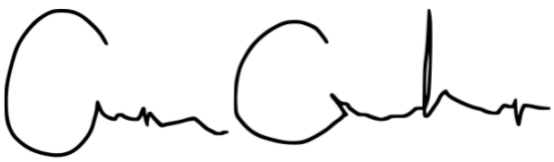
Table of Contents

Mandatory Disclaimer

The author conducted this study as part of the program of professional education at the Frank Batten School of Leadership and Public Policy, University of Virginia. This paper is submitted in partial fulfillment of the course requirements for the Master of Public Policy degree. The judgments and conclusions are solely those of the author, and are not necessarily endorsed by the Batten School, by the University of Virginia, or by any other agency.

Honor Statement

On my honor as a student, I have neither given nor received unauthorized aid on this assignment.



Carson Crenshaw

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Executive Summary

Food insecurity continues to be a critical and persistent issue in southwest Virginia, with over one in five residents facing inadequate access to sufficient, nutritious food. This statistic has remained largely unchanged over the past decade (Feeding America, 2022; Virginia Works, 2024). Even where assistance is provided, the quality of nutrition remains substandard across Appalachia, contributing to a range of serious public health challenges (Trozzo et al., 2019).

Food insecurity, as defined by the USDA, refers to the household-level economic and social condition of limited or uncertain access to safe and nutritious foods. While this term often brings to mind a lack of food, the underlying issue is actually one of nutrition: the ability to access food that not only meets caloric needs but also supports overall well-being. In Southwest Virginia, too many individuals and families lack consistent access to healthy, fresh, and affordable food. Despite ongoing efforts to tackle food insecurity in the region, including food banks, charitable donations, and government assistance programs, the underlying issue remains unresolved. While food access is a critical component of sufficient rural food systems, a broader and more holistic approach is needed that focuses on improving the quality and dependability of the food being provided.

Appalachian Sustainable Development (ASD) is a significant stakeholder in Southwest Virginia, working with local farmers, community members, nonprofits, corporate partners, and individual stakeholders to improve the health of all segments of the population in the Appalachian region. Given its mission of promoting a thriving regional food system, expanding and improving their current programming available to their service area has the potential to improve the nutrition and quality of life for local Appalachian communities. By analyzing the available literature, this report seeks to inform ASD on how community-based interventions can be effectively leveraged in fostering solutions against food insecurity.

Central to this report is the exploration of community-driven interventions that can mitigate food insecurity. These interventions take into account the local context, the specific needs of the community, and the unique challenges faced by rural populations in accessing healthy food. The report highlights the value of such strategies and offers recommendations on how these can be operationalized effectively by ASD. In the course of this report, I will evaluate three potential intervention programs:

1. Cost-Offset Community-Supported Agriculture (CO-CSA)
2. Developing an Emergency Food Plan
3. Nutrition Education Mapping

Each program is assessed using four key criteria: cost, effectiveness, feasibility, and equity. These criteria provide a standardized framework for evaluating the potential impact of each program and assessing its suitability for implementation in the region. This paper proposes that by integrating nutrition-focused programs into the broader fight against food insecurity, communities in Southwest Virginia can build a more resilient and sustainable food system. After a thorough evaluation, the report concludes that the CO-CSA program represents the most promising option. By leveraging the ASD Food Hub and local agricultural resources, the CO-CSA program can provide a sustainable, long-term solution to food insecurity that prioritizes nutrition and community engagement. This program not only addresses immediate food needs but also fosters local economic development, enhances public health outcomes, and empowers communities to take control of their own food systems.

Ultimately, this report builds on the way food insecurity is addressed in Southwest Virginia by ASD. It emphasizes the importance of community-based interventions that prioritize nutrition, sustainability, and local economic development. By adopting programs such as CO-CSA, Southwest Virginia can make significant strides toward reducing food insecurity and improving the overall health and well-being of its residents.

Introduction

Food insecurity is defined by the USDA as the household-level economic and social condition of limited or uncertain access to safe and nutritious foods (USDA ERS, 2024). Food insecurity does not necessarily imply starvation, but hunger is a possible outcome of food insecurity. An individual is food insecure when they lack regular access to enough nutritious food for normal development and an active, healthy life. This may be due to unavailability or lack of resources to obtain food (Carlson et al., 1999; UN FAO, 2024; USDA ERS, 2024). While defined at the federal-level, this definition is consistent across the literature on food access (Carlson et al., 1999; UN FAO, 2024; USDA ERS, 2024).

Food insecurity is a concept that encompasses several different dimensions and can be experienced at different levels of severity. At the macro-level, food insecurity issues are related to food availability and stability. Food availability is a measure of the capacity of a household to acquire sufficient and appropriate foods to ensure a diet that is diverse, nutritious, and safe (Durao et al., 2020). As shown in *Figure 1*, food stability introduces the condition of time to the food security concept: chronic food insecurity, for example, refers to the persistent lack of food over a long-term period (Durao et al., 2020; UN FAO, 2008).

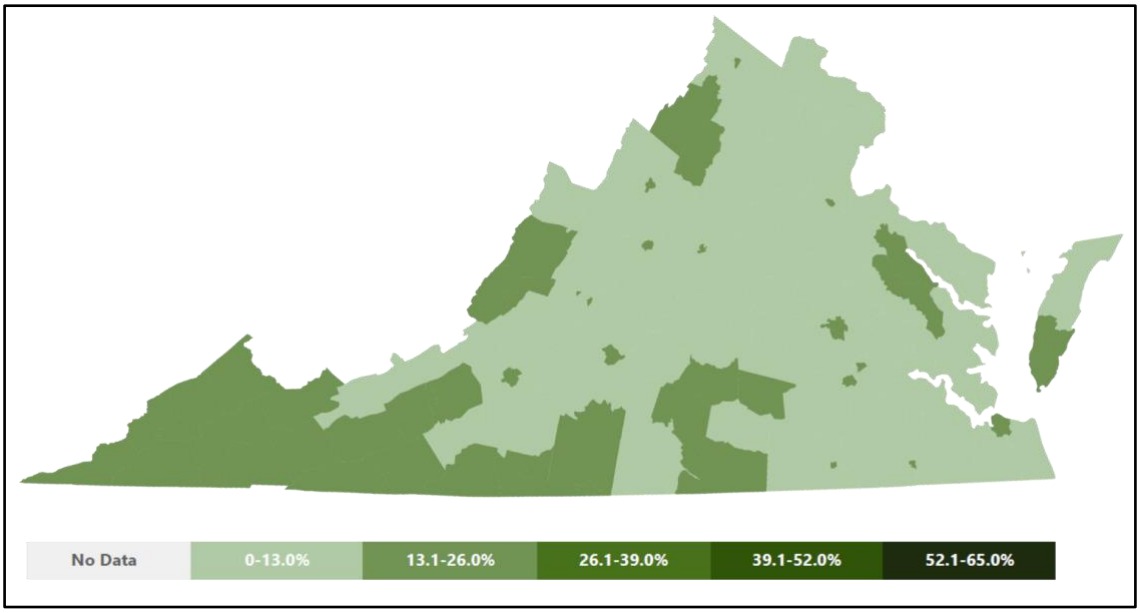
Figure 1: Food Insecurity Experience Scale (FIES)

Source: UN FAO. (2024). *Hunger and food insecurity.* Food and Agriculture Organization of the United Nations. https://www.fao.org/hunger/en

Virginia's food insecurity rate is 11%, not far off from the national average of 10.5% (Abooali, 2022; Escobar-Chena, 2024). According to the most recent estimates from Feeding America there were 963,980 food insecure Virginians in 2022 (Kerrick et al., 2023). The presence of food insecurity in Virginia is concentrated in certain areas of the state (*see Figure 2*). In particular, the Appalachian region of Virginia is home to an estimated 117,760 food insecure residents (Kerrick et al., 2023). The majority of the

Southwest Virginia region is federally designated as rural and has the highest food insecurity and lowest socioeconomic status in the state.

