Resilient Agroecosystems in a Changing Climate: Localized Agriculture & Carbon Emissions

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Abstract

The world has grown to rely on large-scale, industrialized farming methods. The industrialized farming style of production is characterized as having higher crop yield than other forms of farming, making it more favorable than alternative farming methods. Meanwhile, localized agriculture has been overlooked in the public eye. This literature review defines local agriculture, explains economic developments, and lists the benefits of increased reliance on local farming. Throughout this paper, we explore and endorse the integration of localized agriculture within large-scale urban markets. A proposed conceptual framework was developed within the writing to promote the symbiotic relationship between local markets and vendors. Overall, this review suggests the potential of localized agriculture to alleviate various social, economic, and environmental problems. Benefits include public health, improved local economy, and sustainable local farming. Given the misconceptions about localized agriculture, we aim to educate consumers on the implications and effects of their purchasing choices.

Introduction

Carbon emissions are killing the environment by slowly but fatally infiltrating cities, air systems, and communities (Feenstra, 2021). Driving causes of carbon emissions are transportation patterns and reliance on fossil fuels for energy. Transportation emissions result from cars, public transport, and food transportation patterns (Tiseo, 2024). Throughout this research paper, we will investigate and discuss the effects of localized and community-based agriculture on combating the emissions produced by food transportation systems. Purchasing food locally can reduce transportation distances and consequently lower air pollution. However, purchasing local foods can only be accomplished through the cooperation of agricultural producers and policymakers. Both producers' and policymakers' actions to incorporate local agriculture in large-scale urban markets can significantly minimize transport-related pollution, making small-scale localized farming necessary to reduce carbon emissions through transportation.

The goal of reduced emissions requires infrastructural and logistical efforts, such as efficient local transportation and communication networks between local farms and urban communities. The sources we will consult through this literature review will highlight the benefits of local food systems, explicitly reducing food miles, technological innovations that optimize local food distribution, and case studies of food systems dependent on local agriculture and local food distribution. Therefore, encouraging the incorporation of localized

agriculture in the broader supply chain involves strategic planning, marketing, and leveraging research insights to enhance local food systems' viability and sustainability, thus effectively reducing transportation pollutants.

While this review focuses on the planning process in the United States, comparable approaches to sustainability planning incorporating food systems have been seen in other locations, including Sweden, New York City, and British Columbia (Issac et al., 2022). There are three goals for the study: (1) Describe how local governments can integrate localized agriculture into food systems and other sustainability goals; (2) conclude how these changes impact carbon emissions; (3) connect these solutions to overarching goals of the Sustainable Development Goals (UNSDG): SDG 8, which promotes sustainable economic growth; SDG 9, which suggests the implementation of industrial innovation and infrastructure; SDG 17, which calls the action for strengthened partnerships. By connecting these proposed solutions to the UNSDGs, they can apply to nations worldwide. Throughout this writing, we will use the phrases carbon emissions and greenhouse gasses (GHG) interchangeably, although they slightly differ (Environmental Protection Agency, 2024).

Problem Statement

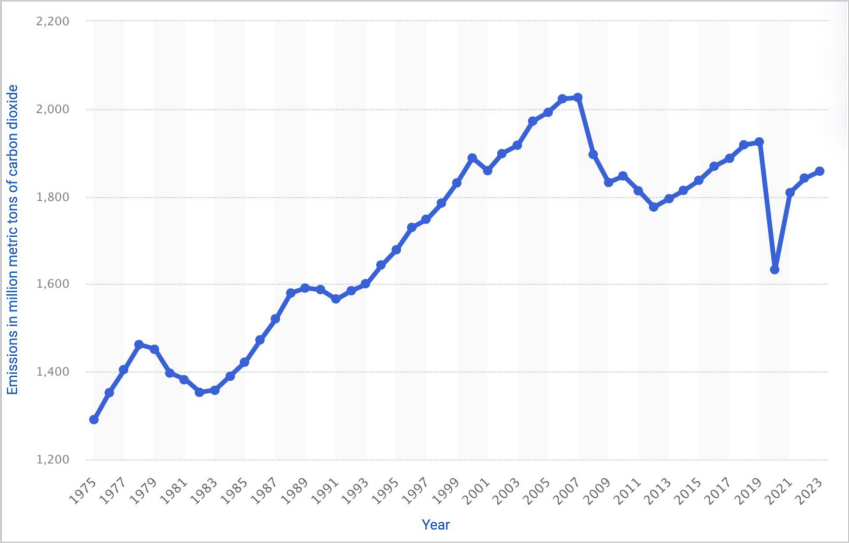
Mass consumption culture in the United States promoted by "big businesses" causes problems like excess waste and carbon dioxide emissions (Goldstein, 2017). A solution to overcoming waste and emissions is localized agriculture, and the shift to a local food production system has an optimistic outlook. A study that modeled urban farming (UF) in Britain advocated the local food production system as an instrument to increase urban sustainability by reducing food-related transport and tapping into local resources (Goldstein, 2017). Additionally, a study reported to the Cooperative Research Centre for Low Carbon Living (CRCLCL) reflected that urban road transport took up “7.3% of Australia's total GHG emissions from all sectors”, proving that the current supply chain and transportation of food has a significant negative impact on the air quality (Philip & Taylor, 2014).

