

## URBAN AGRICULTURE

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## II. ABSTRACT

As students who reside on the NJIT campus in Newark, New Jersey, we became aware of the food desert problem in the city. Food deserts are not an issue put into the light by many, because they are prominent in low-income neighborhoods with residents who have bigger problems. As residents of Newark we chose to research urban agriculture, and how we can bring awareness for others and ourselves to this prevalent subject. We decided to look at urban agriculture as a whole in Newark and looked at the Newark Greater Conservancy and AeroFarms. Through further research and documentation we arrived at our proposal of how a new form of urban agriculture can change the way in which we live.

### III. INTRODUCTION

As the world's population approaches eight billion people and farming occupies 40% of the Earth, urban agriculture will be necessary to help feed and sustain our growth. Throughout the centuries, urban agriculture has always sustained different cities and more recently is reducing our dependence on chemicals and need for untouched land. Recently, there has been current trend of moving from rural to urban farming, due to its sustainable practices. Many organizations and corporations have been making changes in these trends, two of these being, Newark Greater Conservancy and AeroFarms. Newark Greater Conservancy is an organization located in Newark that consists of urban farms and opportunities for residents to live their lives in more sustainable ways. AeroFarms is an organization that is advancing in vertical farming, bringing more urban farming opportunities to the city of Newark. In our paper, we look at and rethink what urban agriculture is and what it can be.

#### IV. RURAL TO URBAN FARMING

Urban Agriculture is not a new trend in urban life or American agriculture production. There has always been a relationship between cities and agricultural production throughout history. Around 4,000-9,000 years ago, a trend of farming production, domestication of animals and settlement developments began occurring in several regions throughout the world. Around 3,500 years ago, early Mesopotamians were setting aside plots of lands in cities to farm. The Aztecs and the Mayans, 1000 years ago, also farmed in their urban environments. Rather than transporting food to their cities, each house compound was provided an urban *chinampa*. *Chinampas* are raised plots of land resting in a lake or swamp area and would produce roughly three to four crops a year. In Medieval Europe, cities would set aside plots of land for herb and vegetable production. According to Wide Urban World, herbs and vegetables would be sold at city markets and would be considered to provide the freshest food.

However, a shift occurred when the Industrial Revolution started changing the urban fabrics of European and American cities. In the 18<sup>th</sup> and 19th centuries, rural farm production became more efficient through the development of farm machinery, fertilizers and pesticides. There were also developments such as refrigeration and train cars that could transport food across a greater distance. This allowed for a huge shift in population towards industrializing cities and also a shift away from urban agriculture. Plots of land in cities became expensive and were not producing enough food to compete with rural farm production. However, there were countless efforts in industrializing regions of Europe and America to provide “farm colonies” that would allow urbanites to become self-sufficient. In 1898, Ebenezer Howard also developed his social theory of a “Garden

City” in which cities would be mixed with industry and urban agriculture. Rather than rely on imports, cities would become self-sufficient and sustaining. According to Oliver Wainwright, only one “Garden City” was ever able to develop as a self-sufficient community in Germany.

During the World Wars, American and Allied cities began encouraging urban dwellers to construct “Victory Gardens”. Community gardening and vacant lot cultivation put unemployed and underemployed workers as well as students to work. Gardening gave urban families the opportunity to be self-sufficient and grow their own food so that other supplies of food could be shipped over to the warfronts. In 1943, during World War II, there were 20 million gardens throughout American cities. Chicago, for instance, farmed “33,000 gardens covering nearly 1,800 acres.” (Green 2012)

Following the war, war economies for most countries shifted back and community gardens became less affordable due to the mass production of food and the ease of supermarkets. As cities declined during the later part of the 20th century, cities also became food deserts. Suburbs continuously became reliant on imported food products to large grocery supermarkets. Americans continued to hold the belief that “farmers are people possessing good old fashioned American values and common sense” (Despommier, 2010). In the 21st century, “the current food production and distribution system does deliver edible calories to the people at an affordable “price” but takes a toll on the environment via herbicides and pesticides, fertilizers and diesel exhaust and fossil fuel emissions” (Despommier, 10).