Figure 2: Map of Virginia Food Insecurity Rates

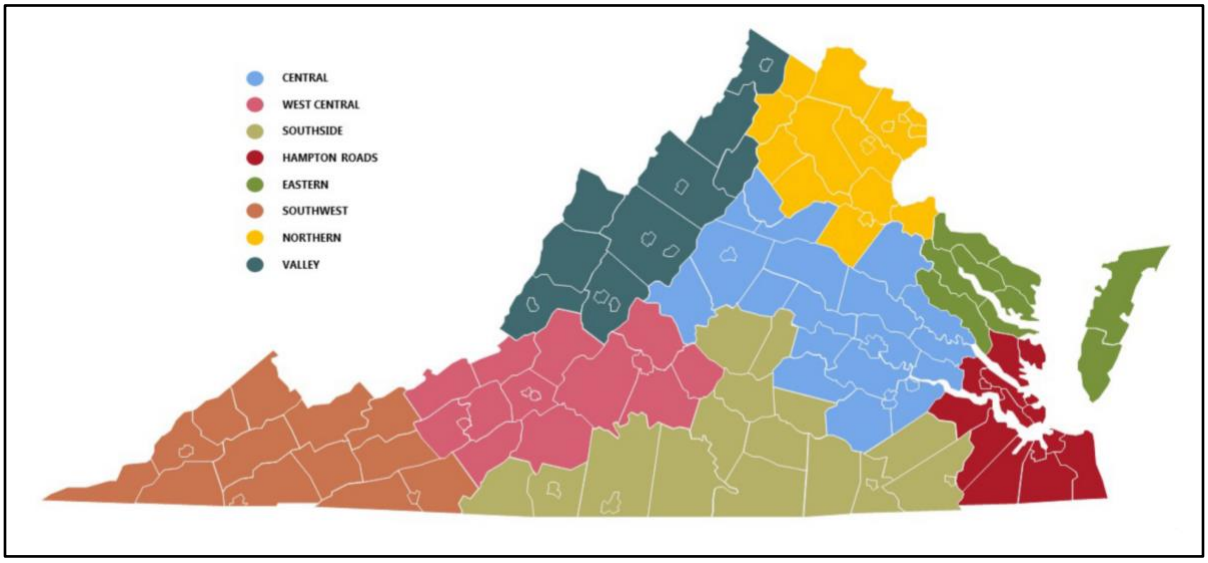


Source: Escobar-Chena, P. (2024, July 1). *Virginians Facing Hunger: Insights from Feeding America's Map the Meal Gap Report.* https://vafoodbanks.org/virginians-facing-hunger-insights-from-feeding-americas-map-the-meal-gap-report/

Geographic Overview

Southwest Virginia, often abbreviated as SWVA, is a mountainous region of Virginia in the westernmost part of the commonwealth (*See Figure 3*). While there are a variety of geographic designations, for the purposes of this report Southwest Virginia will refer to the following counties: Bland, Buchanan, Carroll, Dickenson, Grayson, Lee, Russell, Scott, Smyth, Tazewell, Washington, Wise, and Wythe (University of Virginia, 2024b).

Figure 3: Virginia's Demographic Regions

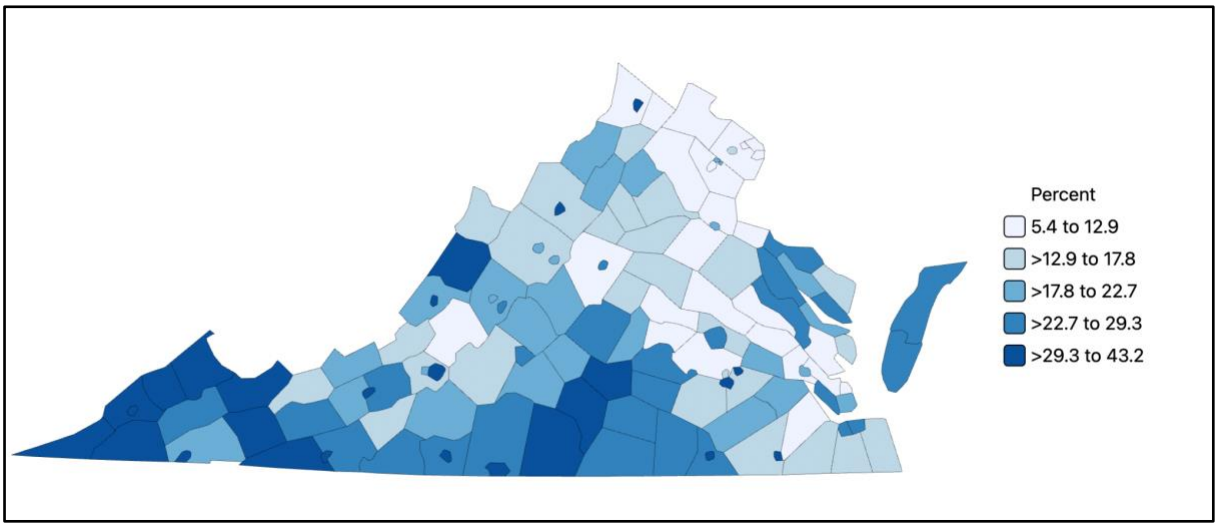


Source: University of Virginia. (2024). *Virginia's Demographic Regions.* Weldon Cooper Center for Public Service. https://www.coopercenter.org/virginias-demographic-regions

Southwest Virginia's distinct cultural identity sets it apart from other regions of the state, largely due to its deep ties to the broader Appalachian region. The culture here is more closely associated with Appalachia, a cultural and geographical area that stretches across the Appalachian Mountains, influencing the region's music, traditions, and way of life. The rural character of Southwest Virginia is a defining feature: much of the region consists of small towns, farms, and communities that still rely heavily on agriculture, mining, and natural resource-based industries. These industries have shaped the local economy for generations. Yet in recent decades, the decline of the coal industry has brought economic challenges. Many communities in Southwest Virginia have struggled to replace those lost jobs (West Virginia University, 2023). Economically, the region has not attracted the same level of investment and development as other parts of Virginia, partly due to its mountainous and rural geography, which limits infrastructure development and access to larger markets (Massari, 2023). This isolation has also restricted access to quality education and healthcare, perpetuating cycles of poverty and low-income status. As a result, the disproportionate low rates of food insecurity among certain regions of Virginia follow the same

data trend that supports the relationship between low socioeconomic status and low rates of food security (Abooali, 2022; National Institute on Minority Health and Health Disparities, 2025).

Figure 4: Persons Below 150% of Poverty by County (2019-2023)



Source: HDPulse: An Ecosystem of Minority Health and Health Disparities Resources. National Institute on Minority Health and Health Disparities. Created 4/3/2025. Available from https://hdpulse.nimhd.nih.gov

Southwest Virginia, despite challenges like the decline of coal mining, has continued to uphold traditional ways of life. The people of Southwest Virginia have long been known for their strong sense of community and self-sufficiency, qualities that align with the broader Appalachian ethos (Elder et al., 2018; Paskett et al., 2019). Unlike the individualistic mainstream U.S. culture, the region's collectivist culture has helped foster local, community-based initiatives to sustain its economy. Recent economic growth has been driven by diversifying into tourism, manufacturing, and emerging as a hub for energy innovation (Yancey, 2024). Bolstering the agricultural sector has also been a focus of the region in order to improve the resiliency of local food systems. The region's unique landscape supports small-scale, family-owned farms, emphasizing livestock, heritage breeds, sustainable practices, and agrotourism. ASD recognizes the importance of supporting this growth to improve food access in Southwest Virginia.

Client Overview

Appalachian Sustainable Development (ASD) is a nonprofit organization that works to grow a stronger Appalachia through agriculture. ASD works with local farmers, community members, nonprofits, corporate partners, and individual stakeholders to improve the health of all segments of the population in the Appalachian region. Additionally, ASD works to ensure that sustainable agriculture and land use are driving forces in the regional economy. The footprint of this work expands across Appalachia, from

eastern Kentucky to Appalachian Ohio, West Virginia, Northeast Tennessee, and Southwest Virginia (ASD, 2024c).

ASD works in agricultural resiliency, food security, and economic development. These goals are actualized through five different focus areas: food access, agricultural education, workforce development, resource management, and economic development. Focusing on food access specifically, ASD primarily works to support the regional food and agriculture economies. In a twofold approach, ASD encourages local producers by buying their product while simultaneously aiding families in need by distributing that produce to area food pantries.

ASD distributes food boxes directly to families in need through the Appalachian Harvest Food Hub. ASD packages and distributes over 6,000 donated food boxes a month from their headquarters in Duffield, VA (ASD, 2024a). To date, ASD has distributed 77,406 food boxes and 2,167,368 pounds of food within the local community. ASD works with 40 partners, consisting of food pantries, food banks, and civic organizations throughout Southwest Virginia, to distribute the donated boxes throughout their communities. ASD also distributes approximately 300 Appalachian Harvest Food Boxes each Friday from their Appalachian Harvest Food Hub. These boxes are uniquely designed to address the lack of nutritious food in southwest Virginia by providing participants with fresh produce, dairy, and meat. Not only is each box designed to provide about eight meals when supplemented with other dry good items, but it can save the recipient about $200 per month on groceries. Because the Appalachian Harvest Food Box program is partially funded by federal grants and private donations, ASD is able to purchase and package local produce at no cost to program participants. Additionally, every box supports local farmers and boosts the local economy.

Secondly, ASD works on expanding education and advocacy for rural communities that are food insecure. ASD develops rural food systems by providing training, resources, and opportunities to help individuals succeed in agriculture. This includes hosting Good Agricultural Practices (GAP) trainings and supporting Appalachian farmers through technical assistance. Additionally, ASD has historically partnered with state and local governments to create new Appalachian food access policies such as the Virginia Food Box program.

