ABSTRACT

Food insecurity describes a “…lack of access to adequate food [caused by] a lack of money and other resources.” In Baltimore City, the food insecurity rate is 21.3 percent. This figure is two to three times more severe than in any of its surrounding counties and is nearly double the national average of 11.1 percent. The effects of food insecurity include increases in chronic disease, premature and preventable death, poor physical and mental health, vastly inflated healthcare costs, developmental problems, and disproportionately negative outcomes for racial and ethnic minorities. This paper explores the causes of food insecurity, the successes and failures of past interventions, and presents a solution to the problem: the formation of Urban Oases – a nonprofit harnessing the power of aquaponics technology to reduce and end food insecurity in Baltimore City. This policy proposal is thereafter evaluated for its effectiveness, costs, and benefits. Through this evaluation, it is demonstrated that this proposal’s benefits outweigh its costs. The paper concludes by recommending to Governor Larry Hogan that Urban Oases and its aquaponics technology be used to address the issue of food insecurity in Baltimore City.

Advised by Paul Weinstein.
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Disclaimer: This capstone thesis was prepared by Steven Kambouris in his personal capacity. The opinions and language expressed herein are the author’s own and do not reflect the official position of Johns Hopkins University or any other organization.
MEMORANDUM FOR MARYLAND GOVERNOR LARRY HOGAN

DATE: SEPTEMBER 10th, 2019

FROM: STEVEN KAMBOURIS

SUBJECT: THE BALTIMORE FOOD SECURITY EMPOWERMENT PROGRAM

I. **Action-forcing Event**

The Supplemental Nutrition Assistance Program (SNAP) provides critical food assistance to over 40 million families, 166,000 of which reside in Baltimore. Mayor Young of Baltimore City recently stated that the Trump administration’s efforts to tighten eligibility requirements for SNAP recipients would hurt thousands of Baltimoreans who rely on it. Johns Hopkins University further notes that 146,077 Baltimore residents – approximately 23.6% of its population – are living in “healthy food priority areas” (formerly known as “food deserts”). The net results of this dynamic are precarious governmental dependence and food insecurity, with the latter increasing the probability of “poor overall health, hospitalizations, and developmental problems…” in children.

II. **Statement of the Problem**

Food insecurity describes a household experiencing a “…lack of access to adequate food [caused by] a lack of money and other resources.” In Baltimore City, the food insecurity rate is 21.3 percent. This figure is two to three times more severe than in any of its surrounding counties (see Figure 1 below), while being nearly double the national average of 11.1 percent.

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Figure 1: Baltimore City Food Insecurity Statistics

Though exact figures cannot be estimated, the literature on food insecurity indicates that it drives chronic disease, premature and preventable death, poor physical and mental health, vastly inflated healthcare costs, and results in disproportionately negative outcomes for racial and ethnic minorities.

While literature on food security may differ on its finer points, some demographic trends are clear. Food Insecurity is most common in, “...households headed by an African American, Hispanic, a never married person, a divorced or separated person, a renter, younger persons, and less educated persons”\textsuperscript{10}. Additionally, “...households with children are more likely to be food

\textsuperscript{6} Onis and Branca. 2016. “Childhood Stunting: A Global Perspective.”
\textsuperscript{7} Gundersen, Kreider, and Pepper. 2011. “The Economics of Food Insecurity in the United States.”
\textsuperscript{9} Gundersen and Seligman. 2017. “Food Insecurity and Health Outcomes.”
insecure than households without children.”9 Reflecting on the above facts, Baltimore City is 62.8 percent African American11, has a single adult rate of 70 percent (the highest rate in MD)11, a single parent household rate of 64.8 percent 11, has more renters (52.5 percent) than homeowners12, and is plagued by chronic underperformance in education13. Baltimore city ranks last among other Maryland school districts13 and sees 47.2 percent of its adults with a high school degree or less11, nearly 30 percent of its families living below the federal poverty line11, and approximately 1/3 of its residents making less than $25,000 annually11.

**Figure 2: Baltimore City Demographic Rates**

<table>
<thead>
<tr>
<th>Race/Ethnicity</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black or African American</td>
<td>62.8%</td>
</tr>
<tr>
<td>White</td>
<td>30.3%</td>
</tr>
<tr>
<td>Asian</td>
<td>2.6%</td>
</tr>
<tr>
<td>Some other race</td>
<td>2.0%</td>
</tr>
<tr>
<td>Two or more races</td>
<td>2.3%</td>
</tr>
<tr>
<td>Hispanic or Latino of any race</td>
<td>4.6%</td>
</tr>
</tbody>
</table>

Taken together, Baltimore City possesses all the demographics most affected by food insecurity, and it possesses each demographic in often the highest rates in Maryland. In Baltimore City, food insecurity is both common and destructive, and contributes to keeping the effects of centuries of oppression, inequality, and injustice in place9,11. Both nationwide and in Baltimore City, chronic diseases are now the leading cause of death and illness11. As stated in the 2017 Baltimore City Community Health Assessment, chronic diseases like, “Diabetes and hypertension contribute to
heart disease, the leading cause of death in Baltimore City.” It is precisely these chronic diseases which are associated with food insecurity. Further, and in keeping with the trend of racial inequity seen thus far, among African Americans in Baltimore City, rates of premature cardiovascular death were over one and a half times more common relative to the city’s Caucasians. Racial inequity aside, food insecurity is now recognized as a health crisis in the U.S. and for good reason: its costs – both to the people and society – are immense. Among children, food insecurity “…is associated with increased risks of some birth defects, anemia, lower nutrient intakes, cognitive problems…aggression and anxiety, higher risks of being hospitalized, poorer general health, [and] worse oral health, [in addition to having higher rates of] asthma, behavioral problems, depression, and suicidal ideation. When assessed in adults, food insecurity leads to lower nutrient intakes, higher incidence of “…mental health problems (including depression), diabetes, hypertension, and hyperlipidemia; being in poor or fair health; and poor sleep outcomes.” It is not only that food insecurity triggers these many ailments; it is that food security can prevent and treat them.

In “Food Insecurity and Health Outcomes”, Gundersen and Seligman state that, “…healthy dietary intake is critical for the prevention and management of numerous chronic diseases, such as obesity, diabetes, coronary artery disease, and congestive heart failure.” They further note that poor diets can increase the risk for these diseases, and that once developed, treating these diseases is exacerbated by food insecurity: “…fluctuations in dietary intake…make the management of chronic disease more challenging, particularly diseases such as diabetes and congestive heart failure, which require titration of medications based on quality and quantity of dietary intake.”

7 Gundersen, Kreider, and Pepper. 2011. “The Economics of Food Insecurity in the United States.”
9 Gundersen and Seligman. 2017. “Food Insecurity and Health Outcomes.”
10 Baltimore City Community Health Assessment, Baltimore City Department of Health, 2017.
Importantly, lapsed medical treatment stemming from food insecurity should not be unexpected; it is part and parcel to the lives of the poor.

If it becomes a struggle to find and earn enough food to survive, tasks like “…refilling medications, checking blood sugar, and attending medical appointments…”, will fall predictably by the wayside. Consequently, we are confronted with a crucial phenomenon: the bidirectionality of food insecurity. As Gundersen and Seligman describe it, “…it is true both that living in a food insecure household predisposes an individual to poor health, and that poor health predisposes one to living in a food insecure household”. It is this circular reinforcement that makes escaping and progressing past the conditions of food insecurity so difficult. While the costs to children, adults, and families outlined above are the most visceral, the economic cost of food insecurity is staggering as well. To explore these economic costs, they will be separated into two areas: (1) healthcare costs, and (2) total government food supplement program expenditures. We’ll begin with unraveling the healthcare costs, and then proceed to food program expenditures.

Quantifying the true costs of food insecurity to the U.S. healthcare system is difficult. This is largely because in a perverse fashion, those people who are food insecure are also often those people who are too poor or too overwhelmed to obtain or maintain access to healthcare and treatment in the for-profit healthcare system of the U.S. In turn, we will review two key data points to ferret out the healthcare costs around food insecurity: (1) U.S. Healthcare costs related to chronic disease (which food insecurity contributes to and exacerbates), and (2) a study conducted in Canada, a country with universal healthcare, which ascertained the costs of food insecurity on their healthcare system.

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6 Onis, Mercedes, and Francesco Branca. 2016.
7 Gundersen, Craig, Brent Kreider, and John Pepper. 2011.
8 Wright, James, Amy Donley, Marie Gualtieri, and Sara Strickhouser. 2016.
To begin, the U.S. spends more on healthcare than any other developed country in the world, equating to approximately 18% of GDP\textsuperscript{15}. Notably, this increased cost does not translate to better outcomes, as our chronic disease rates and other healthcare metrics are frequently worse relative to other developed countries (whom spend much less). In fact, U.S. healthcare is inferior by many metrics relevant to food insecurity, with a few examples being: mortality amenable to healthcare; Years of Life Lost (YLL); mortality rates for endocrine, nutritional and metabolic diseases; disease burden; and hospital admissions for preventable diseases\textsuperscript{15}. This last section is the most pertinent, as the preventable diseases measured are also those associated with food insecurity: congestive heart failure (the number one cause of death in Baltimore City), Asthma, Hypertension, and Diabetes\textsuperscript{15}. Increasing food security could lead to savings in the nation’s ballooning healthcare expenditures, but for now, food insecurity remains high in Baltimore City. Though the above facts around food insecurity are powerful, these are also admittedly broad measurements based on food insecurity’s known associations with disease and death. For a more tangible look at the healthcare costs of food insecurity, we move now to the granularity of the Canadian study.

Ascertaining the true healthcare costs of food insecurity in the U.S. is difficult, because those experiencing food insecurity are also often the poor (who cannot afford regular healthcare and treatment). To find this cost (outside of the human death, disease, and suffering already discussed), Tarasuk \textit{et al} conducted a study in Canada to determine the healthcare costs of food insecurity\textsuperscript{7}. At the study’s conclusion, Tarasuk \textit{et al} noted that, “[a]fter adjusting for other factors, total health care costs were 23 percent higher for adults in marginally food-secure households, 49 percent higher for those in low food-secure households, and 121 percent higher for those in very low food secure households, compared with adults in fully food-secure households.”\textsuperscript{9} From this, we learn two key takeaways. First, food insecurity results in increased healthcare costs for those

\textsuperscript{9} Gundersen and Seligman. 2017.
\textsuperscript{15} “American Health Care: Health Spending And The Federal Budget”. 2019.
who can least afford them in our society. Second, healthcare costs were positively correlated with increasing levels of food insecurity – a trend which Baltimore City can ill afford. Having delved into the healthcare costs around food insecurity, we can now address the direct costs incurred in U.S. food supplement programs.

In direct terms, the U.S. Federal Government spent, “…$98.6 billion in FY 2017 [on food supplement programs], 4 percent less than in the previous fiscal year and almost 10 percent less than the historical high of $109.2 billion set in FY 2013”\textsuperscript{15}. This downward trend in total expenditures is expected, as food insecurity itself has declined at the national level as the nation has recovered from the “Great Recession”\textsuperscript{4}. In fact, food insecurity at the national level was most recently measured at 11.1% - hitting a mark lower than pre-recession levels for the first time\textsuperscript{4}. Nevertheless, Baltimore City has not enjoyed the same level of recovery.