Urban residents today are not self-reliant and do not live within their means of consumption. As global populations and global warming continue to increase, cities will be at the forefront of combatting climate change. One alternative to today's current urban living is redeveloping urban farming. Urban community gardens, farms and vertical farms can allow for sustainability, profitability as well as quality food. Urban farming is not new, but is what urban cities need for the 21st century.

## V. SUSTAINABILITY OF URBAN FARMING

In today's world we are in a paradox of tearing down forests and abandoning existing farms. This way of living is detrimental to our ecosystem and causes us to lose nature's natural way of purifying our water and adding natural nutrients to the soil. Currently we are adding countless amounts of chemicals into the food that we consume to achieve these nutrients and protect the produce from pests. In order to move away from this we must not only move towards cleaner farming, but also to formulate a new strategy that also demolishes our need for destroying habitats to gain land for farming.

Urban farming is a new popular trend that not only creates new jobs but also is potentially more sustainable for the environment. Though clearing land may increase the ease of our lives it is not sustainable and harmful to the environment. In some cities often lot after lot are left uninhabited and unused. Urban farming seeks to make use of those abandoned lots allowing for new space to farm that does not call for nature to be demolished. “A city-based agricultural system would allow us to carry out lives without further damaging the environment” (Despommier 142). Not only would it stop the destruction of forests and other natural habitats but it can also allow for natural cleansing

of water and nutrients to the soil. In addition, less pollution would be produced due to decreased travel distance since the produce would be grown within the cities walls. This then cuts down the ecological footprint (Despommier 143). This also allows for the produce to be picked at its peak of ripeness and not have to be frozen or have preservatives be used.

Jobs, ecosystem restoration, reduced food miles, and elimination of use for pesticides are only some of the advantages of urban farming. Currently many companies are taking urban farming further and designing buildings for vertical farming. This not only has all the advantages of urban farming but has additional ones as well. Vertical farming would allow for year round crop production, no failure due to weather, better control of food safety, and would use less water. With vertical farming pure water would be used in addition to not using pesticides or herbicides. This would allow for a reduction of chemical contamination within the ecosystem. (Despommier 161) Vertical farming's conditions allow for less water to be used. By not using as much water not only is it more sustainable, but also it causes the plant to increase its sugar content, causing its taste to be more flavorful. (Despommier 166)

## VI. HISTORY OF AGRICULTURE AND FOOD ACCESSIBILITY IN NEWARK

Newark, New Jersey's largest city, used to be a flourishing and promising city. It was prominent in agriculture during the 17th-18th century and later industrial production during the 19th-20th century. Following political issues and rioting, Newark's image was negatively impacted. The population of Newark became comprised mostly immigrants,

and low-income families. It became known as a dangerous city. What was once a city of production, specifically food production now became a food desert.

“Food Desert: an urban area which is difficult to buy affordable or good-quality fresh food” (Google Dictionary). When a city like Newark has residents, which cannot pay for rent, find a job, or crime issues, it is difficult to find people who will raise concerns about having healthy and accessible agriculture. When they do lobby for what they should already have access to, there is no immediate action due to the lack of care for these low-income people. The financial backers of the city focus on how to make more income, not the importance of the well being of its community and environment.

As a student in Newark, it has been difficult to buy groceries nearby, unless one had a car or took the train to another city nearby. That should not be the case in a city as large as Newark, which is, as mentioned before, New Jersey’s largest city. Residents in Newark have to go out of their way to buy healthy groceries. It is also alarming, that awareness to such an issue isn’t brought up unless one is put in the living situation. “In Newark, where residents and lawmakers have been lobbying for more grocery stores for decades, the city established a Fresh Foods Program last fall (2010) to use grant funding to attract more supermarkets to the city and persuade existing stores to offer more fresh produce, meat and dairy products.” (Heyboer). Residents have been fighting for a healthier environment; it has taken decades for their voices to be heard. One resident of Newark was forced to travel to the city of Kearney to buy fresh and healthy produce, because there was none available for her in her own city. (Heyboer) It is unacceptable that the state’s largest city does not have access to fresh grown produce and grocery stores near their homes.