According to the U.S. Department of Energy (2009), transportation is the primary factor contributing to global warming in the U.S. and many other developed countries. Transportation-related CO_2 emissions exceeded two billion metric tons, or 4.4 trillion pounds, in 2007 (U.S. Department of Energy, 2009). In contrast, India's transportation-related CO_2 emissions hovered around 307 metric million tons, or 670 thousand pounds (Tiseo, 2024). However, even though incorporating local agriculture would reduce fuel usage over time, a survey conducted by Golicic finds that less than 10% of 500 companies have addressed the environmental impacts of transportation, and even fewer are actively implementing change (Golicic et al., 2010). These statistics were confirmed in recent years and have been supported by the significant rising trend of greenhouse gasses in the United States (Figure 1; Tiseo, 2024). The graph outlines each year's corresponding carbon dioxide emissions from all transportation in metric millions within the United States. From 1975 to 2019, there has been a gradual increase in carbon dioxide emissions from transportation, except in 2020, which had a negative trend in carbon dioxide emissions due to the coronavirus pandemic (Medhi, 2020). With an increasing death toll and less consumption and travel patterns, carbon emissions decreased significantly. After the downturn of coronavirus, the expected trends of transportation and carbon dioxide emissions steadily increased from 2021 to 2023. However,

with the pandemic and unprecedented travel and work restrictions, environmental improvements were ensured, including reduced greenhouse gas emissions, lower particulate matter, and decreased air pollution (Tiseo, 2024). This decline proves that, as a population, we can reduce our carbon emissions with better organization strategies, such as the ones proposed in this literature review. This figure proves that transportation contributes to much pollution and needs monitoring and subsiding.

Figure 1.

Carbon Dioxide Emissions From Energy Consumption in the Transportation Sector in the U.S. from 1975 to 2023 (in Million Metric Tons of Carbon Dioxide) (Tiseo, 2024).



Developing an integrated food system that considers various sustainable elements at different governmental stages (i.e., local, state, and federal) is necessary to ensure the future of food systems and decrease emissions. However, the difficulty is resisting the need to design and implement a single integrated food system model that "fits all". Instead, an integrated food system that recognizes the unique objectives of local communities and encourages adaptive responses throughout the global system. An individualized approach underlines the role of the UNSDG 17, which aims to strengthen the role of partnership and sustainable development. Various local requirements must be addressed to develop more extensive, mutually advantageous national and international collaborations.

Methods

We gained access to many different research papers, literature reviews, and informative sources by utilizing Virginia Tech Library resources. We explored a variety of search engines, including but not limited to JSTOR and EBSCO to compile reliable and authentic sources. These sources will be referenced throughout the review. When searching databases, we used the keywords “localized agriculture,” “carbon emissions,” “greenhouse gasses,” and “urban centers.” We utilized an unstructured research process and chose sources based on our

discretion. The sources were selected based on their relevance, accuracy, and credibility. We used approximately 43 sources. In doing so, we effectively reduced bias by referencing articles on opposing sides of our prompt. Furthermore, we were made aware of the benefits and limitations of our proposed solutions.

In addition to these resources, we also had guidance from various individuals. We worked under the Virginia Governor's School for Agriculture guidelines and rules. Credit is also given to the program director, Dr. Brett Milliken, and the on-site director/graduate student, Maggie Morris. Both of which planned the program and its structured regimen. Most directly and integrally, we worked under and with the guidance of the Governor's School Leaders, Ellie Bowman and Cara George. These individuals provided instructions and informative recommendations on all aspects of this project.