While ASD has dedicated ample resources towards its food access programming, there are potential avenues for expansion. In 2024, ASD unveiled plans for a new agricultural campus which will include an agriculture business development hub, a food hub, a greenhouse and gardens (ASD, 2024b; Cameron, 2024). The development of this property presents significant opportunities for expanding community outreach (*see Figure 5*). With increased space and resources, ASD can offer a wider range of services and reach more individuals in need. This growth will enable ASD to address existing gaps in services and create long-lasting change in Southwest Virginia.

Figure 5: Drawing of ASD Destination Campus

Source: ASD. (2024b). *Growing for a Stronger Appalachia.* Appalachian Sustainable Development. https://www.asdevelop.org/growing-for-a-stronger-appalachia/

Problem Statement

Appalachian Sustainable Development (ASD) is aware of the importance of nutrition and the struggles that many Appalachian communities face in acquiring adequate food. The Appalachian Harvest Food Hub operated by ASD is one of the oldest rural food hubs in the United States that serve a diverse and largely disadvantaged population. Despite their work against food insecurity, the Appalachian region of Virginia is still home to an estimated 117,760 food insecure residents (Kerrick et al., 2023). In Southwest Virginia specifically, more than one in five residents are food insecure, a figure that has not decreased significantly in the past 10 years (Feeding America, 2022; Virginia Works, 2024).

Even where Appalachians are receiving assistance, populations remain food insecure because nutrition is subpar. Given food insecurity is defined by the USDA as the household-level economic and social condition of limited or uncertain access to safe and nutritious foods, it is perhaps not surprising that obesity and related chronic conditions are more prominent in Appalachia when compared with other areas of the United States (Trozzo et al., 2019).

Put simply, too many western Virginia residents have inadequate access to the nutritious food necessary to live a healthy life. Even with an increase in the amount of resources aimed at fighting food insecurity in western Virginia, the prevalence of food insecurity has remained relatively unchanged.

Literature Review

Eating healthy and nutritious food is essential to the growth, development, and maintenance of a healthy body and overall well-being. It is important that people have access to affordable nutrient-rich foods that, when combined with physical activity, can help maintain a healthy weight, reduce the risk of chronic disease, and promote overall health. Factors including environmental barriers and social disparities, such as income, race, ethnicity, and disability, prevent some Virginians from accessing healthy food. The proximity of restaurants and grocery stores, the existence of food and nutrition assistance programs, and community characteristics all contribute to the ability to access healthy food (Virginia Department of Health, 2022).

This literature review will explore the complex realities of food insecurity in the Appalachian region by discussing the impacts food insecurity has over food systems, socio-cultural practices, non-profit organizations, health, and economics. This section will foster an understanding of how community-based interventions as a guiding framework can influence and improve the work of nonprofit organizations against food insecurity. Through a comprehensive analysis of the available literature, this analysis seeks to synthesize and inform an audience of stakeholders such as policymakers, non-profit organizers, and community members on the importance of pursuing nutrition-based programs.

Causes of Food Insecurity

The risk for food insecurity increases when the financial resources needed to buy food are limited or not available (Bowen et al., 2021; Castell & Seefeldt, 2009; Dean et al., 2011; Smith et al., 2000). Food insecurity and poverty are strongly correlated: lower-income households are much more likely to be food insecure (Singh et al., 2020). However, poverty and food insecurity are not synonymous terms. Many poor families are food secure, and some higher-income families experience food insecurity (Gundersen et al., 2018). Additionally, although some households are chronically food insecure, most experiences of food insecurity are intermittent, with households cycling in and out of food insecurity (USDA ERS, 2024).

Setting income aside, research demonstrates that some households are more likely to experience food insecurity than others. For example, food insecurity is more prevalent in households with children and in Black and Latino households, Native American households, female-headed households, and households headed by people with disabilities (Huang & King, 2018; Singh et al., 2020). Recent immigrants and noncitizen immigrant households are also at an increased risk of food insecurity (Potochnick et al., 2017).

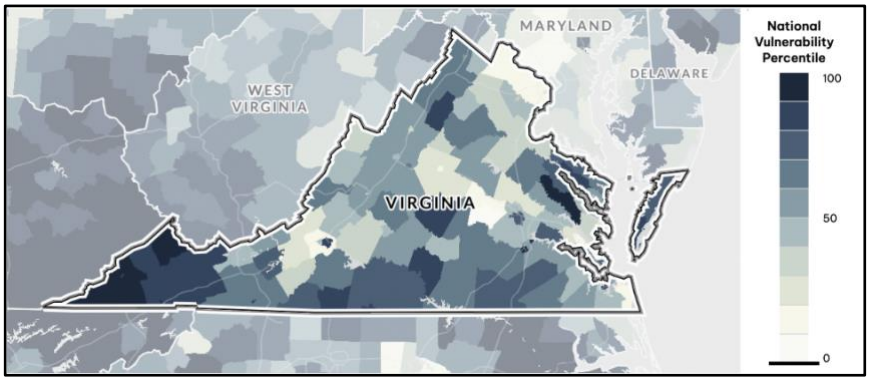
The literature on food insecurity demonstrates that the causes of food insecurity are complex and influenced by various factors such as income, disability, race, and ethnicity. These factors can make it

difficult for individuals to obtain the food they need to maintain a healthy diet. In rural areas specifically, accessibility to affordable and nutritious food can be further exacerbated by geographic conditions such as the physical access to food and lack of transportation.

Some areas, particularly rural towns, are known as food deserts because there are no fresh food retailers that carry nutritious and affordable food (USDA NIFA, 2022). Although local convenience stores provide the baseline caloric requirements, they often have higher prices, lower quality, and less variety than grocery stores. Residents are at higher risk for food insecurity in communities where the travel distance to stores is great, transportation options are limited, and there are fewer grocery stores. In Southwest Virginia, many residents live up to ten miles away from a supermarket (Abooali, 2022). Specifically, Grayson County has only 43.11% of its residential areas within a 10-minute drive of a food retailer, while Bland County's coverage is even lower at 29.32% (Abooali, 2022). This disparity means that residents in rural areas are more likely to have easy access to unhealthy, processed foods rather than fresh, nutritious alternatives. An individual's access to healthy food is also affected by lack of transportation, with food deserts characterized by long distances between residences and locations of nutritious food (Ploeg et al., 2009). People with chronic diseases or disabilities, minority racial groups, and residents of rural areas face a disproportionate lack of transportation to healthy food sources (D'Angelo et al., 2011; Losada-Rojas et al., 2021).

Climate is also a significant consideration when discussing food insecurity. A destabilized climate can exacerbate the severity of extreme weather events, worsening chronic diseases and intensifying socioeconomic stresses. Climate change can affect food availability, access, and utilization over time. Constrictions at any point can lead to food insecurity throughout the food system, including food production, transportation, and storage (Brown et al., 2015). Climate change in Virginia, with its effects on agricultural yields and water availability, poses a significant threat to a sustainable food system, impacting farmers' livelihoods and potentially leading to increased food insecurity in areas with vulnerable populations. In Southwest Virginia specifically, climate change poses a significant threat to food security by exacerbating existing challenges like poor infrastructure, geographic isolation, and loss of agriculture value. The U.S. Climate Vulnerability Index (CVI) is a tool that assesses an area's susceptibility to the impacts of climate change, considering factors like exposure, sensitivity, and adaptive capacity (Environmental Defense Fund, 2025). Developed by the Environmental Defense Fund, CVI has identified Southwest Virginia as facing some of the greatest challenges from climate change in the state (*see Figure 6*). Recognizing this vulnerability enables targeted resource allocation and policy development.

Figure 6: Climate Vulnerability in Virginia by County



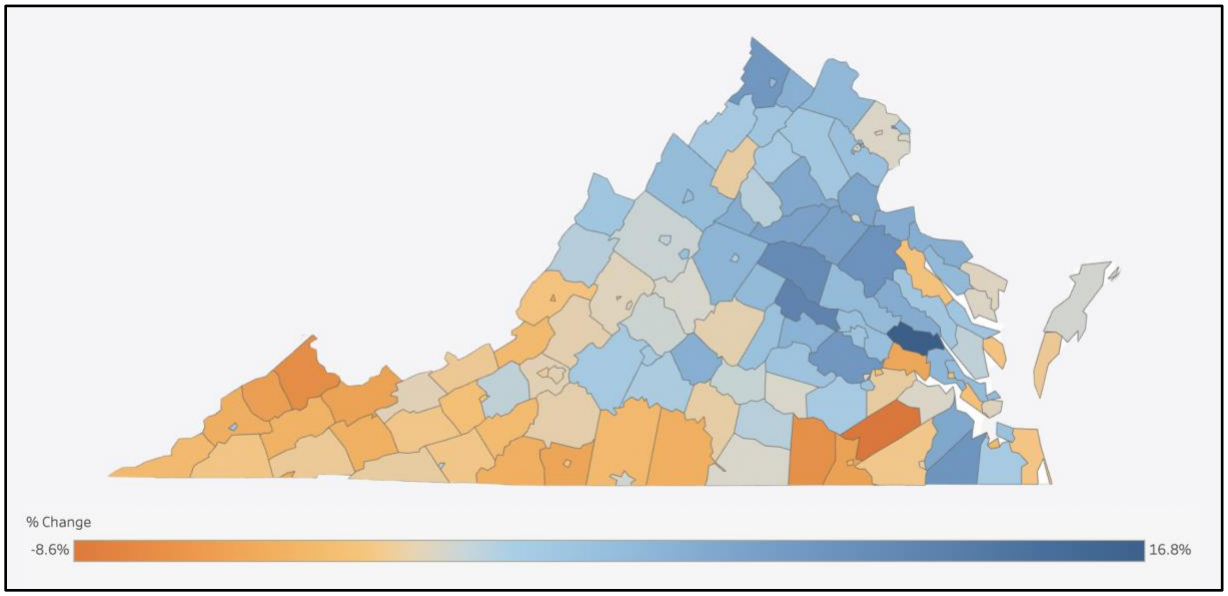
Source: Environmental Defense Fund. (2025). *Overall Climate Vulnerability in Virginia.* The U.S. Climate Vulnerability Index. https://map.climatevulnerabilityindex.org

