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Options Paper

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Urban Agriculture and the Sustainable City:
How Policy Changes Concerning Infrastructure and Urban Agriculture Can
Economically and Environmentally Benefit Atlanta

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“Of all the underlying forces working toward the emancipation of the city dweller, the most important is the gradual reawakening of the primitive instincts of the agrarian.” – Frank Lloyd Wright, 1958

Over 50 years ago, the famed architect Frank Lloyd Wright, while advocating for the decentralization of the city, firmly believed that society longed for a return to a simpler, more natural time. While he was wrong that urbanization would fall to an agrarian society, he was right in noting the importance of food systems in the modern world. Today, society is more urban than ever; yet in the midst of the urbanization, we are experiencing what some call a ‘food revolution.’ This revolution is a conglomeration of multiple actions and movements that seek to take control over the food we consume. The ‘agrarian instinct’ mentioned by Wright is not a move back to the countryside, but rather a notion of reintroducing the agrarian into the urban-sphere.

Our current food systems are more unsustainable than ever. The majority of our food is supplied by a few dominant mega-corporations and distant mega-farms, all increasingly dependent on inexpensive oil, water, and labor. A majority of food consumed in North America today is cheap, low quality and lacking in nutrients, all factors that may contribute to our rising health-care costs and obesity rates. In 2004, for the first time, the amount of food imported into the U.S. exceeded the amount of food exported (Ladner 2011).

Why, then, is something that is so intertwined with our nation’s biggest problems so overlooked? Professional planners are heavily invested in areas concerning water, energy, climate change, air quality, and public health, yet there

is a noticeable lack of interest in food. Our current food systems inherently affect all of the aforementioned issues, and attention towards remedying these systems could help curb some of our cities most pressing concerns (Ladner 2011). The focus now should be in search of an alternative, more sustainable food model that operates at the local level; planning, policy and design will all be integral in seeking new solutions.

One such alternate model is the broad movement called Agricultural Urbanism, or AU. AU is a framework utilizing planning, policy, and design in order to develop an extensive range of sustainable food system elements into multiple local scales (Holland & de la Salle 2010). Above all, it is about establishing a framework for reintroducing food and agriculture into people's daily lives. Agricultural Urbanism is important to the planning of our cities for a number of reasons. The world is seeing an ever-increasing population, a continuing conversion of farmland into urban land, a disappearance of suitable farmland due to depleted and eroded soils, increasing water scarcity, and a continually growing dependence on oil. The United Nation's Food and Agriculture Organization estimates that in order to feed the 2050 predicted world population of 9.1 billion people, food production will have to increase by 70% (Ladner 2011, 5). As water supplies deplete and oil becomes scarce, the cost of foods requiring large amounts of water and transportation will increase and those foods will likely become less available (Ladner 2011).

As cities face these growing concerns of sustainability, it is important to recognize that food systems play an integral part in addressing these challenges.

The intent of this paper is first to assert that urban agriculture provides numerous economic and environmental benefits to cities, and second to identify ways that the City of Atlanta could take advantage of these benefits. The first part of the paper, the Literature Review, will take a broad look at why AU is a desirable land use for cities, and then identify three major areas where cities stand to benefit. The three areas that will be addressed include waste management, public land management, and stormwater management. Within each area, examples will be shown from other cities to support the proposition that AU is an advantageous land use.

Once the argument for AU as a beneficial land use is established, the latter half of the paper will posit that Atlanta could economically benefit from encouraging and allowing urban agriculture within the city. The Analysis and Recommendations section of the paper will assert and test the hypothesis that the City of Atlanta can economically benefit by establishing AU as a land use. The hypothesis will be tested by establishing benchmarks of success, scaling data from the example cities to Atlanta, and providing a land suitability criteria and analysis. A discussion of limitations and policy recommendations will conclude the paper.

To address the hypothesis, the analysis will first establish benchmarks of success and then use data from the example cities to provide scalable metrics. The analysis will then provide a brief context for the City of Atlanta and establish guidelines for a land suitability analysis to be conducted in GIS. The paper will go on to analyze the potential benefits for the city by scaling the collected data to

Atlanta's population and the amount of suitable land available in the city. Finally, the analysis will inform and identify policy changes that will allow the city to better capture these benefits.

Agricultural Urbanism offers a variety of advantages to cities in the form of social, environmental and economic benefits. While the social and environmental benefits may be more obvious, the economic benefits are often overlooked. AU is frequently dismissed as a utopian or charitable ideal, which belies its benefit as a movement that is economically viable and could provide cities with substantial economic returns. Sustainability is usually thought of in the ecological sense of conserving or preserving resources; however, 'sustainable' actually implies something that can be upheld or maintained at a certain rate or level. If an idea is not economically viable, it is not wholly sustainable. The first part of this paper will examine urban agriculture from an economic lens, specifically as it relates to economic and environmental benefits to cities.