After decades of demand from the community of Newark, the city is finally emerging, from a food desert. There are plans to bring more grocery stores and facilities to the city. “Economic development is revitalizing Newark. But beyond economic benefits, development also holds the promise of improving the health and well-being of Newark residents.” (Navarro, Leuchten). A new ShopRite has opened in the city, and a Whole Foods is currently being constructed in the downtown section. There is also a new method of Aeroponic farming being introduced by AeroFarms, in the Ironbound sector of Newark. These are promising efforts being made by the city of Newark. These new facilities have the potential to bring jobs, income, and hope for those in need. Urban agriculture has the power to change the well being, success, and most importantly the health of its inhabitants.

## VII. NEWARK GREATER CONSERVANCY – COMMUNITY GARDENING

Greater Newark Conservancy is a program that strives to improve New Jersey’s urban communities. The organization holds several projects that help to improve the quality of the environment through environmental greening and justice as well as help local citizens through providing jobs, environmental education, and a better ecological footprint for their city.

One large way that the organization is making a difference is by purchasing unused lots and converting them into gardens. Currently the organization is in charge of two main gardens, Court Street Urban Farm and Hawthorne Hawks Harvest Farm. Court Street Urban Farm is an acre of land located next to Krueger-Scott Mansion, which was once owned by a city beer baron. On this acre they are able to produce 15,000 pounds of produce during a season as well as gather fresh eggs from chickens raised on the site and

collect honey. Hawthorne Hawks Harvest Farm is larger than Court Street Urban Farm, covering 2.5 acres of land. The farm has been in production since 2012 when it took over an empty lot that was intended to be a school. The farm produces produce such as eggplants, peppers, tomatoes, beans, squash, and melons. It is also the home to 75 fruit trees, which include apple, peach, pear, fig and cherry trees.

In addition to these farms the organization also holds an Adopt-A-lot Program and sells home garden supply kits so that residents can begin to farm on their own. There are two different types of lot leasing that can be done through the Newark Greater Conservancy. In one option, residents can rent lots for 10 dollars a year residents, which would include a 4 by 8 bed to grow their own produce. In another option residents can participate in the Adopt-A-Lot program where they can lease a city owned lot for a dollar a year. This payment includes technical assistance, soil and raised beds, seeds and workshops. Greater Newark Conservancy also has kits that residents can buy to farm in their own back yard. These products include compost/mulch and raised garden beds.

Adding to the sustainability of the organization they also hold a compost collection and a Youth Farm Stand. The compost program has several pick-up locations located throughout Newark. By having these pick-up locations they are able diminish food waste by recycling the collected composts as nutrients for soil. With the organization's hard work they were able to collect 4,000 gallons of waste within two years. The Youth Farmstand has also been successful, now running for its fourth year. Here, residents can buy produce from the urban farm that is not only at a good price but also allows them to make a more ecological choice. The stand not only sells thousands of pounds of produce a year but also allows for internship opportunities that provide high

school students to help out in their community as well as begin to be active in an ecologically sustainable organization. The internship teaches them about nutrition education and urban agriculture, as well as how to run a small business in a hands-on environment. The farmstand is not the only program that reaches out to help the community through education and involvement. In addition to various education programs, Greater Newark Conservancy holds programs that help the youth that have steered to the wrong path get back to the right one.

### VIII. AEROFARMS – VERTICAL FARMING

In 2004, a micro-agribusiness began developing in the Finger Lakes region of New York State. For ten years, AeroFarms farmed traditionally and began developing plans to create a system of Vertical Farming. Dickson Despommier in 2011 published his book, *The Vertical Farm: Feeding the World in the 21st Century*, in which he described the idealized form of Vertical Farming. Sustainably, Despommier envisioned that Vertical Farming could transform agriculture and urban living.

AeroFarms strives to be the driving force in developing Despommier's ideal views. According to their website,

“AeroFarms is on a mission to combat our global food crisis by leveraging our patented technology and farming locally. We do this by building, owning and operating indoor vertical farms that grow safe, nutritious food in a way that is respectful to the planet and the communities in which we grow.”