Impact of Food Accessibility

Nutritious food accessibility is a leading determinant of individual health (National Alliance on Mental Health, 2024). Adults who are food insecure are at an increased risk for a variety of negative health outcomes and health disparities, including their physical and mental health (Hernandez et al., 2017). The USDA specifies that food insecurity is defined as the uncertain access to safe and *nutritious* foods.Thus, it is unsurprising that obesity and related chronic conditions are more prominent in Appalachia when compared with other areas of the United States (Trozzo et al., 2019). Fruit and vegetable (FV) consumption is associated with reduced risk for chronic disease and other positive health outcomes. However, most U.S. populations do not consume recommended amounts of FV (Hanson et al., 2022). Compared to urban residents, rural populations are 19% less likely to consume five or more daily servings of F&V (Lutfiyya et al., 2012).

Food insecurity does not just impact individuals but has broader implications for the Appalachian region as a whole. Rural depopulation, for example, is closely associated with food insecurity. The agricultural suitability of natural environmental and rural economic opportunities, together with adequate food access, are important driving forces of rural depopulation at local levels (Yu et al., 2022). Following prevailing levels of food insecurity in southwest Virginia, data from the 2020 Census reveals that the rural population declined 5% between 2010 and 2020 (Srygley et al., 2024; University of Virginia, 2024a). Depopulation has a variety of consequences for rural areas, including community marginalization, environmental degradation, and reduction of the local tax base. The region's social landscape is also shifting as there is a trend of out-migration of multigenerational residents in search of other economic opportunities (Trozzo et al., 2019).

Figure 7: Map of Population Estimates for Counties in Virginia, 2020 to 2024



Source: University of Virginia. (2024a). *Virginia Population Estimates.* Weldon Cooper Center for Public Service. https://coopercenter.org/virginia-population-estimates

Figure 8: Population Estimates for Southwest Virginia, 2020 to 2024

FIPS Code	County	2020 Census	Intercensal Estimate for July 1						
			2020	2021	2022	2023	2024	Total Change	Percent Change
	Virginia	**8,644,727**	**342,823**	**340,702**	**337,616**	**8,729,032**	**8,811,195**	**166,468**	**1.9%**
021	Bland	6,270	6,258	6,210	6,295	6,217	6,244	**-26**	**-0.4%**
027	Buchanan	20,355	20,280	19,982	19,434	19,191	19,056	**-1,299**	**-6.4%**
035	Carroll	29,155	29,088	28,819	28,809	28,848	28,772	**-383**	**-1.3%**
051	Dickenson	14,124	14,080	13,902	13,711	13,603	13,432	**-692**	**-4.9%**
077	Grayson	15,333	15,314	15,240	15,347	15,152	15,206	**-127**	**-0.8%**
105	Lee	22,173	22,162	22,116	21,699	21,955	21,610	**-563**	**-2.5%**
167	Russell	25,781	25,753	25,639	25,338	25,033	24,965	**-816**	**-3.2%**
169	Scott	21,576	21,568	21,534	21,309	21,304	21,274	**-302**	**-1.4%**
173	Smyth	29,800	29,745	29,523	29,025	28,963	28,790	**-1,010**	**-3.4%**
185	Tazewell	40,429	40,296	39,763	39,470	39,082	38,572	**-1,857**	**-4.6%**
191	Washington	53,935	53,964	54,079	53,723	53,608	53,369	**-566**	**-1.0%**
195	Wise	36,130	36,080	35,880	35,515	35,019	34,820	**-1,310**	**-3.6%**
197	Wythe	28,290	28,235	28,015	27,941	28,003	27,915	**-375**	**-1.3%**

Source: University of Virginia. (2024a). *Virginia Population Estimates.* Weldon Cooper Center for Public Service. https://coopercenter.org/virginia-population-estimates

Prevalence and Limitations of Food Access Nonprofits

In the last two decades, emergency food provision has become an increasingly institutionalized form of hunger relief (Wakefield et al., 2013). In 2021 alone, the U.S. government spent $182.5 billion on federal food programs (Schwartz & Caspi, 2023). A common solution to addressing food insecurity has included the federal Supplemental Nutrition Assistance Program (SNAP). The income eligibility for SNAP benefits is generally at or below 130% of the poverty line (Abooali, 2022). SNAP, however, is often not enough to alleviate the economic consequences caused by food insecurity due to its physical and cognitive implications (Sathe et al., 2021). For example, options for healthy food under SNAP are limited

throughout counties in Southwest Virginia. The county of Buchanan has 31 stores that accept SNAP, but only three of those stores sell meat, produce, and dairy (Scachetti, 2021).

While federal food programs are still integral to addressing food insecurity, nonprofit strategies have become increasingly important (Edwards, 2012; García-Dastugue et al., 2024; Mohan et al., 2013; Tometi & Wise, 2023). Despite the federal investment in food access, there are individuals who do not qualify for federal assistance or need additional help due to lack of resources. In Virginia, 48% of the food-insecure population are above the SNAP threshold and are ineligible for SNAP benefits (Feeding America, 2022). Where public assistance fails to meet community need, food aid services such as food banks, food hubs, community kitchens, and subsidized community markets have been established to confront the food security gap (Bazerghi et al., 2016).

While nonprofits have long been seen as a safety net for short-term crises, they are increasingly being used to tackle long-term deprivation. In 2021, an estimated 53 million people turned to a network of food banks and food pantries as part of the national charitable food system to obtain food at no cost (Schwartz & Caspi, 2023). The increase in utilization is problematic as nonprofits are not able to completely eradicate food insecurity, nor are they able to meet the nutritional requirements of those in need (Bazerghi et al., 2016; Webb, 2013; Wie & Giebler, 2013). Even where Appalachians are receiving assistance, populations remain food insecure because nutrition is subpar (Batey et al., 2023; Kerrick et al., 2023). Despite the nonprofit work against food insecurity, for example, the symptoms of inadequate access to nutritious food continue to plague residents of southwestern Virginia. Most prominently, the magnitude of the problem is substantial: the Appalachian region of Virginia is still home to an estimated 117,760 food insecure residents (Feeding America, 2022; Kerrick et al., 2023; Virginia Department of Health, 2022). In Southwest Virginia specifically, more than one in five residents are food insecure, a figure that has not decreased significantly in the past 10 years (Feeding America, 2022; Virginia Works, 2024). Given the growing demand of nonprofit institutions, there is a lot of room for improvement on the effectiveness of their food service programs.

Researched Interventions to Mitigate Food Insecurity and Poor Nutrition

Evidence surrounding the prevalence of food insecurity in the Appalachian region demonstrates the importance of nonprofit interventions. The literature is careful to examine the layered considerations that a project on food security and nutrition would need to incorporate in order to adequately address the underlying root causes. Food access programming cannot simply ensure food security, but must support the economic development of the region, the local food supply chain, the personal autonomy of Appalachian residents, and the historic culture of the southwestern Virginia region. In addition to creating and pursuing new solutions oriented around this issue, nonprofit organizations must also coordinate and manage any interdisciplinary actors that wish to participate in future programming. The complexity of food access work allows for a range of interventions at varying levels of influence. Emerging from the literature around food access, this section of the report will propose three potential programs that ASD may pursue to better promote food access and nutrition.