Throughout Global Seminar sessions, lessons, and assignments, we attained the ability to analyze our question with depth: We came up with possible counterclaims with Force Field analysis. We effectively utilized the sources we found during a library seminar, which discussed topics such as reliable research and APA citation formatting, which we utilized throughout this review. These skills will be used to support our claims and evidence with the validity of various sources.

Background

Local vs. Large-scale Farming Production

There are several, often contradictory definitions of "local food". Generally, local food indicates food produced in the same city or state or cultivated within a few miles of the sale site (Martinez et al., 2010). Localized farming or agriculture may refer to food sold within an alternative market (Coelho, 2018). It could also apply to food that embodies the distinct qualities of a specific location or has cultural meaning or worth there (Sonnino, 2007). Governments and organizations have varying definitions of "local food" due to the term's subjectivity. The Food, Conservation, and Energy Act, which was passed by the U.S. Congress in 2008, defines a product as a "local or regionally produced agricultural food product" if either of the following two conditions are met: (a) the product is produced in the state in which it is marketed; or (b) the total distance traveled is less than 400 miles (roughly 644 km) from the source (Martinez et al., 2010). In contrast, in Canada, food is produced in the province or territory where it is sold, and food is sold just across provincial boundaries. These boundaries are within 31 miles (50 km) of the space of origin, which is recognized as "local" by the Canadian Food Inspection Agency (Canadian Food Inspection Agency, 2014). Each geographical location has different definitions of a singular term; however, all can be applicable in the view of this literature review.

Integrating sustainable food production, processing, distribution, and consumption in local farms aims to enhance the local economy, environment, and society (Feenstra, 2002). Hence, "local food" is a subset of the more general ideas, such as local economy, which advocates for patronizing businesses close to where consumers are making their purchases rather than those produced elsewhere. Local food can, therefore, be characterized by the features of the food supply chain and its social impact rather than only being a geographical

concept tied to the distance between producers and consumers (Martinez et al., 2010).

The surrounding environment, economy, and health factors shape local food systems. Thus, the ideas of food security and economy are also included in the local food system. The three fundamental parts of food systems are biological, economic-political, and sociocultural. The method or process by which food is created is called the biological component. The political and economic components are the institutional regulation of the food system and the moderating of various interest groups. The socio-cultural components are interpersonal connections, community ideals, and cultural ties that affect an individual's food consumption (Coelho, 2018). All three of these fundamentals may affect where consumers source their produce.

Large-scale farming, or industrial agriculture, is another variation of produce from which a consumer can choose. To preface, not all large-scale farms utilize industrial agriculture; however, some do so to yield sufficient nourishment to feed the population. Maximum plant and animal production on restricted land is the main goal of intensive and industrial agriculture. It uses high-tech equipment, seeds, animals, and concentrated zones of application of chemical fertilizers, pesticides, herbicides, and water to justify its "intensive" designation (Khatoon, 2023). Additionally, industrial agriculture uses a lot of chemicals, plowing, monoculture farming, irrigation, and machinery; which reduces the need for human labor in contrast to localized agriculture. However, industrial agriculture and animal welfare are frequently at odds with producing meat and dairy products. Concerns about ethics arise because livestock are commonly kept in close quarters, hormone-accelerated, and intentionally bred to increase productivity. For example, one such ethical concern can be seen within Concentrated Animal Feeding Operations (CAFOs). CAFOs are the official term for establishments that confine many live animals for longer than 45 days a year and feed them inside their cages instead of letting them graze (Natural Resources Defense Center, 2020). According to the USDA Economic Research Service (2024), industrialized agriculture poses risks to human health and the environment. However, it has frequently been promoted as the only way to end world hunger and food insecurity, paralleling the public's reliance on these goods.

Small and large-scale farms each offer consumers different options. Both have highly beneficial outcomes and negative concerns. In moderation and with consumer education, they can coexist symbiotically. However, the problem arises when the public is unaware of options beyond industrial agriculture and overlooks localized agriculture. This introduces the need to embed local agriculture within large-scale urban markets, similar to industrial farming.