AeroFarms plans to change agriculture in the 21st century by changing traditional supply chains and growing seasons. According to its website, AeroFarms's vertical farming facilities will use 95% less water and yield 70% more herbs. It also claims that it will transform the tri-state area by growing local food sustainably. AeroFarms also claims that it is innovative, caring, responsible, and engaging. The website also states that AeroFarms is producing high quality food while bettering the community. However, AeroFarms "wants to be a force for good in the world-for the planet, for our stakeholders and investors, for our employees and for the people we feed." (AeroFarms.com)

In 2015, this revolutionary corporation shifted its operations to Newark, NJ to be closer to the tri-state area. Currently its main facility is at 400 Ferry Street, Newark, NJ, 07102. AeroFarms became a commercial leader in Vertical Farming when it developed its own system of Vertical Farming, Aeroponics. Aeroponic is a system of farming that mists the plants with nutrients, water, and oxygen. Plants grow on trays under LED lights in which photosynthesis can be maximized or minimized based on the plants typical growing environment. Aeroponics can lead to more harvest cycles in a year, more plant growth and production, and less environmental impact. AeroFarms claims that by using this technology, it can produce 75 times more plants than traditional farming. AeroFarms also claims that it will use a pest management system that requires no fertilizers. The corporation also believes that by using MIT's Data System<sup>1</sup> they can change environment control systems to grow any type of herb or vegetable.

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<sup>1</sup> MIT Data System: Caleb Harper developed a Food Computer in which it compiles information about different herbs and vegetables. It collects data on their ecosystem, the amount of water and day lighting they need to grow. This is an open source initiative that anyone can access and also upload data.

Environmentally, AeroFarms claims they are making a global impact on water, pesticides, land, fossil fuel use and the economy. They argue that they are using 95% less water than traditional field farming. AeroFarms also recirculates grey water into the system. Pesticide use and fertilizer runoff is affecting the natural ecosystem. However, because AeroFarms does not use soil there is no need for either. They have no runoff and because these plants are grown indoors they require no pesticides. Farming typically takes up about 40% of the world's land. However, AeroFarms claims that Vertical Farms will only take up 1% of the Earth's land and will drastically reduce the need for large-scale rural agriculture. Because vertical farms can be located in urban environments, transportation costs of food will be drastically reduced. Shipping internationally will no longer be required and fossil fuel use will be reduced by 98% according to AeroFarms. AeroFarms also employs local workers and is now part of revival movement in locating businesses and industries in Newark, NJ. This improves the local economy and transforms the neighborhoods of Newark. AeroFarms also requires all their employees to read Dickson Despommier's book, *The Vertical Farm: Feeding the World in the 21st Century*.

AeroFarms today is growing herbs and vegetables and selling them locally in the tri-state region at locations such as Farmer's Markets, Restaurants, ShopRite and the online store of Farmigo. Although their market range is still low, AeroFarms has been quickly growing their investors. Currently, AeroFarms is being back by Goldman Sachs, Prudential Financial, GSR Ventures, Wheatshaf, Middleland Capital, and Mission Point Capital Partners. These investors have contributed money to allow AeroFarms to develop a new facility located at 212 Rome Street, Newark, NJ, 07102. In Spring 2016,

AeroFarms will be open a 70,000 square foot facility that will be the world's largest vertical farm. This facility will produce two million pounds of greens and herbs and will be sold locally throughout the tri-state region. The facility will also create 40 new local jobs. They believe this new facility will revolutionize the tri-state region and will encourage more investors to invest and also develop throughout New York and other international metro regions.

However, this is all idealized and is the vision that Dickson Despommier believed in. Over the past month, we contacted AeroFarms and were instructed that they would only be able to talk at their Farmer's Markets which happen on Ferry Street every Wednesday from 4-6pm. Instead, we decided to explore this revolutionary corporation's facility at 400 Ferry Street and 212 Rome Street. We felt that AeroFarms is actually a controversial, secret, capitalistic and militaristic corporation with a sole goal of controlling the market economy for vertical farm production.