Baltimore City, unfortunately, is far from the national food insecurity average of 11.1 percent\textsuperscript{4}. Instead, Baltimore City’s food insecurity rate sits at 21.3 percent - nearly double the national average (and higher than all but one county in Maryland\textsuperscript{5}). This stark contrast exists for two primary reasons. First, Baltimore City’s demographics – both by title and proportion – virtually mirror those demographics most afflicted by food insecurity, thus maximizing its potential to suffer from food insecurity’s effects and food insecurity’s bidirectional reinforcement\textsuperscript{9}. Second, because of Baltimore’s demographic makeup and history, the city and its residents must contend with the systemic discrimination that has caused the resource deprivation which drives food insecurity\textsuperscript{11}. In short, Baltimore City remains in dire need of assistance and systemic change\textsuperscript{11}.

\textsuperscript{5} “Food Insecurity in Maryland”. 2019.
\textsuperscript{9} Gundersen and Seligman. 2017.
\textsuperscript{11} Baltimore City Community Health Assessment, Baltimore City Department of Health, 2017.
\textsuperscript{15} “American Health Care: Health Spending And The Federal Budget”. 2019.
In terms of categorization, food insecurity is best understood as a socioeconomic issue, though it has elements of fairness, equity, and morality as well. At the national level, the USDA records that:

- rates of food insecurity were higher than the national average for the following groups: households with incomes near or below the Federal poverty line, all households with children and particularly households with children headed by single women or single men, women and men living alone, Black- and Hispanic-headed households, and households in principal cities.

Baltimore City’s distress around food insecurity exceeds state and national averages because so many of its residents fit exactly these most vulnerable demographics.

Given that urban flight is not subsiding for Baltimore City, these most vulnerable groups are only likely to grow proportionally as the tax base shrinks and food deserts, now known as “healthy food priority areas”, resultantly expand. Absent systemic change, the issues discussed above are likely to worsen, as the bidirectionality of food insecurity and resource deprivation accelerate.

III. **Background and History**

The roots of food insecurity go far back into our nation’s and Baltimore City’s history. Therefore, if we are to reduce and resolve food insecurity, we must understand how it came into being, why it persists, and why it tends to afflict some demographics more than others. In turn, this section will begin by explaining how food insecurity itself is created. Next, this paper will apply this understanding to Baltimore City by reviewing its relevant history. Finally, this portion

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8 Wright, James, Amy Donley, Marie Gualtieri, and Sara Strickhouser. 2016.
11 Baltimore City Community Health Assessment, Baltimore City Department of Health, 2017.
of the paper will explore the interventions that have attempted to end food insecurity. Through this process, it will be demonstrated how food insecurity was created, the factors which have exacerbated the issue in Baltimore City, and the reasons why past interventions have succeeded or failed.

**Subsection 1: How is Food Insecurity Created?**

Food insecurity arises because an individual or family lacks the resources needed to obtain adequate, nutritious food\(^4\). These insufficient resources may be purely monetary (low income), or they may cover many other resource deficiencies (with wealth and transportation being two such examples)\(^9\). In the case of Baltimore City, its food insecurity is largely a result of socioeconomic and racial discrimination and oppression which spans generations\(^17\). African Americans, Hispanic Americans, and the poor have been systematically excluded from opportunities to advance and pass on wealth to their children, thus locking them into a cycle of poverty\(^17\). This theme can be seen through an exploration of Baltimore City’s history.

**Subsection 2: Food Insecurity and Baltimore City’s History**

Racial disparity in food insecurity and nutrition-related food outcomes finds its roots in the history of slavery and discriminatory policies in the United States\(^17\). To trace this connection through time, there are two primary elements which must be addressed: (1) the causative socioeconomic policies and effects, and (2) the resultant cultural and behavioral traditions affecting food insecurity today. To elucidate these causative socioeconomic policies, we must begin at one of the darkest chapters in American history: the institution of slavery. Slavery stole the livelihood and property of African Americans while forcing African Americans to become property themselves. Slavery also destroyed, replaced, and radically altered the family structure,

possessions, and culture of African Americans. From colonial times up through 1865, African Americans under slavery were forbidden, by law, from obtaining an education or learning how to read. This necessarily had drastic effects on their economic potential, culture, food security, and nutrition. Living under slavery meant that finding enough food to eat was a daily struggle. This food insecurity led slaves to use the food items not desired by their owners, and such leftover food products were predictably less than healthy or delicious. Consequently, slaves often, “…rendered [these food products] more palatable by adding lots of salt, sugar and fat. From these…experiences in the slave era, the so-called ‘soul food diet’ emerged and remains a predominant fixture in the African American diet over a century and a half after slavery ended”.

This change in diet – engrained into the African American cultural tradition by necessity – is a vitally important and often undiscussed phenomenon in the context of food insecurity, food deserts, nutrition, and nutrition-related diseases.

Shortly after the end of slavery, many state and local governments around the country enacted segregationist laws to prevent the advancement of African Americans and prevent their comingling with whites. Baltimore City was no exception, having enacted numerous segregationist ordinances during the early part of the 20th century. However, “[i]n 1917, the U.S. Supreme Court found ordinances like Baltimore’s 1910 segregation rule unconstitutional…”, thereby nullifying these offending ordinances. Unfortunately, in terms of eliminating racial discrimination, this ruling by the Supreme Court was ineffectual for two reasons.

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8 Wright, James, Amy Donley, Marie Gualtieri, and Sara Strickhouser. 2016.
17 Badger, Emily. 2015.
First, the court made its ruling not on the basis that the segregation ordinance violated the rights of African Americans to live where they chose. Instead, the court ruled the ordinance unconstitutional because it violated the property rights of white people to sell to whom they chose\textsuperscript{19}. Additionally, and regrettably, the mayor of Baltimore City also circumvented this ruling by, “…instructing city building inspectors and health department investigators to cite for code violations anyone who rented or sold to blacks in predominantly white neighborhoods”\textsuperscript{19}. These instructions would soon become a lasting institution in Baltimore City.

In 1922, the subsequent mayor of Baltimore City formally organized his predecessor’s racist policies, “…by forming an official Committee on Segregation”\textsuperscript{19}. Soon after in 1925, “…All Baltimore neighborhood associations came together to form the ‘Allied Civic and Protective Association’”. This organization mandated that, “…new and existing property owners…sign restrictive covenants…[which] bound their signatories to never to sell to an African American”\textsuperscript{19}. This Association and the Committee on Segregation continued their work for years, bringing more neighborhoods into the fold. Through government sanction, they continued to prevent African Americans from moving into white neighborhoods. Unfortunately, government endorsement of these racist policies would become even more powerful with the advent of a policy known as “redlining.”

“Redlining” was the practice of refusing to lend to people who lived in, “…neighborhoods that federally backed officials had identified as having ‘undesirable racial concentrations’”\textsuperscript{17}. In the context of Baltimore City, these “undesirable racial concentrations” were synonymous with African Americans. This policy, which was prevalent in Baltimore City and nationwide, received its namesake, “…because neighborhoods were colored red on government maps to indicate that these neighborhoods should be considered poor credit risks as a consequence of African Americans living in (or even near) them” \textsuperscript{17}. This racially discriminatory practice was, for a time,
the explicit policy of the Federal Housing Administration (FHA)\textsuperscript{17}. In conjunction with Baltimore City’s Committee on Segregation and its covenants, policies like redlining kept much needed resources out of African American neighborhoods and kept African Americans in these resource-starved environments\textsuperscript{17}.

The net effects of these racist policies are crushing and numerous, but it’s most debilitating effect may be this: “Nationwide, black family incomes are now about 60 percent of white family incomes, but black household wealth is only about 5 percent of white household wealth (italics added)\textsuperscript{17}.” This gap in wealth can be attributed to African Americans having been unable able to afford or move into single family homes. For without this ability, African Americans were unable to accumulate and pass on the wealth obtained by white Americans during the suburban housing boom which occurred from the mid-1930s until the mid-1960s\textsuperscript{17}. Simultaneously, African Americans were left behind in the major cities of the U.S. during the exodus of affluent whites. They were thus forced to watch the city’s tax base contract and its resources dwindle, while crime and poverty grew\textsuperscript{17}.

In 1970, a brief ray of hope shone that threatened to end this systemic, government-enshrined racism and oppression. George Romney, the Secretary of the Department of Housing and Urban Development (HUD), declared that, “…the federal government had established a ‘white noose’ around ghettos in Baltimore and other cities…”\textsuperscript{19}. Romney endeavored to destroy this noose by ordering HUD to deny federal funds for, “…sewers, water projects, parkland, or redevelopment…[in] all-white suburbs that resisted integration by maintaining exclusionary zoning ordinances…or by refusing to accept subsidized moderate-income or public low-income housing”\textsuperscript{19}. Regrettably, amid pushback from those invested in maintaining the racial divide,
“President Richard Nixon eventually restrained Romney, HUD’s integration programs were abandoned, [and] Romney himself was forced out as HUD Secretary”\textsuperscript{19}.

Since George Romney, little has been done rectify the devastating effects driven by the racist policies of the past. Notably though,HUD was sued for its policies in 1994. Specifically, HUD was accused of segregating its public housing in Baltimore City, “…after it had concentrated the poorest African American families in projects in the poorest neighborhoods”\textsuperscript{19}. These poorest neighborhoods and “projects” were then demolished, and their residents moved into other “segregated black neighborhoods”\textsuperscript{19}. A settlement was eventually reached in this suit wherein the federal government had to, “…provide vouchers to former public housing residents for apartments in integrated neighborhoods…”\textsuperscript{19}. Additionally, the federal government had to support, “…this provision with counseling and social services to ensure that families’ moves to integrated neighborhoods would have a high likelihood of success”\textsuperscript{19}. With that said, this settlement amounted to a small victory rather than rectifying the systemic issues of the past, and the victimization of Baltimore’s African American community didn’t end here.

Prior to the Great Recession and subprime mortgage crisis of the 21\textsuperscript{st} century, major banks engaged in predatory lending to minority communities, with Baltimore City being a prime example of this practice\textsuperscript{19}. So prevalent was this tactic that the city of Baltimore itself sued Wells Fargo Bank. In court, Baltimore City alleged that, “…the bank had established a special unit staffed exclusively by African American bank employees who were instructed to visit black churches to market subprime loans”\textsuperscript{19}. Additionally, Wells Fargo was accused of giving Baltimore City’s African American residents less favorable rates than similarly qualified white residents, and foreclosed on many homes in Baltimore City, “…creating blight and higher public safety costs”\textsuperscript{19}.

\textsuperscript{19} Rothstein, Richard. 2015.
Wells Fargo eventually settled this issue at the Federal level, agreeing to pay $175 million in total, with $2.5 million going to Baltimore City borrowers, $4.5 million towards down payments on housing loans in Baltimore, an average payout to minority borrowers in Baltimore of $15,000, and $3 million to Baltimore City for “other foreclosure-related initiatives”\textsuperscript{19}. Despite this apparent win, Baltimore City remains in dire straits by many metrics, with food insecurity being one of them\textsuperscript{20}. Even today, those able to leave Baltimore City continue to do so, further worsening the city’s economic condition and by extension, it’s food insecurity\textsuperscript{8,21}. Sadly, this phenomenon is not a new development, and is again grounded in Baltimore City’s racially discriminatory history.

Baltimore City has endured a recurring theme wherein desegregation results in a massive exodus of affluent whites from newly desegregated areas, followed by a large influx of African Americans\textsuperscript{8,17,19,21}. Today, this exodus continues, but with a new trend: affluent African Americans are leaving as well\textsuperscript{21}. As in past times, this loss in population creates economic devastation in its wake, as the city loses its tax base and resources when the affluent leave the area\textsuperscript{17,19}. According to Wright, Gualtieri, and Strickhouser, the exodus of Baltimore’s affluent whites caused “…half the major supermarkets in the three largest cities of the United States to close,”\textsuperscript{8} thus increasing food insecurity. For when these major grocery stores close, they are either not replaced at all, or are replaced by small grocery and convenience stores in the neighborhood\textsuperscript{8}. The resultant dearth of nutritious food in these areas is what gave rise to the term, “food desert”\textsuperscript{8}.