Cost-Offset Community-Supported Agriculture (CO-CSA)

Community-supported agriculture (CSA) is an alternative food marketing model where community members subscribe to receive regular shares of a farm's harvest. Although this direct-to-consumer (DTC) model could improve access to fresh produce in Appalachian communities, disparities in access and financial resources limit low-income household participation (Allen et al., 2017; Galt et al., 2017; Minaker et al., 2014; Vásquez et al., 2016; Wilkins et al., 2015). A cost-offset CSA (CO-CSA) model would provide low-income families with purchasing support (Jilcott Pitts et al., 2022). In a CO-CSA, low-income subscribers pay a portion of the cost. The remainder is subsidized by full-paying CSA members, tiered cost structures, fundraising, or SNAP benefits (SNAP/EBT) (Sitaker et al., 2021). The most commonly implemented CO-CSA cost structure is a sliding scale, typically offering produce at 50% of the cost, face value, or regular price with an additional donation. This model helps support low-income residents while also providing the broader community with access to a valuable source of nutritious food (Sitaker et al., 2021). In contrast to ASD's current Food Box program, the CO-CSA would foster local agricultural sustainability and resilience within the food system by depending entirely on regional producers and consumers, rather than external funding.

Farmers have recognized a market for affordable produce in rural and low-income areas. A national survey of CSA managers found that 14.4% of farms had cost-offset voucher programs for low-income households and 67.7% of these farms expressed interest in coordinating with other producers to adopt a similar program (Woods et al., 2017). While the financial benefits of the CO-CSA model for farmers have yet to be quantified, small-scale commercial farmers have turned to direct marketing as a niche that large-scale businesses cannot exploit (Andreatta et al., 2008). As a result, alternative food institutions emerged

as a way for the small-scale farmer to sell directly to the public and create a local agricultural food system. There is also clear evidence of demand for CO-CSAs. A 2022 survey across 10 micropolitan communities also found that households receiving SNAP had a notably high retention rate, with participants collecting their CO-CSA produce 75.8% of the time (Hanson et al., 2022). CO-CSA participation has been found to positively contribute to fruit and vegetable consumption (Hanson et al., 2017). Adult CSA members consume more fruits and vegetables than their non-CSA counterparts (J. N. Cohen et al., 2012; Miewald et al., 2012; Wilkins et al., 2015).

Yet single farms operating CO-CSAs may struggle to balance the demands of farming with CO-CSA administration. Nonprofit-operated CO-CSA programs are better positioned to address these challenges. Nonprofit CO-CSAs have organizational infrastructure and staff with expertise in fundraising and program management (Jilcott Pitts et al., 2022; Quandt, 2013; Sitaker, McCall, Belarmino, et al., 2020; Sitaker, McCall, Kolodinsky, et al., 2020; Woods et al., 2017). They have the bandwidth to develop community partnerships and may be sourced by multiple farms, serving a wider geographic area (Sitaker et al., 2021). CO-CSAs are a promising strategy for increasing both food access and farm revenues (Seguin-Fowler et al., 2020).

ASD could leverage a CO-CSA program to increase fresh produce consumption in rural areas. As an aggregator of regional produce, ASD could function as a food hub for local pick-up sites. Similar to its Food Box program, ASD will help aggregate year-round produce from pre-established local and regional partners. This would address food access, support local farmers, and provide affordable produce to rural communities.

Developing an Emergency Food Plan

The need for an adequate emergency food plan must also be considered. A study analyzing the nonprofit operational responses to the 2017 Oregon wildfires demonstrates the importance of disaster preparation (Chikoto-Schultz et al., 2018). Emergency food planning is an emerging field of study evolving from the growing understanding of the need to prepare for increased food insecurity due to emergency events.

Natural disasters often lead to a scarcity of local produce, requiring reliance on imports from other regions. The increased costs could make produce unattainable for low-income households and exacerbate food insufficiency. This refers to households “sometimes” or “often” not having enough to eat. Food insecurity includes food insufficiency, as well as a household’s access to a variety of quality foods (USDA ERS, 2024). Hurricane Helene, for example, uniquely affected rural communities and exacerbated food insecurity. Nearly 21% of households in rural areas heavily affected by hurricanes Helene and Milton reported not having enough food within the first seven days of the storm, according to

the November 2024 Consumer Food Insights Report (CFI) (Koppes, 2024). Fresh produce is often the most heavily requested item following a disaster (Sartwell, 2024). The research on food insecurity after disasters in the U.S. is still in its infancy and lacks empirical data on the outcomes of food insecurity and the response management. Yet qualitative data demonstrates the importance of establishing coalitions and resiliency to mitigate food insecurity (Hasnain et al., 2023).

Nonprofit organizations are able to provide key disaster recovery assistance and supplemental food access in rural locations. According to emergency preparation literature, ASD can prepare for disasters by creating and implementing a comprehensive response plan that discusses the logistic elements of distributing nutritious food to the food insecure (Eller et al., 2018; Gerber, 2010; Sapat et al., 2011). The emergency plan will not only outline best practices in the event of a crisis but will also account for the costs associated with mobilizing staff and leveraging a range of pre-existing resources such as box trucks and food boxes. This proactive approach ensures that ASD can efficiently distribute aid and assist communities in immediate need within its service area. By relying on its established infrastructure, ASD is well-positioned to provide timely and effective support during times of emergency, reinforcing its role as a vital resource in the region. Performance measures such as sustaining/increasing the servings of fresh produce consumed in Southwest Virginia would be recorded to improve the efficiency of relief operations, increasing the accountability of crisis response (Balcik et al., 2010; Beamon & Balcik, 2008; Mohan et al., 2013).

Nutrition Education

Nutrition education programs have emerged in food access literature. Food literacy is built through knowledge empowerment, skills building, and cultural sensitivity (Doustmohammadian et al., 2022; West et al., 2020). Previous research has identified strategies for delivering nutrition information to Appalachian residents. Materials encouraging traditional food choices, for example, have seen success (Gutschall et al., 2018; Schoenberg et al., 2013). Individuals are empowered to utilize local resources to make healthier food choices by receiving guidance on budgeting, meal planning, and the nutritional value of foods (Farrell et al., 2018; Gary et al., 2024). Community-based interventions are a strong motivator for dietary behavioral change and an effective way to improve nutrition (Gutschall et al., 2018; Marchetti et al., 2015; Schoenberg et al., 2013). Nutritional interventions improve access and food utilization, increasing the amount of produce consumed by Appalachian residents and demonstrating improvements in food security status (West et al., 2020).

A nutrition education program implemented by ASD will primarily target low-income households in Southwest Virginia. While various techniques have been leveraged by ASD to mitigate long-term food

insecurity, it could further enhance its impact on food access by leveraging its unique position as a key community member to inform residents about available nutritious food options. Currently, ASD's focus is on its internal programming, which limits its ability to serve a wider population. By developing a nutrition mapping tool, however, ASD could expand access to healthy food resources, better serve local residents, and strengthen community partnerships. The nutrition education pursued by ASD will therefore include a map of fresh food locations. Modeled after those utilized by Feeding Southwest Virginia and the Fredericksburg Regional Food Bank, a nutrition map program would visually connect communities with nearby sources of healthy food, such as farmers' markets, food hubs, and community gardens (Feeding Southwest Virginia, 2023; Fredericksburg Regional Food Bank, 2024). By mapping these resources, the program would help residents identify accessible locations while providing educational materials. This resource could also identify the intra-agency shortfall between food needs and meals distributed.

Ultimately, anti-hunger programs across Virginia have been unable to sufficiently organize together against the problem of food insecurity. No holistic map exists that includes sufficient information on food banks, as well as fresh produce or farmers markets across the state. With the understanding that populations remain food insecure because nutrition is subpar, the channels that currently exist to expose food insecure populations to their next meal are doing an insufficient job at providing these families with the proper resources. By expanding its nutrition education to include a mapping resource, ASD could help alleviate this state-wide gap in information.

Criteria for Evaluation

This report presents three policy alternatives and evaluates each using the following set of criteria. The goal is to emphasize the strengths of each policy option in order to assess their effectiveness in mitigating food insecurity in Southwest Virginia.

Cost

The cost criterion is defined as the financial cost to ASD in implementing each alternative. This is a quantitative metric that will demonstrate the dollar amount necessary to fund a given program. The following will be considered:

> Capital costs: One-time expenses required. This includes infrastructure, equipment, and technology (e.g., new box truck, new assembly line for boxing produce)
> Operational costs: Costs associated with the daily operations (e.g., staff salaries, food boxes, website domain fees).

The final cost of each alternative will be recorded in isolation and as a proportion of the operational budget of ASD.

Effectiveness

The effectiveness criterion will evaluate both short-term and long-term policy outcomes. Priority is given to short-term effectiveness as a standardizing metric across the three alternatives. Short term policy's effectiveness will be measured by its quantitative ability to increase the number of servings of fresh produce consumed by Southwest Virginia residents during program implementation. Health experts recommend that individuals consume at least five servings of fruits and vegetables daily (Godman, 2021). Therefore, a program is considered effective if it can increase FV servings to align more closely with this recommended benchmark. This will represent a program's ability to provide immediate healthy food access. Where data is available, the long-term effectiveness will also be assessed by a program's impact on reducing the number of food insecure individuals in southwestern Virginia. This metric, as provided annually by the U.S. Census and American Community Survey (ACS), will illustrate whether a program leads to sustainable improvements in food access and nutritional health (Kerrick et al., 2023). The criterion focuses on whether the policy can achieve both immediate and lasting benefits for rural communities.