When we arrived at the 400 Ferry Street facility, we found that all that was there on the outside was a banner that said AeroFarms. We rang the doorbell not expecting a welcome and were required to sign in and wait until someone was able to meet with us. Ms. Alina Zolotareva, the Director of Marketing, met with us and we were then immediately asked, "Who are you and what do you want?" Taken back, we mentioned that we were architecture students at NJIT and were doing a research project on urban farming and had a few questions. We were instructed to forward any questions to her email and that we would need approval from her bosses to answer any of them. We were also encouraged to have our professor write a letter confirming that we were students. We were also able to take a few photos of the facility. As we left, we noticed that 400 Ferry

Street used to be a factory and then a paintball facility. We questioned if this would have any impacts on the health and quality of the plants, the quality of the air, the water as well as how their environmental control systems and Aeroponics work.

We then left to view their new 212 Rome Street facility that is being constructed. We took photos of the exterior building and found that this facility had three security guards that approached us when we started to take photos. However, we did not speak with them. Following up, we sent Alina Zolotareva an email asking her basic questions about AeroFarms. We also questioned the structure of their facilities and the impacts different environment control systems had on the quality of food. Because Aeroponics uses water, we were curious about where the water comes from and if there could be lead in the water. According to AeroFarms website, their vertical farming facilities do not use any pesticides. However, when we began researching AeroFarms, we discovered a controversial statement. According to Source Magazine, AeroFarms uses an Integrated Pest Management System, which is a system that utilizes chemicals if needed. Lastly, we researched more about the locations of the facilities in Newark. According to the Dirty Little Secret podcast, we found that the new 212 Rome Street Facility is being constructed right next to an Agent Orange contaminated site. The site during the 1940s through the 1970s was where Agent Orange was dumped and buried. In the 1970's, the Ironbound Stadium was constructed on this site. In the 1980's, the Ironbound Recreation Center was being constructed and workers discovered high levels of PCB's and Agent Orange that were left behind after the destruction of a plastics facility. In 1987, the Federal Government closed the stadium and declared it a superfund site. It took 28 years until the city of Newark and Celeanse, a cleanup corporation, agreed to fund the cleanup.

It is costing the city \$2.3 million dollars to drain and cap the field. However, it has been a year since the agreement and little work has been done. We wanted to know if this would affect the new 212 Rome Street Facility that is right next to this site.

Following our emails, we received two emails from Ms. Alina Zolotareva, Director of Marketing and Marc Oshima, Co-Founder & Chief Marketing Officer.

1) Dear Maurie,

Thank you for your note. We love to work with students and try our best to honor local requests as much as possible. As you know, we are a fully operating 24/7 commercial operation, so we struggle to find time and resources to accommodate the hundreds of inquiries we typically receive on a regular basis. I have forwarded this request on to our team and we will get back to you as soon as possible if there is an opportunity to move ahead.

Thank you for your interest and consideration. Please check in with me later this week!

Warm regards,  
Alina

2) Thank you for your interest in AeroFarms.

As you can imagine, we get extensive inquiries, and unfortunately, at this point in time, as a small scaling business, we are not set up to be able to help with different class assignments. As we grow, we would love to be able to work more closely with you and NJIT overall.

For reference, I have included a one pager on our company and the unique benefits.

Marc Oshima  
Co Founder + Chief Marketing Officer

Ironically on its website, AeroFarms claims to be engaging with the community, yet they could not answer any of our questions. They claimed that they are a small, scaling business but when we researched on whom their stakeholders are, we discovered that Goldman Sachs and Prudential Financial are behind their growth. The secrecy behind

their technology and development made us question Vertical Farming and Dickson Despommier's view of the idealized form.