The existing research on food insecurity demonstrates that centuries of systemic oppression, discrimination, exclusion, divestment, and cultural upheaval cannot be quickly remedied\textsuperscript{8,17,19}. This fact is born out by, “[r]esearchers at Virginia Commonwealth University’s Center on Society and Health, [who] found that Baltimore neighborhoods that were redlined in the 1930s still have...
lower rates of homeownership and college attainment and higher rates of poverty and segregation today — as well as worse health outcomes”17. All of these factors (low home ownership, lower education, and higher rates of poverty and segregation) are predictors for higher rates of food insecurity4. Those who have tried to resolve the issue of food insecurity without taking all of these factors into account have learned just how difficult it can be8.

Subsection 3: Food Insecurity Interventions

Past food insecurity interventions have generally taken one of two routes: (1) the goal of eliminating food deserts, or (2) the use of cash (or in-kind benefits) to reduce food insecurity through direct aid8. Given that food deserts and food insecurity are closely related, we’ll discuss first those interventions meant to eliminate food deserts, and second those interventions designed to end food insecurity directly.

Most initiatives geared toward reducing and eliminating food deserts have sought to do so by focusing on two main strategies: (1) increasing the availability of more nutritious foods in the corner stores that dominate low-income, food desert-designated areas, and (2) increasing the nutritional knowledge of the people living there8. The rationale of the first strategy is clear: if people have easier access to more nutritious food, they’ll be more likely to buy and consume it. The second strategy has an equally logical grounding: past studies have indicated that, “…‘Parents’ understanding of food’s nutritional value is variable. Black race, less education, and very low income are associated with poorer nutrition knowledge”8. It would seem (especially given Baltimore City’s food insecure demographics) that these interventions would have resoundingly positive effects. The actual outcomes of these interventions, however, reveal the results of programs which do not have a firm grasp on the issues at the root of the problem. Interventions which have focused on the two strategies outlined above have resulted, by and

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4 Alisha Coleman-Jensen, Matthew P. Rabbitt, Christian A. Gregory, Anita Singh. 2019
8 Wright, James, Amy Donley, Marie Gualtieri, and Sara Strickhouser. 2016.
17 Badger, Emily. 2015.
large, in failure. Indeed, most interventions in the arena of food deserts have failed. In turn, researchers asked parents in the studies why their food choices had not changed. The most common response from parents explaining why they don’t buy more nutritious food was this: healthier food is too costly. The data supports these claims: “[h]igh quality protein is more expensive than canned pasta products; fresh fruits and veggies are more expensive than frozen produce…”, and, “…a meta-analysis of 27 prior studies…[has shown] that on average[,] healthier diets cost about $1.48 more per person per day”. In Baltimore City, almost one quarter of the population lives below the poverty line. For those living at the poverty line of $23,050 a year, an increased annual cost of $2,190 (the cost of eating healthy) is no small figure. Rather, this increased cost equates to a 9.5% increase in annual food costs for a “…four-person family right at the poverty line, and even higher percentage increases for families below the poverty line”.

Recognizing this cost-driven barrier to achieving food security, a subsequent study provided incentives to corner store owners to stock healthier food, while also ensuring that these incentives were passed on to consumers via decreased costs. Known as “The Healthy Incentives Pilot”, this program used performance allowances (discounts given by manufacturers to distributors in exchange for promotion of various products) to test the hypothesis that making healthy food cheaper (and more heavily advertised) will result in the increased consumption of it. While some small positive changes in consumer choice for healthier food items was noted, these changes were not statistically significant. Though the food industry certainly has its roll to play in tailoring advertising to steer individuals toward healthier food choices, a crucial lesson was learned: reducing food insecurity and food deserts will require more than advertising, incentives, food availability, or even reduced pricing. More root factors must be addressed.
In 2013, Antin and Hunt interviewed twenty, “…low-income African American women aged 18-25,” to determine what factors influenced their unhealthy food choices for themselves and their families. By interviewing these women, Antin and Hunt discovered several recurring themes. First on the list of reasons for unhealthy food choice was “familiarity”. Those foods to which the women were exposed to at a young age and throughout their lives tended to persist in their diets. Second was the “convenience” of the food. People trying to make ends meet, hold down a job, take care of their children, and pay the bills have little time to worry about the nutritional quality of the food they consume.

The third reason given for unhealthy food choices was “enjoyment,” which referred to how good the food tastes. Mentioned under this heading of “enjoyment” were “comfort foods,” which are often those foods high in sugar content and thus low in nutritional value. Similarly, “satiation” was listed as a reason for unhealthy food choice. Contextually, “satiation” for these women meant buying cans of pasta (rather than healthier food) for their children, because at the end of the day, they wanted to buy food which “fills [their] children up”. Lastly, the cost of healthy foods was again voiced. As recorded by Antin and Hunt, one woman stated:

I’m going to go towards whatever is on sale even if that’s the worst thing for me. I have to eat somehow and still be able to pay my phone bill, cable, all this other stuff. I feel like for the government to be putting bulletins and having health alerts and stuff, it’s just making people more depressed knowing they can’t afford that.

Summarizing these reasons for unhealthy food choices, Antin and Hunt observe that:

Aggressively cautious food purchasing and preparation could lead to better diets even if incomes did not increase. But doing so increases the time and effort required to shop for and prepare food, and for many poor people, these other factors of satiation, convenience, and the like assume greater importance.

8 Wright, James, Amy Donley, Marie Gualtieri, and Sara Strickhouser. 2016.
In the face of repeated failure, what can be done to reduce the food deserts, food insecurity, and negative food-related health outcomes that disproportionately affect the poor and minorities? It is this question that led to the direct interventions meant to reduce and end food insecurity. With this goal in mind, the U.S. created the “Supplemental Nutrition Assistance Program (SNAP), Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), and the National School Lunch Program (NSLP)”4,8.

**Subsection 4: Subsidy-Based Interventions**

SNAP, WIC, and the NSLP are federal programs designed to alleviate and end food insecurity. Of the three, SNAP is by far the largest, costing $65 billion in fiscal year 20184. In 2018, SNAP provided food stamps (redeemable for food products at participating stores) to 40.4 million people, with an, “…average benefit of $126 per person per month”4. While the aggregate total of 40.4 million people seems high, it’s also true that, “…[only] 56 percent of food-insecure households reported receiving assistance from one or more of the three largest Federal food and nutrition assistance programs”4. In other words, there are millions of people who are eligible for these programs but for some reason, are not utilizing them. Those intent on using these programs to end food insecurity then asked, “what is causing reduced participation in these programs?” A study by Gundersen, Kreider, and Pepper sought to answer this question.

Based on their analysis, Gundersen, Kreider, and Pepper cited three reasons for why the food insecure were not participating in these programs: (1) stigma, (2) transaction costs, and (3) the low benefit level available to participants7. Regarding stigma, eligible but non-participating individuals may have a personal distaste for receiving food stamps, or they may fear the judgement of others and coworkers7. Transaction costs from trying to obtain program benefits may include travel time, “…time spent in the [SNAP] office, the burden of transporting children

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7 Gundersen, Craig, Brent Kreider, and John Pepper. 2011.
8 Wright, James, Amy Donley, Marie Gualtieri, and Sara Strickhouser. 2016.
to the office or paying for childcare services, and the direct costs of transportation"\(^7\). Lastly, regarding the perceived small amount of benefits available, some families may only be eligible for as little as $17 a month. The small size of these benefits then decreases the attractiveness of the program itself, especially if compounded by the stigma and transaction costs outlined above\(^7\). Notably, this reticence toward participation in these programs isn’t limited to private individuals; food vendors also often fail to participate in these programs.

For instance, of the 525 small grocery and corner stores in Baltimore City, only 103 participated in WIC and SNAP\(^22\). Notably though, those small grocery stores which do participate in WIC showed a, “…41% increase in [Healthy Food Availability Index] HFAI score compared to similar stores that do not accept nutrition benefits”\(^22\). Similarly, “Small grocery, corner, and convenience stores that accept SNAP have an HFAI score 18% higher than stores of the same size that do not accept nutrition benefits”\(^22\). This data illustrates that the nutritional mandates within WIC especially (and SNAP to a lesser degree given its lessened standards) increase the nutritional value of the food available to consumers. If participation rates could be increased substantially, these mandates may have a dramatic effect on food insecurity\(^22\). However, healthy food availability does not necessarily translate to increased consumption or a decrease in food insecurity. Almost bizarrely, some studies have shown the opposite to occur.

While the goal of SNAP is to reduce food insecurity, “…[the] rates of food insecurity among recipients are about double the rates among eligible non-recipients…and these higher rates remain even after controlling for observed factors”\(^7\). Put more simply, those participating in SNAP experience food insecurity at roughly \textit{twice} the rate of those who are eligible for the program but do not participate. This finding produces many questions. Are benefit levels too low

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\(^7\) Gundersen, Craig, Brent Kreider, and John Pepper. 2011. 
to alleviate food insecurity? Is the program creating learned dependency? Are there more unseen and unmeasured factors creating this result? While future studies will have to answer these questions, this much is clear: despite these federal subsidy interventions, food insecurity in Baltimore City persists. Furthermore, interventions designed to improve nutrition-related health outcomes and eliminate food deserts and food insecurity and have met repeated failure. In turn, the Baltimore Food Policy Initiative (BFPI) was formed.

**Subsection 5: the Baltimore Food Policy Initiative (BFPI)**

The BFPI is an interagency collaboration designed to, “address health, economic, and environmental disparities in Healthy Food Priority Areas (a.k.a. “food deserts”)”. The BFPI is informed by the research, analysis, and mapping efforts of Baltimore City’s Department of Planning and the Johns Hopkins Center for a Livable Future. This program monitors 525 small grocery and corner stores, 183 convenience stores, 6 public markets, 47 supermarkets, 18 farmers markets, 23 urban farms, and 83 community gardens operating in Baltimore City to gauge the city’s food environment. Concurrently, BFPI also recorded 586 summer meal sites, 268 after school meal sites, 425 food pantries, 58 senior eating sites, and 13 virtual supermarkets all designed to increase the availability of food within Baltimore City. Despite all of these interventions however, Baltimore City food insecurity remains stubbornly at 21.3%, with children being the demographic most likely to be affected.

To reduce this food insecurity rate, the BFPI has adopted the following goals:

- Support resident-driven processes to guide equitable food policy, programs and resources
- Improve small grocery, corner and convenience stores
- Retain and attract supermarkets

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5 “Food Insecurity in Maryland”. 2019.
8 Wright, James, Amy Donley, Marie Gualtieri, and Sara Strickhouser. 2016.
- Increase the ability of the public markets to anchor the healthy food environment
- Address transportation gaps that impact food access
- Implement supply chain solutions that support healthy food distribution and small businesses
- Maximize the impact of federal nutrition assistance and meal programs
- Support urban agriculture, emphasizing historically disenfranchised populations and geographies

While these goals are laudable and logical, only time will tell if they are successful. Despite the best of intentions, a systematic review of child food insecurity interventions in the U.S. and the UK has concluded that the evidence base is “lacking in robustness” and reflects mixed results. These mixed results indicate that it is often unclear at this point which types of interventions work better or worse than others and in what situations. The lack of robustness can be remedied through (1) standardized measurements of food insecurity, (2) grounding proposals in theories of change, and, (3) “taking a systems-based approach to both implementation and evaluation of…interventions.” The second issue of “mixed results” can then be resolved through learning the lessons from the past (contained in the newly created, more robust literature) and adjusting the programs of the present and future accordingly.