Growing Urban Cities and Grocery Stores

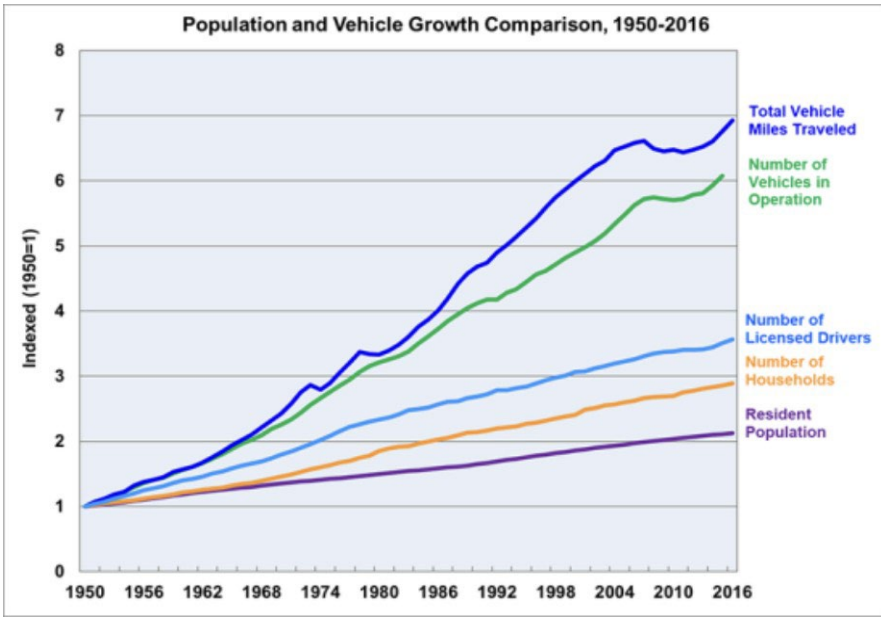
The Second Industrial Revolution began in the second half of the 19th century, after the Civil War. This period resulted in a shift of Americans from a rural, agrarian society to a country dominated by urban cities. Due to new mechanical advancements, fewer individuals were needed as manual labor on farms, and more young individuals moved to metropolitan cities, hoping for economic prosperity. From 1870 to 2020, the United States population has grown from 38 million to 331 million, many of which are housed in densely populated urban centers (U.S. Census Bureau, 2020). This rapid growth in population raises concerns over food

security and the transportation of food in urban cities.

One act in particular, the Federal-Aid Highway Act of 1956, also known as the National Interstate and Defense Highways Act, created an increased reliance on automobile consumption and usage (Yuko, 2021). The graph below shows a rapid and stable increase in the number of vehicles in operation and the number of licensed drivers (Office of Energy Efficiency & Renewable Energy, 2018). The graph's statistics and upward trends show the public's dependency on automobiles and food transportation vehicles. It shows the shift within the twentieth century away from trivial forms of transportation, such as buses and bikes.

Figure 2.

Population and Vehicle Growth Comparison, 1950-2016 (Office of Energy Efficiency & Renewable Energy, 2018).



In addition to increasing reliance on transportation, urban grocery stores have doubled profits since 1992 (Statista, 2020). Due to the rising demand of growing populations, the reliance on grocery stores becomes even more significant. People in urban cities gravitate to these grocery stores as their primary food source due to its convenience and proximity (Sonnino, 2007). Although profits are expected to rise, approximately 1.3 billion tons of food are wasted worldwide, accounting for a loss of 750 billion U.S. dollars yearly (Cheng et al., 2023).

Carbon Emissions Caused by Food Transportation

Fresh produce and other commodities use large types of transportation that require mass energy to mobilize. However, there are adverse effects associated with the use of these

methods of transport. In 2022, 94% of fossil fuel-based transportation used petroleum as their primary energy source, which directly caused greenhouse gas emissions (U.S. Environmental Protection Agency, 2022). Due to their efficiency and cost, vehicles specializing in trade depend on fossil fuels for energy. Large food market industries seek to spend less on investments to achieve as much profit as possible. However, the environmental impact is significant as this method produces greenhouse gasses daily. After collecting data from 74 countries on food movement, researchers found that food transportation alone contributed to 3.0 gigatonnes of carbon dioxide (CO_2) emissions into the atmosphere in 2017 (Kreier, 2022). According to the U.S. Energy Information Administration (2024), the United States will experience a six percent increase in CO_2 emissions from motor gasoline from July to September compared to the beginning of the year in 2024. In other words, the increase will be from 261 million metric tons to 278 million. The same is predicted for 2025, meaning the United States will steadily increase the amount of greenhouse gasses in the air through the years if this issue remains.