Feasibility

Feasibility is a qualitative criterion used to assess the practicality, ease, and sustainability of the proposed alternatives. Organizational feasibility considers administrative resources, capacity, funding, and other

internal processes necessary for a successful implementation. Public feasibility considers community demand and engagement, local infrastructure, cultural norms, and other social factors embedded in successful implementation. Feasibility will help ASD evaluate how viable each alternative is within the constraints of nonprofit work and Appalachian society. This criterion will be measured on a scale of low, medium, or high.

Equity

Equity is another qualitative measure that will examine fairness and justice in the distribution of policy alternatives. The criterion will be evaluated across three different considerations. First, it will determine how each policy distributes benefits and burdens across populations. It will also consider the policy's impact on the local economy, ensuring that economic benefits from each alternative are distributed equitably across communities in Southwest Virginia. Finally, it will assess how each policy promotes environmental sustainability and addresses climate challenges in a way that is fair to all stakeholders, particularly those who may be disproportionately affected by environmental issues.

Evaluation of Alternatives

Many western Virginia residents lack access to nutritious food. This report aims to propose, analyze, and evaluate intervention options that address food insecurity in southwestern Virginia. The following section utilizes four criteria to evaluate the proposed policy alternatives: cost, effectiveness, feasibility, and equity. Each alternative section presents a description and evaluation of the proposed alternative using the standardized criteria. The analysis explores tradeoffs, advantages, and disadvantages through a direct comparison of the CO-CSA, Emergency Food Plan, and Nutrition Mapping programs in an outcomes matrix. The final section concludes with a recommendation and considerations for implementation.

Cost-Offset Community-Supported Agriculture (CO-CSA)

Cost

Expenses associated with CO-CSA implementation are broken into considerations of program and participant cost during a single year of program implementation. The expenses reflect the burden of resources that programmers may expect to bear: salaries and wages, equipment, supplies, and travel. The direct expenses and opportunity costs borne by participants taking part in the intervention will then be added to the costs from the program implementation costs for a more broad illustration of total cost (Garner et al., 2023; Sitaker, McCall, Belarmino, et al., 2020). See the report appendix for cost details across all alternatives.

Direct participant expenses included half the price of the CSA share and travel-related costs incurred for CSA pick-up. The roundtrip mileage was multiplied by the 2025 government mileage reimbursement rate of $0.70 (Internal Revenue Service, 2025). Time was valued according to the average applicable state-level minimum wage rate for 2025 of $12.41 (Clausing, 2024). The average hours participants are anticipated to spend in intervention-related activities over the course of the program season are multiplied by this rate to estimate the opportunity cost of intervention participation. Participant costs per season totaled $1,912 per household, inclusive of expenses associated with the 50%-subsidized CSA share, travel to and from CSA pick-up sites, and the opportunity cost of time spent in intervention-related activities. Participant expenses for the subsidized CSA share averaged $936 per household per season. Participant expenses related to the CO-CSA share were estimated based on the market price of a food box ($36, per internal documentation) assembled at ASD's Food Hub subsidized at a rate of 50% multiplied by the portion of weeks participants are eligible to pick up their share (Garner et al., 2023). Participant travel expenses will likely average approximately $546 in CSA-related travel. The opportunity cost of participants' time was estimated at approximately $430 per season, assuming the average time spent traveling to and from CSA pick-up was 30 min and median time spent at the pick-up site was 10 min for a total time cost per trip of 40 min (Garner et al., 2023).

The total annual program expenses associated with salaries, wages and benefits was $74,920, including half the salary paid for an ASD site coordinator and the wage of box packing staff. Only half of the site coordinator's salary was included to account for the portion of their responsibilities that fall outside of program implementation and thus not relevant to this analysis. Equipment, supply, and travel costs of assembling and distributing food boxes is estimated to total $54,821 per internal organizational documentation. This included half the price of each participant's CSA share; costs associated with picking up produce; and a one-time expense associated with stocking sites with necessary implementation equipment. Overall program expenses were estimated at $129,741 annually, or about $2,595 per household. In total, program implementation will cost approx. $4,507 per household annually ($2,595 in implementation-related expenses and $1,912 in participant-incurred costs).

Effectiveness

CSA participation has been linked to increased fruit and vegetable (FV) intake and other positive behavioral and health outcomes (Allen et al., 2017; Berkowitz et al., 2019; Minaker et al., 2014; Vásquez et al., 2016). In a peer reviewed study, Allen et al. (2017) distributed detailed surveys to existing shareholders of CO-CSA participants in rural Kentucky to gauge participation impact. The researchers found that CSA participants reported a decrease in eating at restaurants, less processed food intake while in the car, eating healthier foods, and increased FV intake. Before participating in the CSA, the mean self-reported FV intake was 4.55 servings per day. After, the mean intake was 7.22 servings (Allen et al., 2017). In a separate study, CSA participants reported that after joining a CSA, there were more vegetables present in the household, more frequent family meals, and increased FV intake (Jilcott Pitts et al., 2022; Vásquez et al., 2016).

Long term effectiveness is also significant. Using data from a randomized controlled trial conducted across New York, North Carolina, Vermont, and Washington, Garner et al. (2023) estimated programmatic and participant costs and calculated cost-effectiveness ratios for participant daily fruit and vegetable (FV) intake. For health-related outcomes there was an 18% point increase in the portion of food secure households following the CO-CSA researched interventions. For a sample composed of 100 households, for example, this net change in household food security represents 18 households shifting from food insecure to food secure (Garner et al., 2023).

Feasibility

Organizational feasibility is *high*. Research highlights the challenges faced by single farms in balancing farming demands with CSA program administration, suggesting that nonprofit models with dedicated infrastructure are more effective. ASD has the advantage of such organizational infrastructure (N. Cohen

& Derryck, 2011; Woods et al., 2017). Further, ASD currently operates a food hub sourced by multiple farms, thereby allowing the program to serve a wider geographic area (Sitaker et al., 2021). ASD benefits from a well-established organizational infrastructure that gives it a strong foundation for expanding its initiatives. The success of its current free Food Box program demonstrates the organization's capability to manage logistics, coordinate distribution, and serve the community efficiently. This established framework can be leveraged during a transition to a CO-CSA model as the procedures for sourcing, packing, and distributing food would be directly adaptable. By replicating these processes, ASD can ensure continuity and minimize the challenges typically associated with launching a new program. Additionally, ASD's experience with community engagement, resource management, and partnerships further enhances its ability to effectively implement a CO-CSA model, thereby extending access to healthy, locally grown produce to even more residents in need.

Community feasibility is *Medium*. A similar packaging and distribution system to the current food box program will lead to sufficient public uptake and retention considering the current demonstrated community demand and engagement (White et al., 2018). According to internal documentation, there is currently a waitlist for the food boxes being donated. However, it's important to note that these boxes are provided at no cost to consumers. While the CO-CSA model helps ensure that nutritious resources are being extended, it's likely that the demand for these boxes may not be as prevalent when free options are available. The CO-CSA will also need to address and counteract a cultural dependency on less-nutritious, more convenient foods (Hoogland et al., 2019). This will require significant effort in education, community outreach, and ensuring that nutritious food options are both affordable and accessible in the long term.

Equity

For the CO-CSA alternative, equity is *high*. The CO-CSA model removes access barriers to locally grown produce and increases fruit and vegetable consumption among low-income adults (Berkowitz et al., 2019; Quandt, 2013; Seguin-Fowler et al., 2020). Augmenting vegetable preferences and increasing consumer willingness to vary vegetable intake seasonally supports local food production, improving nutrition while increasing local food system sustainability (Landis et al., 2010; Wilkins et al., 2015). ASD currently purchases food from 40 local farmers to support their Appalachian Harvest Food Boxes program, a number that has the potential to grow with the added purchasing support from a CO-CSA (ASD, 2024a). CO-CSAs have the potential to tap into a new market segment, thus expanding CSA farms' customer base at a time when DTC growth has plateaued (Low & Vogel, 2011; Sitaker et al., 2019; Sitaker, McCall, Kolodinsky, et al., 2020).

Emergency Food Plan

Cost

Implementing an emergency food plan includes food procurement, storage, and administrative expenses. Understanding these costs is crucial for effective resource allocation (Meyer-Emerick & Momen, 2003). Developing an emergency response plan primarily involves staff time. While studies on this scenario are limited, one can infer costs based on related roles. For instance, the average annual salary and fringes for a supervisory role at ASD is around $50,000, equating to about $24 per hour (ASD, 2025). Therefore, dedicating 4 weeks to developing a plan would cost $3,840. One should also consider the annual opportunity cost of reviewing the emergency plan. Updating emergency response plans regularly is crucial for effective crisis response. At the predetermined rate specified, spending a single workday on reviewing the plan would cost around $192.