Subsection 6: Summary

From this history review, four key themes emerge which must be addressed in order to solve the problem of food insecurity. First, the inability of people to afford or obtain nutritious food must be resolved. Second, the lack of knowledge around healthy vs unhealthy foods must be remedied. Third, the fact that, “…custom, habit, tradition and culture…”, are driving unhealthy food choices must be acknowledged and cured. Fourth and finally, a careful measurement and

implementation plan must be crafted to maximize the program’s robustness and its probability of success in decreasing food insecurity.

The solution to food insecurity will have to take into account all four of these common themes, or it will fall short just as past interventions have. In Baltimore’s case, its racially and socioeconomically disparate rates of food insecurity are exceptionally high because as a community, racial minorities have been oppressed, disenfranchised, and victimized for generations\textsuperscript{17,19}. It makes sense then that the solution include economic empowerment, cultural rehabilitation, and cross-generational, community engagement which shuns corporate solutions in favor of the restoration of the community itself\textsuperscript{8}.

IV. **Policy Proposal**

**Subsection 1: Policy Goal**

To reduce food insecurity in Baltimore City, this paper proposes the formation of the nonprofit *Urban Oases*. Urban Oases will reduce food insecurity in Baltimore City by using the produce generated in its aquaponics systems. Urban Oases’ aquaponics operations will be two-fold. First, Urban Oases will operate its own aquaponics systems for educational purposes and to partially offset its operating costs by donating and selling the produce and fish it generates (at discounted cost) to those in need. Second, Urban Oases will partner with Baltimore schools to construct and operate aquaponics systems in the schools. The produce and fish yielded from these partnerships will be used to supplement the food donations being provided by The Baltimore Hunger Project – a nonprofit dedicated to feeding Baltimore City’s children who experience food insecurity\textsuperscript{24}. Success will be measured via the production goal of 250 pounds of fish and 50

\textsuperscript{8} Wright, James, Amy Donley, Marie Gualtieri, and Sara Strickhouser. 2016.
\textsuperscript{17} Badger, Emily. 2015.
\textsuperscript{19} Rothstein, Richard. 2015.
\textsuperscript{24} “Baltimore Hunger Project: Feeding Those In Need”, 2019. *Baltimore Hunger Project*.
pounds of leafy green vegetables per school per month. Donations to The Baltimore Hunger Project will begin six months after the nonprofit’s entry into its first Baltimore City high school.

**Subsection 2: Policy Authorization Tool**

Utilizing a nonprofit as the vehicle for ending food insecurity is advantageous in many ways. First, the U.S., Maryland, and Baltimore City have a rich history of nonprofits leading the way on social change. Second, no official authorizing legislation is required; the nonprofit simply needs to be incorporated and form the necessary partnerships to begin operations. Third, the necessary partners under this proposed program are primarily schools and nonprofits, and encouraging collaboration between nonprofits is highly encouraged by many in the sector. Fourth and finally, nonprofits have the flexibility to adjust quickly to a changing landscape.

**Subsection 3: Policy Description**

Functionally speaking, Urban Oases will operate as a team of engineers and aquaponics professionals who plan, organize, and assist with aquaponics systems construction and operation in partner schools and at their home site. Urban Oases will have its own aquaponics facility to be used for: (1) a training aid, (2) for educational purposes with local schools, and (3) to produce vegetables and fish to partially offset operating costs and feed those in need. The projected costs and planned revenue streams of Urban Oases will be covered in subsections 5 and 6.

Urban Oases will also work with Aquaculture in Action, a Maryland-based nonprofit dedicated to aquaculture and environmental education. This partnership with Aquaponics in Action will serve to obtain (for partner schools) the equipment and funds needed to construct, install, setup, and operate school aquaponics systems. Aquaculture in Action, with the help of Maryland Sea Grant, provides start-up funding and aquaculture equipment to schools which join

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their program\textsuperscript{27}. The systems provided by Aquaculture in Action include a 250-gallon reservoir and associated equipment.

Based on analysis from other aquaponics systems, this 250-gallon tank could be used to grow as much as 250 pounds of fish and 50 pounds of leafy green vegetables per month\textsuperscript{28}. Urban Oases engineers and aquaponics professionals, in coordination with Aquaculture in Action, will train and support partner school faculty and students in the construction and operation of these systems. The goal will be to provide sufficient training for schools to take over the program and operate it themselves. Urban Oases will then monitor the systems remotely and provide higher level maintenance and operational support as needed.

As stated above, once systems are setup and operational, Urban Oases will remain involved with its partner schools for monitoring, training, and maintenance support, with these latter two services becoming less frequent and intensive as the necessary skill base is created among the school personnel. This “train the trainer” paradigm will enable Urban Oases to act as a force multiplier in Baltimore’s urban communities, eventually establishing aquaponics systems in schools throughout the city. With that said, Urban Oases will have another task: coordinating and monitoring the donation of produce and fish from the aquaponics systems to The Baltimore Hunger Project.

The Baltimore Hunger Project is a nonprofit dedicated to reducing food insecurity in Baltimore City by providing food to food insecure children on weekends\textsuperscript{24}. Their core goals are increasing children’s nutritional value, reducing hunger, breaking the cycle of poverty, and building strong communities\textsuperscript{24}. Urban Oases shares these same goals, and by partnering with The Baltimore Hunger Project, Urban Oases gains an established network and delivery system for the food produced in its aquaponics systems.

\textsuperscript{24} “Baltimore Hunger Project: Feeding Those In Need”, 2019.
\textsuperscript{27} “Aquaculture In Action Participating Schools”, 2019. Maryland Sea Grant. \url{https://www.mdsg.umd.edu/topics/k-12-aquaculture-education/aquaculture-action-participating-schools}.
Subsection 4: Timeline for Implementation

The timeline of implementation for Urban Oases reflects the many necessary steps preceding its operation. First, Urban Oases must be incorporated, which necessitates all of the steps involved in the formation of a nonprofit\(^{25}\). After the nonprofit’s formation, its funding must be secured; the plans to secure this funding are covered in subsection 6 below. Once funding is acquired, property will be obtained by utilizing Baltimore City’s vacant properties. Many initiatives exist to make this process as streamlined as possible, including Baltimore City’s “Vacants to Value” initiative\(^{29}\). After property is secured, utilities will be purchased and the property made ready for aquaponics system installation. After installation, operation of the systems will begin. A more detailed account of this timeline is below.

\(^{25}\) Wenger, Yvonne. 2015.
**Figure 3: Implementation Timeline**

<table>
<thead>
<tr>
<th>Goals</th>
<th>Activities</th>
<th>Date Begin</th>
<th>Date End</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incorporation</td>
<td>Incorporate the nonprofit under the name “Urban Oases”</td>
<td>Aug 2020</td>
<td>Dec 2020</td>
</tr>
<tr>
<td>Secure funding and materials</td>
<td>Obtain funding to cover the cost of facilities, utilities, payroll,</td>
<td>Jan 2021</td>
<td>Initial Funding Deadline:</td>
</tr>
<tr>
<td>to begin operations</td>
<td>construction materials, seed stock, fish, administrative expenses, and</td>
<td></td>
<td>Jul 2021</td>
</tr>
<tr>
<td></td>
<td>other expenses totaling between $116,840 - $134,240; see tables 1, 3,</td>
<td></td>
<td>Ongoing process thereofafter</td>
</tr>
<tr>
<td></td>
<td>and Subsection 5 for breakdown of costs by category</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Secure property and facilities</td>
<td>Secure property and facilities for Urban Oases’ aquaponics farm</td>
<td>Aug 2021</td>
<td>Oct 2021</td>
</tr>
<tr>
<td>Construction</td>
<td>Construct, operate, and maintain urban aquaponics farm at Urban Oases</td>
<td>Oct 2021</td>
<td>Begin operation: Jan 2022</td>
</tr>
<tr>
<td>Develop rapport and</td>
<td>Develop rapport with the community, schools, and public officials</td>
<td>Oct 2021</td>
<td>Ongoing</td>
</tr>
<tr>
<td>partnerships</td>
<td>Develop collaborative relationships with The Baltimore Hunger Project</td>
<td>Oct 2021</td>
<td>Ongoing</td>
</tr>
<tr>
<td></td>
<td>Aquaculture in Action, and select school(s)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Develop rapport and partnerships</td>
<td>Establish relationships with local vendors and farmers markets</td>
<td>Feb 2022</td>
<td>July 2022; ongoing</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>---------------------------------------------------------------</td>
<td>----------</td>
<td>-------------------</td>
</tr>
<tr>
<td>Bring produce and fish to market in Baltimore City</td>
<td>Bring produce to market and sale at local vendor establishments and farmers markets, transitioning to donations as necessary</td>
<td>April 2022</td>
<td>Ongoing</td>
</tr>
<tr>
<td>Develop rapport and partnerships</td>
<td>Form partnerships with target schools and secure their entry into Aquaculture in Action</td>
<td>Apr 2022</td>
<td>Ongoing</td>
</tr>
<tr>
<td>Begin school-based aquaponics programs</td>
<td>Construct and maintain aquaponics systems in partner schools; the operation and maintenance of these systems will be off-loaded to some degree as training of school personnel matures</td>
<td>May 2022</td>
<td>Oct 2022</td>
</tr>
<tr>
<td>Bring food donations to The Baltimore Hunger Project</td>
<td>Have at least one school aquaponics system complete and in operation, bringing 250 pounds of fish and 50 pounds of vegetables to the Baltimore Hunger Project on a monthly basis</td>
<td>Apr 2022</td>
<td>Ongoing</td>
</tr>
</tbody>
</table>
Subsection 5: Costs and Revenue Plan

The costs associated with operating an aquaponics system are separated into two stages: investment and operation. Investment refers to the money necessary to initially construct the systems. Financial analysis conducted by Quagrainie, Valladão Flores, Kim, and McClain provide excellent estimates of the costs associated with aquaponics construction and operation at a scale roughly equivalent to that planned by Urban Oases (six 380 L tanks and plant beds operating in a greenhouse environment). The costs of the investment stage are outlined below:

Figure 4: Investment Costs

<table>
<thead>
<tr>
<th>Table 1. Total initial investment for aquaponics experiment.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item</td>
</tr>
<tr>
<td>------------------------------</td>
</tr>
<tr>
<td>Fish tanks</td>
</tr>
<tr>
<td>Plants beds</td>
</tr>
<tr>
<td>Water pumps (peristaltic pumps 115v)</td>
</tr>
<tr>
<td>Water pumps accessories</td>
</tr>
<tr>
<td>Tubing</td>
</tr>
<tr>
<td>Air pumps</td>
</tr>
<tr>
<td>Air stones</td>
</tr>
<tr>
<td>Aquaponic installation cost</td>
</tr>
<tr>
<td>Biome and Media bag</td>
</tr>
<tr>
<td>Aquatic heaters</td>
</tr>
<tr>
<td>pH electrode</td>
</tr>
<tr>
<td>Conductivity electrode</td>
</tr>
<tr>
<td>Dissolved oxygen probe</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

After the investment stage comes the operational costs of the aquaponics system. These costs are affected by many factors, including but not limited to climate, infrastructure, labor, utilities, consumables, water monitoring and treatment, the size of the system, and the plants and fish grown in the system. After discussing these items, a table will be provided which summarizes the projected operating costs and potential revenue from the system.