Agroecosystems in the Economy

Specifying an agroecosystem's complexity and functional elements is essential to understanding its importance in today's economy. An agroecosystem is a place of agricultural activity regarding a biotic and abiotic ecosystem used in farming (Xu & Mage, 2001). Agroecosystem spatial borders might be as comprehensive as a landscape, a collection of nearby farms, or a tight single field. In economic terms, the functioning of an agroecosystem is to provide sufficient amounts of produce for society in markets and other agricultural companies for profit (Xu & Mage, 2001). However, global agricultural productivity is already negatively impacted by climate change, and these negative effects will almost certainly only worsen as agroecosystems face new challenges due to rising temperatures, rising CO_2 levels, and more variable precipitation patterns (Pappo et al., 2023). These factors will continue to affect our atmosphere and global health. Agroecosystems need to be modified and saved from the increasing climate change.

Implemented Policies to Support Localized Farming

Support for localized farming is the next big step in expanding innovative farming structures within cities to reduce carbon emissions caused by food transport. One of the policies currently implemented in the U.S. is the Local Food Promotion Program (LFPP). The LFPP funds various projects, such as promoting local foods from producer to consumer and expanding agricultural businesses within local communities (Agricultural Marketing Service, 2024). Farmers and food businesses can use this program to plan ways to improve their production and marketing strategies. However, there are barriers to implementing policies for local farmers, such as competition in marketing prices, high volume demands, and the availability of crop variety (Martinez, 2016). Policymakers need to consider these factors when developing an effective plan. To reduce carbon emissions caused by food transportation, future governmental policies must focus on the involvement of every local farm in urban markets, which will significantly impact the carbon footprint left behind as less food is being transported across longer distances. Mitigating the effects of economic disparities between local and industrial farming can also imply the innovation of new technologies and improving production demand.

Solutions

The goal is to address the issues regarding carbon emissions caused by long-distance food transportation (Kreier, 2022). There are many possible approaches; however, the chosen potential solutions to resolve this pending crisis are innovative infrastructure in urban centers and funding for marketing. Since switching these practices overnight to relying on localized agriculture completely is nearly impossible, it is essential to consider alternative solutions, such as utilizing eco-friendly vehicles. However, for our research, we will be working on the assumption that urban grocery stores will accept implementing local agricultural products within their market. Innovative urban localized farming techniques are also explained to keep up and supply for consumers who utilize the implemented localized agriculture. These solutions are simply proposed and have not been tested scientifically within a study.

Innovative Infrastructures in Urban Centers

The method highlighted recently is growing crops without soil in tall, controlled environments – also known as vertical farming. Culturing crops in water instead of soil is known as hydroponic plant production (Kozai et al., 2015). Although there are debates over the profitability of vertical agriculture due to the expensive initial costs and maintenance fees, the ability to grow crops year-round overrides these concerns. In 2015, indoor vertical farming of leafy lettuce was 100 times more productive than traditional crop cultivation (Kozai et al., 2015). In addition to increasing production, vertical farming decreases expenses for the transportation of produce to urban centers, lowering the amount of carbon emitted. Overall, vertical farming poses many benefits for local farmers and offers a more environmentally friendly method of agriculture production in urban centers (Oh & Lui, 2022). The vertical farming company Bustanica has been incredibly successful in Dubai, producing over 2.2 million pounds of leafy greens yearly (Siegfried, 2024). This achievement showcases the potential of supporting localized agriculture within urban cities in the United States.

While many innovative infrastructures utilize limited farming space, aquaponics stands out. Aquaponics is a unique combination of hydroponic plant production and aquaculture. Hydroponics involves growing plants in water instead of soil; however, much water flows out of the system. Similarly, in aquaculture, toxic fish waste accumulation must constantly be refreshed from the fish's water supply. Aquaponics resolves both of these pending problems. Through the nitrogen cycle, bacteria break down the fish waste from ammonia to nitrate, creating a nutritious plant fertilizer (Elliott, 2023). In addition to this effective water recycling, aquaponics can be used anytime and anywhere. Even in the frigid winters in New York City, locally grown produce and high-protein fish can be grown for urban consumers. Moreover, aquaponics provides jobs for local individuals in the agriculture industry, especially during the colder months. While there are many logistical and financial concerns regarding this system, such as the costs of raising low-priced fish in a contained environment, similar systems have been successful in Asian countries such as the Philippines (Bosma et al., 2017).