The implementation of an emergency food access relief program can be adapted to address various factors. However, ASD's unique position as a food hub will likely focus the plan on a distribution of tangible goods. Relief efforts will focus on ensuring there are sufficient resources to mobilize and distribute food boxes to community partners in Southwest Virginia. Given ASD's current capacity, the emergency food supply plan is designed to provide emergency food boxes for up to 300 individuals in need per week. This plan acknowledges the unpredictability and variability of emergency relief aid from state and federal sources, and as such, it focuses on ASD's ability to independently mobilize and respond to crises within its service area. The approach ensures that ASD can remain agile and self-sufficient in times of emergency, regardless of external circumstances or delays in outside aid. To minimize disruption and strain on the supply chain, the plan will utilize 300 pre-assembled food boxes per week from ASD's existing Food Box initiative, which are typically distributed from the Food Hub in Duffield. By repurposing these boxes, ASD can efficiently redistribute resources to affected areas without significant delays. This strategy ensures that critical food assistance is available during emergencies.

Implementing this emergency response will likely result in significant expenses as this plan must account not only for the cost of the boxes themselves, but labor and transportation costs. Accounting for these factors, implementing one week of food box assistance in an emergency situation will cost approximately $13,530. Costs will vary with the frequency of donation based on the severity of the natural disaster (*see Appendix*). Considering both program creation and implementation, the cost of an Emergency Food Plan can cost as little as $17,370 for 1 week of aid or as much as $179,730 for 3 months of aid.

Effectiveness

In a natural disaster, supply chains are affected and produce is cut off from rural communities. Food deserts expand and there is often little local agricultural infrastructure in place to sustain communities. A food box intervention would increase total fruit and vegetable consumption frequency in a crisis, especially when compared to those without access to such a distribution program (Miewald et al., 2012; Vasold, 2024). Research on emergency disaster response indicates that one of the most significant barriers to food access after a disaster is the distance to fresh produce. Studies have shown that interventions designed to reduce this distance such as delivering food aid directly to affected communities can significantly increase the intake of fruits and vegetables (Mark et al., 2025; Ploeg et al., 2009). In fact, research demonstrates that even a small reduction in the driving distance to the nearest FV store can have a substantial impact on consumption. For example, reducing the distance by just one mile could result in an 8.9% increase in FV intake, equivalent to an additional 2.178 servings or 174.24 grams of fruits and vegetables per person (Katapodis et al., 2019). This highlights the critical role that proximity to fresh food sources plays in improving dietary habits, especially during emergencies when access to resources is already limited. By addressing this logistical barrier, interventions can help ensure that affected populations maintain healthier, more balanced diets even in times of crisis.

Long term effectiveness can be accounted for anecdotally. While an emergency food plan provides immediate relief to Southwest Virginia, it is unlikely to impact the overall number of food-insecure individuals. Food security requires consistent, reliable access to nutritious meals over an extended period. Emergency food distributions do not address the root causes of food insecurity. The emergency food plan will ultimately not provide the lasting impact needed to significantly reduce food insecurity in the region (Durao et al., 2020; UN FAO, 2024).

Feasibility

Organizational feasibility is *low.* ASD currently works with about 40 partners, consisting of food pantries and civic organizations throughout Southwest Virginia, all of which may be leveraged to serve emergency food in this region (ASD, 2024a). Existing networks are vital to future collaboration in terms of the provision of information, resource and expertise sharing, and compensation for organizational and sector shortcomings. Additionally, ASD has the institutional capacity to collect produce from providers up to 400 miles away, accounting for any impact disasters may have on the local agricultural supply (ASD, 2024a). However, it is important to recognize that this program may conflict with ASD's original mission to prioritize and serve its immediate community. As outlined earlier, the emergency food plan is based on redistributing existing resources to ensure sustainability and support during emergencies even in the absence of external aid. While this approach allows ASD to respond to crises, it also creates a challenge

in balancing local needs with the demands of a crisis response. The feasibility of meeting both needs may improve over time with an expansion of resources and infrastructure, but the current capacity remains limited. Therefore, while the program is valuable, its effectiveness is constrained by the availability of resources and the inherent challenge of serving multiple communities with limited supply.

Community engagement is assumed to be *high* following a natural disaster. However, the level of community engagement can vary depending on several factors, including the severity of the disaster and the pre-existing relationships within the community. While community involvement is typically strong, sustained engagement requires continuous effort, coordination, and resources to maintain momentum and ensure that individuals and groups are effectively supported over the long term.

Equity

Equity is *high*. The food distribution program specifically supports disadvantaged populations. These communities often face the compounded challenges of geographic isolation and economic hardship, which are exacerbated during crises. By targeting at-risk groups, the program mitigates food insecurity during a critical period. This approach supports local businesses and ensures the region's agricultural sector is able to recover and continue thriving post-disaster. The program provides immediate relief and also contributes to long-term rebuilding efforts for the Appalachian region, promoting both social equity and economic sustainability (Meyer et al., 2023).

Nutrition Education Mapping

Cost

One common tool is ArcGIS, which is utilized by professional organizations like the USDA to display geographic data (Feeding America, 2021; USDA, 2025). ArcGIS can range from $500 per year for individual users to $4,200 annually for enterprise-level use (ESRI, 2025). Due to the professional nature of this project and the scope of geographic data utilized, ASD will likely need the enterprise-level software cost. The initial development of a geographic map of fresh food locations may take weeks. If ASD staff dedicate 5 weeks to executing this mapping project, the cost would be around $4,800 for an executive individual making approximately $50,000 (ASD, 2025). Additionally, development and ongoing maintenance of the website will be a responsibility of ASD. Checking the website every month to ensure that the data is accurate is crucial for maintaining the reliability of the website. With this in mind, routine development on the mapping website would likely cost $2,304 a year.

Effectiveness

Food mapping improves access to, and engagement with, local produce. Research shows that participatory mapping and related community-based interventions can indirectly increase the consumption

of fresh produce (Downs et al., 2024). Participatory mapping involves community members in identifying local food access points, leading to a more accurate understanding of food environments. This process empowers communities to advocate for improvements and ensures that interventions are tailored to their specific needs. Additionally, education resources are influenced not only by actual access to food but also by how these interventions shape individuals' perceptions of the food environment. When the availability of food resources is made more salient this can positively impact their perceptions of food security. Research has shown that improving the perception of food accessibility can lead to increased fruit and vegetable (FV) consumption. For instance, a one standard deviation increase in the food environment perception score, which reflects a more favorable view of food availability, is linked to a 6.02 g increase in FV intake (Menezes et al., 2018). While the impact of this intervention may appear smaller compared to other alternatives, it is still important to recognize that enhancing knowledge and awareness about food resources can have a measurable effect on fresh produce consumption.

While there is a lack of evidence demonstrating the long-term mitigation of food insecurity, the long-term considerations of this program will still be considered. Food mapping helps identify areas with limited access to nutritious food and highlights the locations of food sources like grocery stores. This information can help direct resources and interventions to areas most in need, improving access to fresh food. However, while food mapping is an effective tool for enhancing food access, it represents only one component of a broader solution. To meaningfully reduce food insecurity in southwestern Virginia, it must be integrated with other comprehensive, long-term strategies. These should include efforts to enhance economic opportunities, address transportation barriers, and ensure the resilience of the local food supply. Without such initiatives, the impact of food mapping will be limited, and broader structural issues will remain unaddressed.

Feasibility

Organizational feasibility is *medium*. While participatory mapping can be time-and resource-intensive, the benefits it offers are substantial. Participatory mapping actively involves community members in the process of identifying and understanding food access challenges. This approach fosters greater community engagement, leading to a sense of ownership over the developed solutions (Corbett, 2009). Organizational feasibility is medium, however, because ASD staff will need to undergo training to familiarize themselves with an unfamiliar technological system. This may involve learning how to navigate ArcGIS's interface and understand its functionality.

Community feasibility is *medium*. One of the key advantages of this technique is the ability to overlap multiple layers of geocoded information, such as locations with Kosher/Halal options, to create maps

showing the spatial outlay of features of interest. Mapping techniques that incorporate community participation are particularly relevant for capturing lived environment realities (Downs et al., 2024; Muzenda et al., 2022; Shannon et al., 2021). However, it is crucial to address the challenges related to the visibility and utilization of this online mapping tool. While no holistic nutrition mapping resource exists in Virginia, there are other similar resources available. To ensure the success of ASD, it will be essential to conduct robust outreach and marketing efforts, both within the community and among potential partners. Effective communication and engagement strategies, such as embedding the map on ASD's website and social media platforms, will be needed to raise awareness about the tool and encourage its adoption.

Equity

Equity is *high*. Participatory mapping generates local knowledge that increases people's awareness regarding where food comes from and how it is distributed. Food Mapping strengthens and establishes new social and economic links between different components of the food web. It can highlight land use (fruit trees, community gardens, etc.) and identify the possibilities for current and future projects. It can also locate food deserts and highlight the supports and barriers to healthy food availability. Food mapping creates transparent, abundant data that can show relationships between community organizations, businesses, and farmers.