The first factor influencing cost is climate. Stated simply, the warmer a region is, the lower the operating costs for the aquaponics system\textsuperscript{30,31,32}. This is due to the lessened need for heating costs to keep the water and ambient air temperature within acceptable levels for the plants and fish. The USDA breaks the country down in regions according to the average temperature and growing characteristics (plant hardiness zones) in an area. In the case of Baltimore City, it falls into region 7b\textsuperscript{33}. Here, the use of a greenhouse and/or heating system will be necessary to continue production of vegetables and fish through the winter months\textsuperscript{30}. Second, the available infrastructure and space will also affect the costs of an aquaponics system. These considerations play a role in the system’s planning, construction, size, and operation\textsuperscript{30}. For instance, the quality of the water in the area must be assessed. Some water in the United States can be tainted with heavy metals or other contaminants, rendering it unusable for the growing of produce or fish\textsuperscript{34}. Luckily, that is not the case in Baltimore City\textsuperscript{35}.

With that said, most water in the United States (including that in Baltimore City) is chlorinated for disinfection purposes. Chlorine can be dangerous for the plants, fish, and bacteria in the aquaponics system\textsuperscript{34}. Luckily, if you adhere to a few key guidelines, tap water will work well with aquaponics systems. Such guidelines include:

- refilling the system via the fish reservoir (to compensate for evaporative loss) rather than refilling via the grow bed;
- limiting refills to less than, “…a quarter of the volume of the tank over 3-4 days,” and;
- ensuring the water is pH balanced to the system and tolerance levels of the plants and fish\textsuperscript{34}.

\textsuperscript{30} Quagrainie, Kwamena K., Roberto Manolio Valladão Flores, Hye-Ji Kim, and Verena McClain. 2018.
\textsuperscript{31} Short, Gianna, Chengyan Yue, Marie Abbey, Neil Anderson, Nicholas Phelps, Paul Venturelli, and Zata Vickers. 2018.
\textsuperscript{32} Canner, Larry. 2016.
\textsuperscript{33} “USDA Plant Hardiness Zone Map". 2019.
Another factor influencing cost is the utility rates\textsuperscript{30}. Electricity is needed to operate the pumps, air stones, monitors, lights, and other electronic components. Gas is needed for heating in colder climes, and water is needed due to evaporation\textsuperscript{30}. In the Baltimore area, estimated utility rates break down as follows:

- Average 2018 electricity rate: $0.12 per kWh\textsuperscript{36}
- Average 2018 natural gas rate: $1.31 per therm\textsuperscript{36}
  - “A therm is equal to 100,000 BTUs. A BTU, or British Thermal Unit, is the quantity of heat required to raise the temperature of one pound of water by one-degree Fahrenheit”\textsuperscript{36}
- Average 2019 water rate: Baltimore City water charges are three-fold\textsuperscript{37}:
  - a volumetric rate for water use measured in CCF (100 Cubic Feet)One CCF = 748 Gallons\textsuperscript{37}
  - a fixed rate dependent on the size of the meter\textsuperscript{37}
  - variable rate for stormwater management\textsuperscript{37}

These utility costs will be shaped by usage and usage will be shaped by conditions and the size of the system(s)\textsuperscript{30,31}. As before, projections for these costs will be posted at the conclusion of this subsection.

The next cost inherent to aquaponics operations is the consumables used to maintain water quality. Monitoring and adjusting parameters of water quality is essential to maximizing yields and avoiding plant and fish death\textsuperscript{30}. Parameters measured include pH, conductivity, ammonia, nitrates, nitrites, dissolved oxygen, and many others. While some of these parameters can be

\textsuperscript{30} Quagrainie et al. 2018.
\textsuperscript{31} Short et al. 2018.
\textsuperscript{32} Canner, Larry. 2016.
\textsuperscript{37} "Water Billing Rates And Fees", 2019. Baltimore City Department Of Public Works.
measured using durable tools and equipment (which carry their own costs), many require the use of materials that are consumed and disposed of after daily use\textsuperscript{30}.

Lastly, and most notably in terms of cost, comes the labor needed to plan, construct, and maintain these systems. Studies have consistently shown that labor is the most expensive component of aquaponics operations\textsuperscript{30,31,32}. With that said, recent studies suggest that these costs can be mitigated to some degree by using remote monitoring technology\textsuperscript{28}. This remote monitoring technology was not used in the study conducted by Quagrainie et al, so those potential cost savings have not been factored into the costs described in Figure 5 below. However, Urban Oases does plan to utilize remote monitoring.

Figure 5: Operating Costs\textsuperscript{30}

<table>
<thead>
<tr>
<th>Table 3. Operating costs and revenue for aquaponics experiment (6 tanks).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenue</td>
</tr>
<tr>
<td>---------------------------------</td>
</tr>
<tr>
<td>Lettuce</td>
</tr>
<tr>
<td>Basil</td>
</tr>
<tr>
<td>Cherry tomato</td>
</tr>
<tr>
<td>Tilapia</td>
</tr>
<tr>
<td><strong>Total</strong></td>
</tr>
<tr>
<td><strong>Operating Cost</strong></td>
</tr>
<tr>
<td>Consumables for water test</td>
</tr>
<tr>
<td>Energy—Air pump</td>
</tr>
<tr>
<td>Energy—Water pump</td>
</tr>
<tr>
<td>Energy—Lights</td>
</tr>
<tr>
<td>Energy—Greenhouse heating/cooling</td>
</tr>
<tr>
<td>Seeds—Lettuce</td>
</tr>
<tr>
<td>Seeds—Basil</td>
</tr>
<tr>
<td>Seeds—Washington cherry tomato</td>
</tr>
<tr>
<td>Fish feed</td>
</tr>
<tr>
<td>Fish fingerlings</td>
</tr>
<tr>
<td>Clay pebbles</td>
</tr>
<tr>
<td>Net pots</td>
</tr>
<tr>
<td>Labor</td>
</tr>
<tr>
<td>Chemicals (sulfuric acid)</td>
</tr>
<tr>
<td>Water</td>
</tr>
<tr>
<td>Germination trays</td>
</tr>
<tr>
<td><strong>Total</strong></td>
</tr>
<tr>
<td><strong>Annual Profit</strong></td>
</tr>
</tbody>
</table>

\textsuperscript{28} Robb, John. 2019.

\textsuperscript{30} Quagrainie et al. 2018.

\textsuperscript{31} Short, Gianna, Chengyan Yue, Marie Abbey, Neil Anderson, Nicholas Phelps, Paul Venturelli, and Zata Vickers. 2018.

\textsuperscript{32} Canner, Larry. 2016.
Notably, the labor costs listed above use a $10 hourly wage over the 90-day duration of the subject study and only account for one employee. Urban Oases intends to pay its engineer and technician at the average annual salary for aquaponics technicians (approximately $70,000 per year). Additionally, the prices charged by Urban Oases for its produce and fish will be discounted to make them more affordable for those in need in Baltimore City. In turn, while sales of produce and fish can help offset costs to some degree, Urban Oases is not designed to be a self-sustaining or for-profit operation.

Instead, Urban Oases is designed to reduce food insecurity and develop resilient, healthy, and revitalized communities in inner-city Baltimore. As such, Urban Oases will be seeking other sources of revenue to enable its mission.

**Subsection 6: Revenue Sources**

To cover the costs of Urban Oases outlined above, a diversified funding plan has been developed. The primary sources of income for Urban Oases will be grants from federal sources, the state of Maryland, and grants from private organizations. Similarly, the revenue for school aquaponics programs will be achieved through grants from private organizations, and will be offset by the labor, expertise, and remote monitoring provided by Urban Oases personnel. The donor organizations being pursued are dedicated to education on healthy eating habits, organic produce and foods, environmental education and conservation, and ending food insecurity. Each of these donors will be discussed below.

To begin, Urban Oases will be seeking a $287,000 grant from the USDA’s Farmer’s Market Promotion Program. The mission of Urban Oases fits well with the objectives of this program.

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42 "Program Details – Apples For Education". 2019. Apples For Education. [https://apples4ed.com/program-details/](https://apples4ed.com/program-details/).
Specifically, Urban Oases syncs well with the Farmer’s Market Promotion Program because it will:

- Increase domestic consumption of locally produced agricultural products;
- Develop new market opportunities for locally produced agricultural products;
- Develop, improve, expand, and provide outreach, training, and technical assistance to community-supported agricultural programs, and;
- Improve access to producer-to-consumer market opportunities.

The primary goal of this grant from the USDA’s Farmer’s Market Promotion Program is to obtain funding for Urban Oases’ internal costs; this is in contrast to the costs of the partner school aquaponics programs. However, in order to ensure the financial stability of Urban Oases, a second grant will also be pursued on its behalf: Simply Organic’s new “Giving Fund.”

Through their new “Giving Fund” program, Simply Organic intends to, “[p]romote access to organic food options…[u]tilize and distribute organic food/meals…[and] provide nutrition counseling and food preparation education.” The mission of Urban Oases fits these goals nearly verbatim. Urban Oases promotes access to organic food through its produce, distributes organic food to the food insecure through its partnership with The Baltimore Hunger Project, and provides nutritional education through its education component. With Urban Oases’ funding plan outlined above, we now look to the ways in which Urban Oases will help partner-schools obtain the funding they need for their own aquaponics programs.

To fund the school aquaponics programs, Urban Oases will first target the U.S. Apple Association’s “Apples4Ed” program. This program:

…helps school communities implement programs that meet their students' unique nutritional needs…whether that's providing supplemental nutrition, helping students learn

about healthy food choices, or teaching them the skills to grow, prepare, and enjoy healthy foods they don't normally encounter\textsuperscript{42}.

In line with this mission statement, Urban Oases’ aquaponics program generates lettuce, basil, and other organic produce, as well as fresh fish. Through the participation of schools in the Urban Oases and Aquaculture in Action program, students and faculty will be taught more than just how to grow this produce; they will also be taught about the health benefits associated with consuming it and the environmental benefits of aquaponics itself\textsuperscript{26}.

The second donor organization sought by Urban Oases (in coordination with partner schools) will be Annie’s and its “Grants for Gardens” program. As stated on Annie’s website, this program is dedicated to, “…showing future generations how sustainable food is grown [and how it] changes their lives…”\textsuperscript{40}. In addition, Grants for Gardens is geared toward, “…[c]onnecting kids to gardens…”, and helping, “…them to start [think] more holistically about their food, their communities, and the planet”\textsuperscript{40}.

Lastly, but perhaps most importantly, Urban Oases will help partner schools connect with and become a partner of Aquaculture in Action. Through its partnership with Maryland Sea Grant, Aquaculture in Action funds aquaculture and aquaponics programs throughout the state of Maryland and around the country\textsuperscript{26}. This program even provides a start-up aquaponics system for partner schools and can connect them with other schools in their network to provide useful insight should be it required\textsuperscript{26}. \textit{Subsection 7: Summary}

In sum, Urban Oases will serve as a partner and source of knowledge and technical assistance for partner schools in Baltimore City. Additionally, Urban Oases will operate an internal aquaponics program to serve as an educational hub and to generate produce and fresh fish to be sold (at discounted prices) and donated to those in need. Through its collaboration with schools, Aquaculture in Action, and the Baltimore Hunger Project, Urban Oases will reduce food

\textsuperscript{26} “Aquaculture In Action Participating Schools”. 2019.
\textsuperscript{40} “Grants For Gardens - Annie's Homegrown”. 2019.
\textsuperscript{42} “Program Details – Apples For Education”. 2019.
insecurity. This will be done directly and indirectly by helping to reduce childhood hunger and by building resilient, self-sufficient communities in Baltimore City.