Hydroponics, used in vertical farms, enhances crops with artificial fertilizers to prevent pumps from clogging; alternatively, aquaponics utilizes natural fertilizers from fish waste. Thus, crops produced through aquaponics can be marked as "organic" for consumers, allowing

the prices to be adjusted accordingly. The novelty of aquaponics also attracts consumers to farmers markets, promoting localized agriculture in urban communities. Both methods offer differing benefits and limitations because there is no "one size fits all" solution. Instead of debating which is better, both infrastructures should be implemented to maximize outputs and minimize excess carbon emissions from transportation (Beecher, 2021).

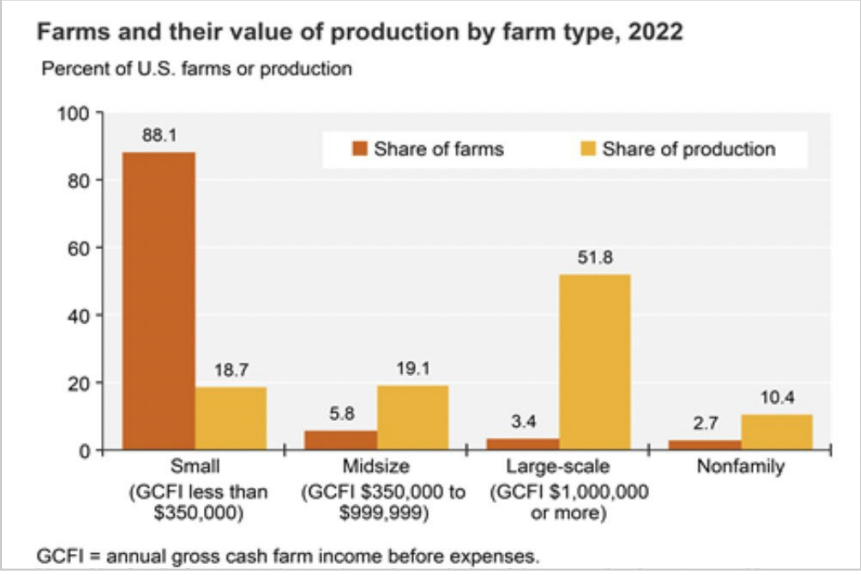
However, one should note the immense funding required to construct and maintain innovative solutions like vertical farming and aquaponics. Today, local farmers may not possess the proper tools and resources to spread these ideas to densely populated urban cities. In contrast, this economic concern will be further analyzed subsequently in the review.

Funds for Marketing

The price disparity between farmers markets and urban stores is a significant issue. This is often due to higher production costs for small-scale farmers, limited economies of scale, and direct-to-consumer sales models that do not benefit from the bulk purchasing power of large retailers. Additionally, the fresher, organic, and locally-produced goods offered at farmers markets can increase prices. The labor and time required to cultivate and produce food through localized agriculture is significantly more than that of a larger farm, causing the price increase. Large-scale farms have a gross cash farm income (GCFI) of one million United States dollars. Furthermore, they make up approximately three percent of all farms but produce more than half of the total value of agricultural production (Weatherell et al., 2003).

Figure 3.

Farms and Their Value of Production by Farm Type, 2022 (Farming and Farm Income, 2024).



In comparison, ninety-seven percent of local small farms whose produce is far less

purchased and not preferable over their larger counterparts (Figure 3; Farming and Farm Income, 2024). Statistics from the United Kingdom even go so far as to state that although most consumers are interested in local agriculture, only approximately six to ten percent of people seek to purchase (Weatherell et al., 2003). This growing disparity shows the unsupportive nature of consumers when choosing local agricultural products over mass-produced goods.