Although Vertical Farming conceptually seems good, we discovered that there are some negative aspects to it. Lloyd Alter is a Canadian architect who has been a critic of the vertical farming movement. According to Lloyd Alter, in the construction of a vertical farm, there is an increase of energy at the site compared to traditional farming. Natural day lighting requires a building to heat and cool the building throughout the day and night. LED lights and the mist machines also require large amounts of energy. This may also be equal to the amount of fossil fuels used in traditional farming. George Manibot, a global warming activist, "calculated that the cost of providing enough supplementary light to grow the grain for a single loaf would be almost \$10 or more! Some moderate estimates say that initial building costs can easily be over \$100 million, for a 60-hectare vertical farm." (Alter) It is also important to consider where in urban environments vertical farms are constructed and how contaminated sites can affect a vertical farm. Lloyd Alter argued that certain measures are necessary in order for Vertical Farms to be regarded as sustainable. Corporations need to tap into local, renewable energy sources as well as smart reuse of gray water. Stan Cox, writing on Alternet, argued "although the concept has provided opportunities for architecture students and others to create innovative, sometimes beautiful building designs, it holds little practical potential for providing food." (Cox 2010) The realized form of AeroFarms is contradicting a lot of what Dickson Despommier hoped for. Vertical Farms is still early in its development and we will have to wait and see how the company is ultimately able to contribute to our community and the environment.

## IX. OUR VISION OF WHAT URBAN AGRICULTURE CAN BECOME

After researching and learning about urban agriculture, as well as the fairly new vertical farming facilities, we have envisioned an ideal urban farming city. We propose a city, which actually uses urban agriculture to promote the health and prosperity of the city. This was a project done by Zeel Parekh, Gregory Yakimik, and Ian Villanueva during the Fall 2015 semester under the supervision of Professor Thomas Navin as a part of an Options I Studio. The project reimagines the smokestacks, which dominate Newark's skyline as vertical farm centers. This vertical farm center would serve as a means of food production, community engagement, and a center for denim distribution/recycling and sustainable design.

This project aims to connect Newark's industrial city to its parks and people. The building includes the "tower" the vertical farm, and the "hill" a smaller joint building that appears as a landscape. The vertical farm stands as a large tower to re-identify the image of Newark's smokestacks. It is meant to stand as a billboard for a new image for the city of Newark. Newark was an industrial city dominated with factories and smokestacks, which contribute smoke, pollution, and toxicity. The vertical farm center aims to contribute fresh produce, community engagement, and sustainable design. The tower consists of Aeroponic farming, which is a method of farming that uses less water, soil, and pesticides. Allowing for a more sustainable method of farming.

The produce grown in the center would then be distributed throughout local grocery stores, farmer's markets, and supermarkets. This would allow a reduction in the use of fossil fuels by keeping the transportation of produce local to the city of Newark. It also allows for the creation of jobs and revenue for the city as well. The "hill" is where

the distribution of the produce occurs. It is distributed through the city, as well as in the hill. Newark's residents will be allowed to come to the center to buy produce, and even view the farming process. The denim distribution & re-fabrication center in the hill is a place that allows Newark residents to drop off their old jeans, and recycle them. They can make new products out of those jeans, or buy a pair that is refabricated at the center. The gallery would allow for local community members to have shows and showcase their work. The "hill" also has angulations on the exterior that collect rainwater, which would be used for the production of food as well as for use in the building.

The involvement of the community makes this project such an ideal center in a city like Newark. Urban agriculture is not only about growing produce and selling it. It is about creating a healthy environment, which in turn allows for a prosperous community. Our ideal vision proposed through this project is seeing companies like AeroFarms involve its community more.

## X. CONCLUSION

As it becomes more apparent on how the current ways of living is unsustainable and unhealthy, we must change the way in which we live. We must rethink the way we farm, the chemicals we use, and the lands we destroy. Newark Greater Conservancy is providing an opportunity for Newark residents to reconnect to agriculture and produce their own food. AeroFarms, on the other hand, is a corporation that is rethinking vertical farming and how it can provide sustainable produce to the tri-state area. However, after researching and visiting AeroFarms' facility, we have discovered flaws in their mission and plans. AeroFarms seems not as community oriented, transparent and welcoming as Dickson Despommier hoped for in his book, *The Vertical Farm: Feeding the World in the 21st Century*. We envision an urban agriculture center in Newark that not only grows and sells produce but also creates a nourishing and prosperous environment for its residents. We hope to see a growth in urban agriculture that brings about a healthy change to our society.

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