V. Policy Analysis

Urban Oases will reduce food insecurity among Baltimore City’s children by partnering with Baltimore City schools and Aquaculture in Action to create an aquaponics program within each partner school. The aquaponics systems in these schools will generate 250 pounds of fish and 50 pounds of produce per school per month. This fish and produce will then be delivered to The Baltimore Hunger Project: a nonprofit dedicated to giving food to children who are food insecure on the weekends. Urban Oases will also donate its own produce and fish on a monthly basis to The Baltimore Hunger Project in the amount of an additional 250 pounds of fish and 50 pounds of produce per month.

By connecting partner schools with Aquaculture in Action and Maryland Sea Grant, teachers and students will further be exposed to nutritional and technical education that will change historic and counterproductive dietary norms and impart useful, marketable skills. Finally, by establishing this collaborative network of partners, Urban Oases will help to strengthen a sense of community in a city that has frequently experienced social strife, disempowerment, and injustice.

The success of Urban Oases hinges on the ability of its aquaponics program to produce the amounts of produce and fish outlined above, deliver that food to those children in need, and ensure that the food produced is consumed by food insecure children. The question then becomes, “will Urban Oases be able to accomplish these tasks?”

8 Wright, James, Amy Donley, Marie Gualtieri, and Sara Strickhouser. 2016.
17 Badger, Emily. 2015.
To answer questions like these and determine a program’s potential for success, the Johns Hopkins’ Master’s in Public Management Program teaches its students seven evaluative criteria. These criteria are:

- Effectiveness
- Efficiency
- Equality
- Liberty
- Administrative Capacity
- Technological Capacity
- Legality

In the succeeding paragraphs, each of these terms will be briefly explained and then applied to the Urban Oases proposal to determine the program’s likelihood of success.

**Subsection 1: Effectiveness**

When analyzing policy, “effectiveness” refers to the degree to which a policy has met or will meet its goal(s). The goal of Urban Oases is to reduce food insecurity in Baltimore City, with a specific focus on reducing child food insecurity. Per the implementation timeline in Part IV, Subsection 4, Urban Oases aims to have at least one partner school producing 250 pounds of fish and 50 pounds of produce on a monthly basis by April 2022. Based on studies thus far conducted, this target is achievable.

As detailed by Walden Labs, a 10,000-gallon tank can produce 10,000 pounds of fish and 2,000 pounds of leafy greens per month. The tanks provided to Urban Oases’ partner schools through the Aquaculture in Action program are smaller, more manageable starter systems at 250

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gallons each. When scaled down from the 10,000-gallon tank to the 250-gallon tanks, this equates to 250 pounds of fish and 50 pounds of fresh produce per month. However, there are other factors to consider beyond that of scalability when determining an aquaponics system’s ability to generate fresh fish and produce.

Various aspects of an aquaponics system (heating, water, lighting, etc.) will be dictated by the space, facilities, climate, and utilities available. Furthermore, it often takes teachers and students many months to acquire the needed knowledge and expertise to operate these systems; without this knowledge and expertise, they will be unable to keep their environments balanced. Should these aquaponics systems fall out of balance, the fish, produce, and bacteria in it will either underperform or perish, raising operating costs. Urban Oases avoids these pitfalls by using mitigation strategies in its implementation timeline. Examples of these mitigating strategies include the development of necessary partnerships, conducting site surveys, designing and constructing aquaponics systems, conducting the necessary training with school faculty and students, and providing sustaining technical support and remote monitoring.

Once the aquaponics systems are operational and generating food, the newly grown fish and produce must still be delivered to those children in need. Urban Oases’ partnership with The Baltimore Hunger Project will accomplish this goal. As stated in Part IV, Subsection 3, the expertise of The Baltimore Hunger project will give Urban Oases and its partner schools an established network and delivery system for the food they generate. The Baltimore Hunger Project regularly accepts donations from outside organizations and delivers this food to the families of children in need. Through donations to the Baltimore Hunger Project, Urban Oases’ fresh produce and fish will be delivered to the food insecure children and their families.

In sum, aquaponics studies demonstrate that the aquaponics systems themselves have the technical capacity to produce the target amounts of fish and produce per month. Further,
partnerships with other nonprofits, training materials, and technical support ensure that schools will receive the equipment, training, and assistance they need to meet their food production goals. However, one vital concern remains in determining whether or not Urban Oases can attain its goal: whether or not this nonprofit can obtain its desired grant funding.

Should Urban Oases be unable to obtain the grant funding outlined in Part IV, Subsection 6, Urban Oases would be unable to self-fund its operations purely through the sale of its own produce and fish. Consequently, other grants or funding mechanisms would have to be pursued. This risk has been mitigated through the choice of donor organizations outlined in Part IV, and by ensuring that the donor organization mission statements and history of giving align with the mission of Urban Oases.

**Subsection 2: Efficiency**

“Efficiency” refers to a policy’s level of achievement relative to its costs. The achievement sought through Urban Oases is the reduction of food insecurity in Baltimore City’s children. The vehicle for this achievement is the produce and fish yielded by the operation of Urban Oases’ aquaponics systems. The efficiency (and costs) of these aquaponics systems depend upon many environmental factors. These factors include, but are not limited to, climate, infrastructure, labor, utilities, consumables, water monitoring and treatment, the size of the system, and the plants and fish grown in the system.
Thankfully, aquaponics studies conducted by Johns Hopkins’ Center for a Livable Future have yielded many “lessons learned” that can and will be used to increase the efficiency of Urban Oases aquaponics systems. These lessons learned include:

(1) Rainwater Collection: collecting natural rainwater can reduce or eliminate the water needs of an aquaponics system.

(2) Solar power: during warmer months especially, solar energy collection and solar thermal heating systems can greatly reduce the heating costs in aquaponic systems.

(3) Structural efficiency: careful site surveys and consideration of each site’s environment must be considered to tailor the aquaponics system to the site. Doing so can reduce heat loss, increase natural heating, and reduce costs in many other areas.

(4) Heat recovery Water Heaters: some modern water heating systems capture and store what would normally be wasted energy in the form of heat. By building systems with heat recovery water heaters, significant energy savings can be achieved.

(5) Row covers: row covers allow air, sunlight, and water to pass through them while also helping to capture and retain heat. This is very helpful in aquaponics systems exposed to cold temperatures during winter months, thus reducing heating costs.

(6) Plant Choice: different climates are suitable for different types of plants. By choosing plants which flourish in Maryland’s colder months, produce yields can be maximized while losses and costs are minimized.

(7) Fish Choice: for each aquaponics system, the type of fish to raise must be determined. In some instances, owners will choose to use ornamental fish species. In others, owners will choose to use harvest species like perch, catfish, or tilapia. In Maryland, those species most tolerant to Maryland winters will be chosen to maximize yields and prevent losses from fish die-off. Further, in Urban Oases’ systems, fish choice may be influenced by market price and

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customer/beneficiary preference to increase consumption of nutritious foods and maximize revenue generation.

(8) Pest Management: during site surveys, engineers will design aquaponics systems to minimize loss from pests associated with the site and the types of produce and fish being grown.

(9) Waste Disposal: fish waste solids can be collected in geotextile bags and composted to minimize waste from the system. Additionally, this composted waste can serve as a source of income.

Taken together, these measures listed above will help to maximize the efficiency and productivity of Urban Oases aquaponics while also minimizing investment and operating costs.

While the above mechanisms for efficiency are helpful, it’s also true that evaluating this program’s overall efficiency requires a review of its investment costs and operating costs relative to the value generated by the program’s charitable and revenue-generating works. To begin, the investment costs of the aquaponics systems operated within partner schools will be covered by the Aquaculture in Action Program and the grants outlined in Part III, Subsection 6 of this proposal. Similarly, the investment and operating costs of the aquaponics systems owned by Urban Oases are detailed in Figures 4 and 5 within Part IV, Subsection 5. To cover these costs, Urban Oases will seek the grants outlined in Part IV, Subsection 6 of this proposal. Additionally, Urban Oases will offset some of its cost through the sale of a percentage of the fish and produce it generates at its own facility. To accomplish these sales, Urban Oases’ fish and produce will be sold at farmer’s markets and other Baltimore City locations to help generate revenue and offset costs while bringing nutritious food to an area often beset by food priority zones (formerly known as food deserts). Having accounted for the costs and the funding to meet them, the focus moves now to quantifying the value of the Urban Oases aquaponics program.

2 Duncan, 2018.
44 McCleary, Kate. 2015.
The value of Urban Oases is multifaceted. It’s first metric for success is the monthly weight of produce and fish generated by each system it operates and supports. However, this is a measure of productivity of the systems themselves rather than the program’s true goal of reducing child food insecurity in Baltimore City. Consequently, Urban Oases will also record how many food insecure children are fed through Urban Oases’ donations to the Baltimore Hunger Project. Concurrently, Urban Oases will monitor the rates of child food insecurity in Baltimore City (via community assessment reports) to check for impacts driven by Urban Oases operations. Notably though, this final measure of success is much more vulnerable to “noise” from environmental factors beyond Urban Oases’ operations. Thus, it is necessary for Urban Oases to use all three measures of value and success.

Ultimately, inquiries into the efficiency of Urban Oases’ operations demonstrate that its value exceeds its costs. As a nonprofit that:

(1) partners with existing nonprofits and established aid networks,
(2) utilizes grant funding for much of its costs,
(3) offsets its overall costs through the generation and sale of fresh produce and fish, operates at or below market costs and wages38,
(4) provides food insecure children with much-needed nutritious produce and fish,
(5) benefits schools, faculty, and children through education and training, and;
(6) functions as the first-ever aquaponics program likely to reverse centuries of counterproductive, culturally engrained dietary choices8, it becomes clear that this program’s benefits outweigh its costs.

8 Wright, Donley, Gualtieri, and Strickhouser. 2016.
38 “Aquaponics Salaries. 2019.”
Subsection 3: Equity

Through its goal of reducing childhood food insecurity in Baltimore City, Urban Oases will also help to rectify racial and socioeconomic inequity driven by centuries of oppression and injustice\textsuperscript{17}. Urban Oases will accomplish these tasks in many ways. First, the systems within the Urban Oases grow facility will be multipurpose. These systems will be used to educate teachers and students, while also yielding fresh produce and fish. This training and education will help to instill knowledge, skills, and interests that may shape the educational future and economic prospects of those taking part. Further, the produce and fish generated via aquaponics will be divided between two purposes: donations to The Baltimore Hunger Project (and food insecure children), and sales to various outlets to generate revenue. These donations and sales of fresh produce and fish will consequently influence dietary choice in a city stricken by food-priority (a.k.a. “food desert”) areas\textsuperscript{2} and diet-driven comorbidities\textsuperscript{8,9}.

In addition, Urban Oases itself is designed to reduce the inequality that has existed in Baltimore City for many generations\textsuperscript{11,17}. As described in Part III above, the scars of racism and segregation still manifest themselves deeply in Baltimore City\textsuperscript{17}. The results can be seen not only in the demographics most affected by food insecurity, but also in the demographic differences in wealth, health, and education, often drawn along distinctly racial lines\textsuperscript{11}. Since food insecurity affects African Americans and the poor the most, Urban Oases’ stands to have a significant impact on inequality given the demographic makeup of Baltimore City\textsuperscript{11}. By providing those in need with the basic necessities of life, a healthy dietary lifestyle, and the skills needed to pass on these benefits to others, outcomes in health and wealth will over time begin to improve toward parity with other more prosperous racial demographics\textsuperscript{11}.