Promoting local farmers markets for consumers will make them more educated and prone to purchasing local agriculture. However, local food producers frequently need help in distribution and marketing (Medhurst & Segrave, 2007). Local farmers need to invest time in locating other crop markets, but commodity farmers can assign marketing tasks to third-party organizations (De Roest et al., 2018). In addition to paying higher handling and shipping costs per unit, small-scale farmers transporting modest volumes of commodities to nearby markets lose out on the economies of scale that come with long-distance freight transit. Medium-sized farms are typically too small to participate in commodity-based marketplaces. Therefore, direct-to-consumer marketing is not always economically feasible for them. Food for local markets, therefore, may be more expensive to provide through conventional channels, including large-scale urban grocery stores, due to high marketing and distribution expenses (Dorneich et al., 2023).

We recommend government funding to overcome these challenges and promote local farming support to the public. Promoting localized farming would be a public service for various reasons, making it a federal obligation. Consuming localized farming would mean safer consumption as it can decrease serious health complications. Small-scale localized agriculture most often does not utilize chemicals such as food additives, preservatives, pesticides, and herbicides to bolster the quality of their produce (McCurdy et al., 2022). Additionally, they rarely package their foods in materials that contain chemical substances, as their foods do not travel farther than local markets and are usually picked twenty-four hours before being sold. The quick food supply chain protects consumers from bacterial or viral contamination during distribution (McCurdy et al., 2022). Due to their freshness, local agricultural produce is packed with essential nutrients such as potassium, magnesium, and vitamins A and C. These antioxidants and polyphenols benefit cardiorespiratory, brain, and gastrointestinal health (McCurdy et al., 2022). These public health benefits should all be protected by the government's ability to pay for marketing and education of the consumers on local agricultural products.

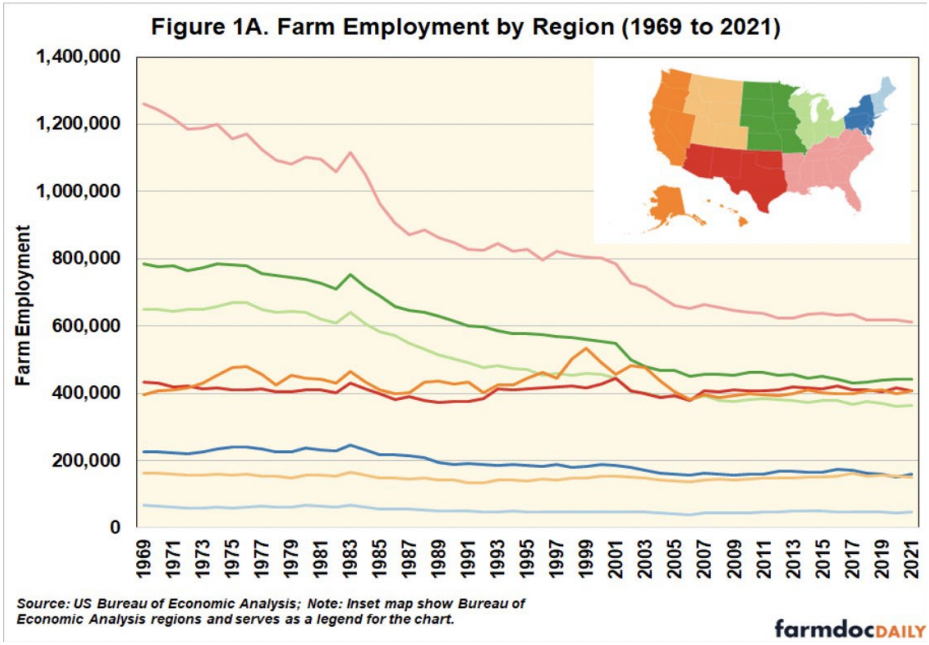
Government grants such as the Governor’s Agriculture and Forestry Industries Development (AFID) Planning Grant should be explored. The AFID Planning Grant encourages local governments and the agricultural/forestry community to collaborate on improving the integration of these industries into their community's broader economic development initiatives, as well as providing funding for creative local initiatives aimed at supporting enterprises in these sectors. In collaboration with local governments, the AFID Planning Grant program offers matching grants of up to $20,000 (for a single locality application) or $35,000 (for multiple locality applications) to assist or promote agriculture and forestry through a multitude of initiatives, including creating business or marketing plans, feasibility studies, and local ordinances for local farms (Virginia Department of Agriculture and Consumer Services, 2024). By using the AFID Planning Grant as inspiration and a

structured example of how to help localized agriculture, it can be expanded and globalized on the same basis for significant benefits.