Recommendation

From an analysis of the various program alternatives, this report submits the CO-CSA alternative as its final recommendation. A CO-CSA program is recommended as the best course of action for ASD moving forward. CO-CSA has the clearest strengths in effectively reducing food insecurity, as well as positive considerations for organizational feasibility and equity. However, all other recommendations rank marginally close in terms of feasibility and have different implications for program effectiveness. As a result, ASD could consider these programs as supplemental interventions or stand-alone options if they are faced with a more constrained budget.

	Alternative #1: Cost-Offset Community-Supported Agriculture (CO-CSA)	Alternative #2: Developing an Emergency Food Plan	Alternative #3: Nutrition Education Mapping
Effectiveness	Average increase in **213.6g FV intake** or **2.67 FV** servings after CO-CSA participation (Allen et al., 2017) **18% point increase** in the portion of food secure households following similarly researched interventions (Garner et al., 2023)	One-mile decrease in driving distance to the nearest FV store could lead to an **8.9% increase in FV consumption (2.178 servings or 174.24g)** (Katapodis et al., 2019)	One standard deviation increase in food environment perception score (indicating better availability) is associated with a **6.02 g higher FV intake** (Menezes et al., 2018)
Cost	Total Annual Program Cost for ASD **$129,741** Participant cost per CO- CSA household **$1,912**	Program Cost for 1 Week **$17,370** (+$192 annually) Program Cost for 3 Months **$179,730** (+$192 annually)	**$4,800** (+6,504 annually)
Feasibility	Organizational: High Community: Medium	Organizational: Low Community: High	Organizational: Medium Community: Medium
Equity	High	High	High

Implementation of Cost-Offset Community-Supported Agriculture (CO-CSA) Program

Given disparities in diet quality and higher incidence of diet-related diseases among lower-income groups, enhancing CSA participation among individuals with lower incomes may offer an effective strategy for increasing the quantity and variety of vegetables they consume. In a CO-CSA, low-income subscribers pay a portion of the cost in installments throughout the harvest season while the remainder of the shares are subsidized for low-income households. The food hub may continue to sell through wholesale channels and raise funds to buy farmers' leftover end-of-season crops for donation to food pantries while operating the CO-CSA (Sitaker et al., 2021). ASD should extend its capacity for food boxes to encompass a CO-CSA, functioning as a food hub that aggregates food from multiple independent farms and then delivers CO-CSA shares at a pick-up site.

A recent environmental scan of CO-CSA programs throughout the USA found that the sliding scale was the most widely used funding mechanism (Jilcott Pitts et al., 2022). For ease of implementation and logistical management, funding for the off-set cost will be operated by ASD. Subsidized CSA shares will be reduced to 50% of the original box price, while other community members will have the option to purchase a share at face value or purchase a share with an added donation. Most nonprofits have instituted formal eligibility criteria for CO-CSA membership, such as current participation in SNAP-EBT or self-reported income at or below 185% of the federal poverty level (Sitaker et al., 2021).

Because the traditional lump sum payment structure of CSA can be a deterrent for low-income families, ASD should use a weekly or biweekly payment structure. Further accommodation such as the option for a monthly payment may be necessary to further facilitate CSA membership and consider monthly exhaustion of SNAP benefits (White et al., 2018).

Participating in a community supported agriculture (CSA) share is one way for individuals with low income to use their Supplemental Nutrition Assistance Program (SNAP) benefits in buying local, seasonal fruits and vegetables. The USDA's Food and Nutrition Service authorizes businesses to accept SNAP benefits, including direct marketing farmers and nonprofit food buying cooperatives operating a CSA (Hall & McCann, 2021). SNAP benefits may not be used to pay any administrative, delivery, or membership fees, nor taxes or down payments associated with operating your CSA. Your CSA can participate in Double Up Food Bucks (Double Up), a nutrition incentive program helping SNAP participants purchase more fruits and vegetables with their SNAP benefits. Double Up works by matching SNAP benefits dollar-for-dollar, up to a specific amount, such as $10 or $20 (Hall & McCann, 2021).

To minimize logistical costs for this new program, implementation would likely center around a single location at ASD's Appalachian Harvest Food Hub in Duffield, VA. Preselected produce and pre-packed boxes improve ease of transport and efficiency at pick-up. While this would effectively serve the local population, the small service radius would restrict participation to individuals living within a limited geographic area. Additionally, ASD's centrally-located warehouse is still more convenient to local consumers in a food desert than traditional grocery stores.

Lack of awareness is one of the barriers to joining a CSA (Howard & Goodrum, n.d.). ASD has extensive local connections in the southwestern Virginia region and should leverage these partnerships in advertising the acceptance of SNAP benefits at the CSA through community-based organizations, such as food pantries, churches, libraries, neighborhood groups, community health clinics, and after-school programs. ASD should also expand its social media and local news outreach efforts as an affordable communication tool to raise awareness of your SNAP and Double Up incentive programs. In addition to

leveraging more formal channels of outreach ASD currently uses, ASD can encourage a word-of-mouth by notifying their current and former foodbox recipients (an approach of which is often the most effective and widely used outreach strategy in rural communities).

Word Count: 8362

Appendix

Cost Calculation for CO-CSA

Cost Categories	Calculation	Research Estimate
Program Expenses		
Salaries, Wages, and Benefits	Supervisor: $50k/year inclusive of fringe benefits, 50% Packing staff: 4 people x 16 hours/week @ $15/hr	**$74,920**
Equipment, Supplies, and Travel	Original $36 price of CSA share derived from the current cost of food boxes currently distributed by ASD. Price of year-round CSA share not paid: $46,800; $18/week on average across sites for a season length of 52 weeks, multiplied by conservative estimate of 50 households per season. Number of households derived from CO-CSA models adopted in rural localities (Sitaker et al., 2021) Delivery and equipment cost pulled from ASD internal documentation, adapted from current Food Box program operational costs. Produce delivery: $7,221 Equipment cost: $800	**$54,821**
Program Expenses – Total, Annually		**$129,741**
Program Expenses – Per Household	50 household estimate	**~ $2,595**
Participant Costs		
Subsidized CSA Share	$36 ASD food box subsidized at 50% per week multiplied by 52 weeks	**$936**
Participant Travel	Gov. reimbursement of $0.7/mile Lower bound of 5 miles, upward bound of 30 miles for CSA program (round trip); average of 15 miles. 52 weeks	$182 - $1,092 Av. 15: **$546**
Opportunity Cost	VA minimum wage rate of $12.41/hr Assumes the average time spent traveling to and from CSA pick-up was 30 min and median time spent at the pick-up site was 10 min for a total time cost per trip of 40 min (Garner et al., 2023).	**~ $430**
Participant Cost – Per Household		**~ $1,912**
Total "All-In" Costs – Per Household		**~ $4,507**
Total "All-In" Costs		**~ $225,341**

*Pricing information pulled from internal organizational budgeting documents.

Cost Calculation for Devising Emergency Plan

Cost Categories	**Calculation**	**Research Estimate**
Internal Plan Development Costs		
Supervisory Role	$50k/year, ~ $24 per hour 4 weeks of planning	~ $3,840
Annual Review of Plan	8hrs @ ~ $24 per hour	~ $192/year
Total		$3,840 (+$192 annually)
Emergency Aid Costs		
Food Box Contents	@ ~ $36/box	~ $10,800
Boxes	@ ~ $2.50/box	~ $750
Misc supplies for packing boxes (anti-fatigue mats, brooms, squeegees, new packing tables)	~ $800	~ $800
Travel		
Gas	1 delivery trip to centralized emergency response location, radius of 55mi approximately serving the SWVA area, mileage charged @ .655/mile	~ $100
Labor		
Truck Driver	8hr day @ $15/hr	~ $120
Packing	Packaging is a standardized process conducted at the ASD Food Hub. Deliveries are produced every week, therefore ASD warehouse employees are given a week to prepare for need. 4 people x 16 hours/week @ $15/hr	~ $960
Total Emergency Aid Cost (1 week)		$13,530
Total Emergency Aid Cost (3 months)	$13,530 x ~13 weeks	$175,890
Total Costs (1 week)		$17,370 (+$192 annually)
Total Costs (3 months)		$179,730 (+$192 annually)

*Scaling these calculations can be completed depending on the severity of the emergency.

Cost Calculation for Nutrition Mapping

Cost Categories	**Calculation**	**Research Estimate**
ASD Staff	$50k/year, ~ $24 per hour 5 weeks of planning 7 days/week, 8 hrs/day	~ $4,800
Mapping Platform (e.g. ArcGIS)	$500 - 4,200	$4,200
Monthly Review of Website	8 hrs/day 1 day/month 12 months/year ~ $24 per hour	~ $2,304
Total		$4,800 (+6,504 annually)

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