\textsuperscript{8} Wright, Donley, Gualtieri, and Strickhouser. 2016.
\textsuperscript{9} Gundersen, Craig, and Hilary K. Seligman. 2017.
\textsuperscript{11} Baltimore City Community Health Assessment. 2017.
\textsuperscript{17} Badger, Emily. 2015.
**Subsection 4: Liberty**

Liberty is defined as the ability of individuals to pursue their own interests freely without impediment from authorities or institutions\(^45\). Given that Urban Oases is a nonprofit, liberty is maximized under this plan. No new taxes are proposed and participation in Urban Oases, whether as a donor or as a partner, is completely voluntary. Costs to liberty under Urban Oases are consequently negligible or nonexistent.

**Subsection 5: Administrative Capacity**

To define Administrative Capacity, one may view the words of Eisenstadt, who describes administrative capacity as the ability, “…of a political system to respond to or ‘absorb’ new demands arising from its social and international environments, which must be present for political development to occur”\(^46\). To tailor this definition better to Urban Oases, one may substitute “nonprofit” for “political system,” and “organization success” for “political development.”

One of the primary reasons that Urban Oases was conceived as a nonprofit is because there are many signs that Baltimore City itself lacks the administrative capacity to reliably institute and operate a similar program. Such signs include the resignations of its past two elected mayors\(^47\), frequent and widespread unrest\(^17\), various corruption scandals\(^48\), and a frequent inability to account for its spending\(^49\). Additionally, operating as a nonprofit affords Urban Oases an agility
and responsiveness to new environmental pressures. Finally, unlike Baltimore City as it exists today, Urban Oases will possess the personnel, knowledge, expertise, and resources needed to, “…respond to…new demands arising from its social…environments”47.

**Subsection 6: Technological Capacity**

Within the public sector, Technological Capacity refers to the, “…ability to explore, develop and/or adapt new technological solutions in public-service design, delivery and evaluation”50. As stated in previous sections, Baltimore City’s woes around corruption and finances call their technological capacity into question48,49. As a result, having Urban Oases operate as a nonprofit makes logical sense.

Urban Oases’ organizational structure and status as a private organization give it higher potential to explore and develop new technologies while also maintaining its charitable focus51. In fact, Urban Oases itself centers on the use of a relatively new and developing technology in aquaponics and can use its own aquaponics systems to test and innovate in the area of aquaponics technology. Lastly, Urban Oases will build its aquaponics systems to employ IoT (Internet of Things) remote monitoring technology, thus increasing efficiency and reducing labor costs for all parties involved52. In sum, the partnerships forged by Urban Oases and its technological focus enhance its public-service design and delivery, while constantly reinforcing the need for technological planning, monitoring, and innovation.

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47 Rasmussen, Frederick. 2019.
48 Mossburg, Marta. 2019.
Subsection 7: Legality

Unlike proposals for new legislation, executive orders, regulation, or other implements of the law, Urban Oases operates as a nonprofit. As a nonprofit solution to a public problem, Urban Oases is not mired in the legal questions which would affect many other proposals. Consequently, this proposal minimizes resource costs that would otherwise be foisted on a city government already struggling to overcome a litany of issues\textsuperscript{47,48,49}.

Political Analysis

Urban Oases will help to create more self-sustaining and resilient communities in a city where nearly a third of its residents live in poverty\textsuperscript{11}. Urban Oases will accomplish this by uniting separate aid networks in a concerted effort to impart marketable skills and nutritional knowledge. By doing so, communities will be reconnected and counterproductive cultural dietary norms will be changed, helping to reduce comorbidities and healthcare costs\textsuperscript{7}. Ultimately, food insecurity among children will be reduced and the “food deserts” of the present will begin to be replaced by communities with access to fresh and nutritious foods. The benefits from this program are many, but no program is without some costs. One way to explore these benefits and costs is through political analysis. By using this tool, it will be shown that this program’s political benefits outweigh its costs.

As a nonprofit, Urban Oases avoids many of the political hurdles and pitfalls that accompany other proposals. While this negates many of the worries normally associated with legislative or regulatory change, there are still other factors to consider, such as stakeholder groups and donor

\textsuperscript{7} Gundersen, Craig, Brent Kreider, and John Pepper. 2011.
\textsuperscript{11} Baltimore City Community Health Assessment, Baltimore City Department of Health, 2017.
\textsuperscript{47} Rasmussen, Frederick. 2019.
\textsuperscript{48} Mossburg, Marta. 2019.
\textsuperscript{53} “Concerned Parents And Civil Rights Organizations Call On The State Of Maryland To Provide More Education Funding For Baltimore Schools And Investment In Children Of Color”. 2019.
organizations. Two vital stakeholder groups involved with Urban Oases are its partner schools and the Baltimore City government.

As stated previously, Baltimore City has been plagued by corruption and scandal while continuing to hemorrhage residents; these combined factors have led to consistent budgetary shortfalls as the tax base shrinks. This exodus has hit Baltimore City schools especially hard for many years, sparking outcries from parents worried that their children will not receive the education they deserve. While the Kirwan Commission has developed a plan to nearly double Baltimore City school funding to address these issues, this plan does not address the sources of this additional funding. Until when and if these large sums of money can be found, it becomes necessary for private charity to fill the gap left by the shrinking tax base. It is here that Urban Oases can help these schools broaden their educational programs while avoiding a rise in real property taxes that are already the highest in the state.

By focusing on grant funding from the federal level and private organizations, Urban Oases can do its part toward improving the education of Baltimore City students without raising taxes. Through its use of grants from Simply Organic’s Giving Fund, Annie’s Grants for Gardens, and the Maryland Sea Grant, Baltimore City schools will be given the additional funds they need for this program without incurring additional budgetary shortfalls. The use of grant funding also avoids risking political capital on a divisive debate around increasing taxation – an act which could lead to further affluent flight from Baltimore City residents. With that said, grants are not givens. In turn, each donor organization must be assessed for its likelihood to contribute to Urban Oases and its partner schools.

48 Mossburg, Marta. 2019.
53 “Concerned Parents And Civil Rights Organizations Call On The State Of Maryland To Provide More Education Funding For Baltimore Schools And Investment In Children Of Color | NAACP Legal Defense And Educational Fund”. 2019.
Joining the Aquaculture in Action program is the first and most important step for partner schools, but not only because it gains them their aquaponics systems. By joining Aquaculture in Action, schools also join a network of organizations working together towards positive change for students and the environment. These partner organizations include the Chesapeake Bay Trust, Maryland Department of Natural Resources, Institute of Marine and Environmental Technology, Johns Hopkins Center for a Livable Future Food System Lab, the National Aquarium, and the Maryland Sea Grant. Admittance into Aquaculture in Action is thankfully a straightforward and welcoming process, with 30 partner schools in Maryland alone, and three of those 30 being in Baltimore City itself. As such, any additional Baltimore City schools should gain relatively easy admittance into this program, with Urban Oases able to provide assistance and guidance as needed. Once the initial equipment and continued support is obtained through a school’s admittance into the Aquaculture in Action program, the question then becomes, “how will the schools sustain the operation of the programs?” This is where Annie’s Grants for Gardens and Simply Organic’s Giving Fund become necessary.

Annie’s Grants for Gardens program is dedicated to “…showing future generations how sustainable food is grown [and how it] changes their lives…”, as well as, “…[c]onnecting kids to gardens…”, and helping, “…them to start [think] more holistically about their food, their communities, and the planet”. The Urban Oases’ aquaponics programs and mission accomplish all of these goals, bringing schools into alignment with the mission of Annie’s Grants for Gardens. Past recipients of their grants further show a mix of elementary, middle, and high school programs. This variety in levels of schooling serves to maximize this grants applicability to Baltimore City schools within the Urban Oases network.

Similar to Annie’s Grants for Gardens program, Simply Organic’s Giving Fund is another grant which aligns remarkably well with the Urban Oases program. As detailed in Section IV,
Subsection 5, the Giving Fund seeks to, “[p]romote access to organic food options…[u]tilize and distribute organic food/meals…[and] provide nutrition counseling and food preparation education”\(^{39}\). Given this mission statement, partner schools should have high chances of success for obtaining these grant funds. While Simply Organic does not list all of its grant recipients on their website, the organization does note that:

> There's a long list of social organizations using organic growing to improve their communities that have been supported by the fund. These organizations address the hunger of low-income families, individuals, people with health challenges and school children with organic growing — home gardens, community gardens, food pantry farms and school gardens\(^{39}\).

The target demographic of Urban Oases operations is precisely the food insecure children noted in Simply Organic’s statement above. School children are engaged in this effort, and the aquaponics systems function as school gardens. Consequently, Urban Oases’ partner schools should do very well in obtaining this grant. With the funding for the school programs themselves having been accounted for, the focus now shifts to the funding of the growing operations and other needs of Urban Oases itself.

The final grant being sought as part of Urban Oases is the USDA’s Farmer’s Market Promotion Program. As stated in Section IV, Subsection 5, Urban Oases is seeking $287,000 to fund its investment and operating costs. Per the records kept on the USDA website, the average dollar amount of grants awarded under this program is roughly $253,828\(^{41}\). In terms of monetary value, Urban Oases is well within the range of the USDA Farmer’s Market Promotion Program’s historic payouts. Furthermore, those organizations which have received these grants also reflect many of the themes and missions sought through Urban Oases. Such themes and missions include


\(^{41}\)“Farmers Market Promotion Program | Agricultural Marketing Service“. 2019.
supporting Community Supported Agriculture (CSAs) programs, the reduction or elimination of food deserts, reversing poor dietary habits, developing sustainable food solutions, encouraging community farming, and educating students and the public on nutrition. As such, the USDA’s Farmer’s Market Promotion Program is an excellent fit for Urban Oases.

All of the above notwithstanding, it is true that some stakeholders may be apprehensive about the Urban Oases program. For instance, those who produce and/or sell fresh vegetables, greens, or fish may fear the effects that this program can have. Through its operations, Urban Oases will be giving fresh produce and fish to Baltimore City residents and will be selling its produce (at discounted values) through Baltimore’s farmer’s markets and other outlets. While the charity isn’t likely to heavily affect the sales of other farmers, sales made by Urban Oases will likely constitute competition in the eyes of other farmers. However, this fear can be mitigated to some degree by noting that if Urban Oases is successful in changing cultural eating habits, overall demand for fresh produce and fish may increase in Baltimore City, thus helping all producers and vendors in the area.

Notably, the public of Baltimore City itself could also be a source of some opposition. Over time, many nonprofits and outside organizations have come into Baltimore City. Oftentimes, these outside organizations make grand promises of change to Baltimoreans. These promises of “change for the better” have rarely materialized, leading to a distrust of and lack of faith in “outsiders”. Dave Landymore, deputy director of The 6th Branch, a nonprofit dedicated to community service initiatives in Baltimore City, detailed this dynamic when recounting his own experiences in the area. However, thanks to his insight, Urban Oases has postured itself to overcome this hurdle by building trust with Baltimoreans through its programmatic structure.

Specifically, Urban Oases will overcome this issue of distrust toward outsiders by working with

57 Landymore, Dave. 2018, September 15th. Personal interview Steven Kambouris.
those organizations who have already established rapport within the community. By working with area schools, interacting with their faculty and students, and partnering with The Baltimore Hunger Project and others, Urban Oases will develop relationships with the Baltimore City community that will make its program a success and a lasting benefit to the people living there.

In sum, the political analysis of Urban Oases reflects a high likelihood of achieving its funding goals while developing the rapport necessary to obtain the community buy-in that will make or break any nonprofit trying to operate in Baltimore City. Having the support of public officials within this cohesive network will lead to greater success for all.