Furthermore, local government support, including the AFID Planning Grant Program, will ultimately be beneficial for fostering individuals in agricultural careers. According to a study tracing the changes in farm employment, the number of individuals employed on farms has declined by 35% in the U.S. from 1969 to 2021 (White & Leuven, 2023). Farm employment in the southeast region, known for the crops produced from the fertile coastal plain, decreased drastically, dropping more than 50% in the previous half-century (Figure 4; White & Leuven, 2023).

Figure 4.

Farm Employment by Region (1969 to 2021) (White & Leuven, 2024)



Promoting localized farming will not only impact the consumers or the producers who are already involved in the industry, but it will also impact the individuals who consider agriculture a future career choice, offering them better plans and opportunities. Suppose the current negative trend of total agricultural employment gets overturned through governmental funds, promoting more agricultural employees in the newer generation. In that case, the role of localized agriculture will expand, thereby achieving the goal of a sustainable environment. The importance of the agricultural sector is growing due to these sustainability goals. A study revealed that the youths' attitude toward agricultural careers could be improved through guidance from governmental agencies, providing them with the prospect that lies in the path (Mat Taib et al., 2019).

Conclusions

In conclusion, addressing carbon emissions through localized and community-based agriculture is vital for alleviating environmental damage and improving urban air quality. According to a simulation of urban cropping in Seoul, South Korea, GHG emissions reduction was expected due to the shortened food mileage and the net distance of food traveling to reach the consumers (Lee et al., 2015). When urban agriculture was implemented in the Seoul metropolis, the average decrease in food mileage was 91.35 t-km for outdoor space and 99.16 t-km for indoor space (Table 1; Lee, 2015).

Table 1

Decrease in food mileage by the Seoul metropolis urban agriculture (Lee, 2015).

Decrease in food mileage by the Seoul metropolis urban agriculture.

Name of crop	Food mileage (t-km)	Decrease in food mileage (t-km)	
		In outdoor space	In indoor space
Radish	300.02	18.89	20.47
Welsh onion	228.54	11.65	12.43
Chinese cabbage	354.57	17.97	17.97
Cucumber	145.89	6.83	7.68
Cabbage	271.61	12.03	13.54
Potato	155.88	–	3.91
Raw pepper	207.32	8.28	9.39
Cherry tomato	237.07	6.12	6.12
Sweet potato	150.13	3.54	3.54
Spinach	118.28	2.30	–
Lettuce	159.28	2.14	2.53
Eggplant	57.92	0.74	0.74
Mushroom	89.82	0.86	0.86
	Total	91.35	99.16

In achieving this goal, collaborating with agricultural producers and policymakers to integrate local agriculture into large-scale urban markets will be highly beneficial. The suggested solution method in this study includes innovative infrastructure, funds for marketing, cooperation between farms of diverse sizes, and alternatives. Such solutions will be impactful by directly addressing the root cause of emissions from food transportation, promoting sustainable economic growth (UN SDG 8), and fostering innovation and infrastructure (UN SDG 9). They will also strengthen partnerships (UN SDG 17), creating a model that can be replicated globally. These actions will have a broad overall impact, inducing healthier local communities and a more resilient economy.

As individuals, our role of encouragement and support is pivotal, especially since agro-ecological issues are highly intertwined with society and have mutual impacts. According to a survey collected from the public of diverse nationalities, Scandinavian countries (Sweden, Denmark, and Norway), which are considered “one of the most advanced welfare states in the world,” showed “the greatest willingness to sacrifice" and support for the environment. This proves that public environmental support is highly relevant to the prosperity and welfare of a nation (Inglehart, 2013, pp. 4). Denmark and Sweden have among the highest percentages, 69% and 65%, respectively, on public support for environmental protection. Parallelly, China has the highest percentage of willingness to sacrifice for environmental protection, 78% (Inglehart,

2013). Both qualities are imperative to the environment, but physical action rather than thought creates real change. That action is necessary globally, not just in individual countries.

Although it is difficult for everyone in a society to make ecologically conscious decisions, these choices will ultimately save our environment. Whether that be choosing to buy local products or advocating for supportive policies, both efforts will drive meaningful changes in our future. The environment is a finite resource but is the only thing available. Therefore, the responsibility for its well-being falls to its inhabitants. The proposed solutions within this literature review offer consumers a showcase of lifestyle changes they can implement daily to decrease mainstream unsustainable practices.

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