VI. **Recommendation**

Baltimore City’s food insecurity rate is two to three times more severe than any of its surrounding counties and is nearly double the national average. The scientific literature indicates that food insecurity drives chronic disease, premature and preventable death, poor physical and mental health, vastly inflated healthcare costs, and results in disproportionately negative outcomes for racial and ethnic minorities. Children are especially affected by food insecurity, as it increases the probability of “poor overall health, hospitalizations, and developmental problems…” Furthermore, “[a]fter adjusting for other factors, total health care costs were 23 percent higher for adults in marginally food-secure households, 49 percent higher for those in low food-secure households, and 121 percent higher for those in very low food secure households, compared with adults in fully food-secure households.” In other words, those already in the greatest need are also those most negatively affected.

According to Feeding America, a nonprofit dedicated to ending food insecurity, the annual food budget shortfall in Baltimore City is $74,689,000. Unfortunately, Baltimore City does not...
have the funds to meet this shortfall. In large part, this is due to Baltimore continuing to lose its affluent residents – a trend that stretches far back into the city’s troubled past\textsuperscript{17,19}. In fact, Baltimore City has seen a reduction in its population for the last four consecutive years\textsuperscript{16}. Sadly, this urban flight has disproportionately affected the poor and minorities in the present just as it did in the past, when racial minorities were blocked from leaving Baltimore City through racially discriminatory policies and laws\textsuperscript{19}.

**Figure 6:** Urban flight has been a primary contributor to the urban decay that now blights many areas of Baltimore City\textsuperscript{5}.

Reasons for this urban flight are many and hotly debated, but among them are the very tax rates employed by Baltimore City itself\textsuperscript{48}. Baltimore City’s real property taxes are already the

\textsuperscript{5} *Food Insecurity in Maryland.*
\textsuperscript{16} “Baltimore's Population Continues To Plummet: Census Data”. 2019
\textsuperscript{17} Badger, Emily. 2015.
\textsuperscript{19} Rothstein, Richard. 2015.
\textsuperscript{48} Mossburg, Marta. 2019.
highest in Maryland and are twice that of surrounding counties, leading many families and homeowners to leave the city. These facts make raising property taxes for the city’s residents an untenable option to resolve the food insecurity experienced by Baltimore residents. Ergo, a more creative solution is needed.

Aquaponics are highly adaptable systems that can be operated in urban environments. Additionally, they offer a view into the future of sustainable farming that will be integral to feeding future generations and preserving the environment. Urban Oases will bring this new technology into classrooms across the city, imparting marketable skills to the faculty and children taking part in the program. These systems will each produce 250 pounds of fish and 50 pounds of leafy green vegetables per month, then donating this fresh produce to those experiencing food insecurity. By partnering with established nonprofit aid networks like The Baltimore Hunger Project, Urban Oases will first reduce food insecurity among Baltimore City’s most vulnerable demographic: its children.

While others may point to existing programs like SNAP as solutions to food insecurity, these programs are being cut (through eligibility requirements) rather than being expanded. As a nation, the U.S. is $22 Trillion in debt and annual deficits are on the rise. Furthermore, “…[the] rates of food insecurity among [SNAP] recipients are about double the rates among eligible non-recipients…and these higher rates remain even after controlling for observed factors.” In light of these facts, the issue of food insecurity in Baltimore City should be addressed in an innovative way through the nonprofit sector.
Urban Oases will reduce child food insecurity, impart marketable skills, generate interest in sustainable technologies, reverse counterproductive cultural dietary norms, reduce chronic disease rates, reduce food priority areas (food deserts) and invigorate communities by reconnecting people with one another. Urban Oases will serve to not only help those in need; it will impart the skills and perspective required for those now in need to help others and themselves.
Curriculum Vitae

Steven Kambouris was born on March 6\textsuperscript{th}, 1984 in Baltimore, Maryland.

\textbf{Johns Hopkins University}
\textit{Masters in Public Administration} \hspace{2cm} September 2017 – Present
GPA: 4.00 Institutional
\textbf{Related Coursework}
Legislative Language and Policy Making; Public Policy Evaluation and the Policy Process; Fundamentals of Quantitative Methods; Proseminar: Essentials of Public and Private Management; Economics for Public Decision Making; Data-driven Campaigns and Elections; Fundamentals of Nonprofits and Nonprofit Management
Capstone: Urban Oases

\textbf{Augusta University} (formerly Georgia Regents University)
Augusta, GA \hspace{2cm} September 2014 – May 2017
\textit{Bachelor of Arts in Political Science}
\textit{Bachelor of Arts in Sociology}
GPA: 4.00 Institutional / 3.91 Overall
\textbf{Related Coursework}
Constitutional Law: Distribution of Power; Constitutional Law: Civil Liberties; Criminology; Social Problems Analysis; Judicial Process; Methods in Social Research I; Methods in Social Research II; World Politics; Politics of Latin America; Social Deviance; American Political Thought

\textbf{Cochise College}
Sierra Vista, AZ \hspace{2cm} September 2002 – October 2003
GPA: 3.76
\textbf{Related Coursework}
Digital Circuits and Systems; Linux Operating System; Essentials of Networking; Advanced Microsoft Server; Microprocessors and Microcomputers; Semiconductors and Transistors; Linux System Administration

\section*{WORK EXPERIENCE}

\textbf{American Fisheries Society}
\textit{Meeting and Program Coordinator} \hspace{2cm} May 2018 – Present

\begin{itemize}
  \item Organized and executed the logistics and scientific program for the first ever joint meeting between the American Fisheries Society and The Wildlife Society in Reno, Nevada in 2019, successfully hosting over 4,000 fisheries and wildlife professionals, educators, and state and federal officials from around the country and the world.
\end{itemize}
• Created the new AFS Center for Fisheries Technology and Collaboration, initiating the new Tech Talks Program and deepening the mutually beneficial collaboration between fisheries vendors and fisheries professionals.
• Recruited over 15 new fisheries vendors to the AFS trade show, bringing in over $20,000 of additional meeting income to the 2019 joint annual meeting with The Wildlife Society.
• Organized and executed the logistics and scientific program for the successful 2018 annual meeting of the American Fisheries Society, despite only having been in the organization for two months prior to the meeting.

**United States Army**

*National Security Agency Georgia (NSAG) Help Desk Officer in Charge (OIC)*

*706th Military Intelligence (MI) Group Maintenance Officer*

Fort Gordon, GA  
October 2010 – May 2014

- Led the Command and Control Network Operations Center (C2NOC), an integrated computer, network, audio visual multimedia (AVMM), and hardware maintenance operation for NSAG.
- Supported over 5,000 end users and associated equipment, communications lines, and mission systems.
- Provided leadership, mentoring, and development for 1 NSA civilian, 1 Army Civilian, 20 contractors, 10 Senior Non Commissioned Officers, and over 80 NCOs and Soldiers.
- Served as the 706th MI Group Maintenance Officer and 707th MI Battalion Chemical, Biological, Radiological, and Nuclear (CBRN) officer.

*Intelligence & Electronic Warfare Shop OIC*

Fort Carson, CO  
May 2008 - September 2010

- Operated as the 1st Platoon Leader for B Co, 4th Brigade Special Troops Battalion, 4th Brigade Combat Team, 4th Infantry Division during Operation Enduring Freedom (OEF) in Afghanistan May 2009 through May 2010.
- Fielded and supported the 1st Satellite Communication On-The-Move (SOTM) System in Afghanistan, providing communication lines and geolocation intelligence to higher echelon intelligence activities.
- Provided technical guidance to senior commanders and leaders in Regional Command-East, Afghanistan.
- Provided leadership, mentoring, and development for eight NCOs and thirty Soldiers.
- Responsible for the maintenance of: six major end item SATCOM and electronic intelligence intercept systems, ten additional portable electronic intercept systems, multiple servers and their accessory equipment; network services, software applications, and operating systems.

*Tactical Unmanned Aerial Vehicle (TUAV) Unit Trainer*
Camp Taji, Iraq          October 2006 – May 2008

- Responsible for the maintenance and flight readiness of four Unmanned Aerial Vehicles.
- Selected and trained all Crew Chiefs, Technical Inspectors, and Quality Assurance/Quality Control (QA/QC) NCOs.
- Managed multiple maintenance services and flight hours to ensure maximum mission readiness.
- Conduct preflight inspections as crew chief, ensuring the safest flight possible. Completed over 1,000 accident free launches.
- Completed all required services to maintain mission readiness.
- Collaborated with other units to create a 24 hour fully mission capable flight line, supporting six brigades within the Area of Operations.
- Inspected Soldiers’ maintenance for completion and correctness as Technical Inspector and QA/QC NCO.

TUAV Unit Trainer

- Responsible for the maintenance and flight readiness of four Unmanned Aerial Vehicles.
- Selected and trained all Crew Chiefs, Technical Inspectors, and Quality Assurance/Quality Control (QA/QC) NCOs.
- Managed multiple maintenance services and flight hours to ensure maximum mission readiness.
- Conduct preflight inspections as crew chief, ensuring the safest flight possible. Completed over 1,000 accident free launches.
- Completed all required services to maintain mission readiness.
- Certified five personnel in the duties of crew chief, resulting in the first unit on Fort Carson to complete reset training with no accidents.
- Inspected Soldiers’ maintenance for completion and correctness as Technical Inspector and QA/QC NCO.

TUAV Crew Chief
Camp Al Taqqadum, Iraq       August 2004 – August 2005

- Responsible for the maintenance and flight readiness of four Unmanned Aerial Vehicles.
- Conduct preflight inspections as crew chief, ensuring the safest flight possible.
- Completed all required services to maintain mission readiness.
- Inspected Soldiers’ maintenance for completion and correctness as Technical Inspector and QA/QC NCO.
- Responsible for ordering and maintaining all stock parts used to maintain the air vehicles and accessory equipment.
Camp Essayons, Korea       November 2003 – July 2004

- Responsible for the maintenance and flight readiness of four Unmanned Aerial Vehicles.
- Conduct preflight inspections as crew chief, ensuring the safest flight possible.
- Completed all required services to maintain mission readiness.
- Responsible for ordering and maintaining all stock parts used to maintain the air vehicles and accessory equipment.

PROFESSIONAL ACHIEVEMENTS

- Graduated summa cum laude from Augusta University in May 2017
- Conducted Oral Presentation at the Southeastern Undergraduate Sociology Symposium (SEUSS): *The Age of the Fox and the Lion in the Shadows*
- Deans List: Fall 2014, Spring 2015, Fall 2015, Spring 2016, Summer 2016, Fall 2016, Spring 2017
- Inducted into the Alpha Beta Beta Chapter of The National Political Science Honor Society Pi Sigma Alpha
- Awarded Augusta University Model United Nations Study Abroad Scholarship
- Selected for promotion to Chief Warrant Officer Three (3) in July 2014.
- Recognized as the NSAG Officer of the year in 2011, 2012, and 2013.
- Earned the Distinguished Honor Graduate award for the April – May 2008 Warrant Officer Candidate School at Fort Rucker, AL through physical competitions and GPA.
- Implemented a new technical training program resulting in NSAG’s technical repair division being recognized number 1 in the NSA enterprise in 9 of 12 months measured.
- Led the entirety of the NSAG Information Technology support operation during the government shutdown of Oct 2013, maintaining local and worldwide intelligence support for NSAG operations
- Conducted an AR 15-6 investigation at Fort Gordon GA; the investigation was later redacted and adopted as the new Fort Gordon standard for all subsequent 15-6 Claims investigations
- Completed over 5,000 accident-free flight hours during OIF 06-08.

TECHNICAL SKILLS & CERTIFICATIONS

Military Intelligence Systems Maintenance and Integration, Integrated Technology Information Library (ITIL) Foundations Certification Level 1, Tactical Unmanned Aerial Vehicle Maintenance, Security +, Emergency Medical Technician, CBRN Officer, Combat Lifesaver

REFERENCES

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