Literature Review

I. Urban Agriculture: A Desirable Land Use

From an economic standpoint, cities and their citizens stand to benefit a great deal from urban agriculture. For one, growing local food decreases the distance that food must travel. Food prices decrease because they no longer have to account for the energy and oil required by transportation. Another broad benefit of local food is that it supports the local economy. For example, a Seattle study found that adjusting 20% of the city's food dollars into locally directed spending would introduce upwards of \$1 billion a year into the regional economy (Ladner

2011, 103). A Detroit study showed that purchasing 20% of fresh food from local sources could create over 4,700 jobs and generate \$20 million in tax revenue (Ladner 2011, 103). The city of Portland invested \$66,000 in buying local food for the public school system; though the local food was more expensive, every \$1 spent in the school food system saw an extra \$0.87 spent in the state. This 'multiplier effect' resulted in a 241% return on investment (Ladner 2011, 103). The multiplier effect is the principle that money spent on a local business circulates through other local businesses, essentially multiplying the benefits to the community. Other spinoff benefits to communities include health benefits, educational benefits, and increased green space (Ladner 2011).

Urban farms have the additional advantages of readily accessible markets, friendlier growing conditions, access to water and waste, minimal capital costs, and diminished distribution costs. On average, urban farms net 13% more revenue per acre than non-urban farms due to proximity to customers, direct sales, and crop intensity (Ladner 2011, 82). This paper is not focused on the economic viability of individual urban farms, but rather on the overall economic benefits to cities of establishing and allowing urban agriculture as a land use. Nonetheless, it is important to understand the economic context of urban farms as individual entities. Though there are many obvious general economic benefits that urban farms can provide cities, there are also many challenges that should not be overlooked. Urban land costs are higher than non-urban land, there is little protection of urban farmland from speculators, food prices can be higher,

and there is potential for nuisance concerns, primarily due to smells and sounds (Ladner 2011).

Urban agriculture also provides numerous environmental benefits to cities, many of which supply inherent economic benefits. A UK study discovered that the accurate cost of a grocery basket of food would be 12% more expensive if it accounted for the true cost of food miles and the subsequent environmental factors. The study also noted that 12% was a low estimate (Ladner 2011, 102). Decreasing food miles could mitigate pollution and energy use in addition to increasing local food security. Other environmental benefits include the use of vacant lots and brownfields, which results in more greenspace and generally safer, cleaner and more beautiful neighborhoods. Increased access to fresh food can also result in better nutrition. Increased greenspace can reduce stormwater runoff and vacant lot use can decrease necessary city maintenance. Although all of these benefits are environmental or social, they also provide economic merits. Safer, cleaner neighborhoods help spur development, while better nutrition may decrease obesity rates and healthcare costs. Reduced stormwater runoff and vacant lot maintenance can reduce costs to the city and taxpayers.

Agricultural Urbanism is an approach that merges ideas of sustainable cities and sustainable food systems. “To fully capture the value of the local economy around food and agriculture, we need to establish systems for sustainable-food processing, distribution, celebration, education, and waste” (Holland & de la Salle 2010, 28). In other words, there is a need for a redefined infrastructure, specifically one that merges urban and food infrastructure.

Currently, urban and rural infrastructures operate in opposition to one another. However, an integrated system can offer new ways to conceive of energy, water and material flow that can simultaneously benefit the city and the food system in multiple ways. The following are principles of integrated infrastructure systems, as outlined in the Agricultural Urbanism Handbook (Holland & de la Salle 2010, 104):

- Interconnect systems so that output from one system can be used as input to another
- Treat all waste materials as resources
- Generate value and revenue from these resources wherever possible
- Achieve multiple benefits from each system or component wherever possible
- Locate resource producers and users near each other to facilitate resource exchange

The new opportunities afforded by an integrated infrastructure could significantly alter cost benefit equations for the better, primarily by recycling the inevitable urban outputs, or waste, into the necessary food system inputs, or resources (Holland & de la Salle 2010). The next step is to consider the needs of urban food systems and how each could improve and benefit cities. In doing so, it is important to remember that there are no standard solutions; each city is unique and thus will have different requirements, needs, and potential ways to benefit (Holland & de la Salle 2010).

Areas of Focus

The primary needs of urban farms are land to farm on, water for irrigation, and compost for fertilizer. Some of the largest burdens on cities are vacant public land, stormwater runoff, and enormous amounts of waste. It is clear that these issues can become resources for urban farms, but what is not clear is how cities stand to benefit. While all of the benefits mentioned in this section are worthy of study, I have chosen to focus on three areas: waste management, stormwater management, and public land management. I will examine each area in terms of economic and environmental benefits; benchmarks of success for each category will be established in the analysis section of the paper. The next section will establish broad benefits for each category and discuss examples of cities that will help identify metrics and goals. The primary intent of this section is to make the proposition that urban agriculture is a desirable land use, and to support this proposition through examples from other cities.

Waste Management

In 2008, the average American generated 4.5 pounds of waste per day. Of that waste, 24.3% was recycled, 8.9% was composted, and 66.8% was sent to the landfill. Though 12.7% of waste generated in 2008 was made up of food scraps, only 2.5% of those food scraps were composted (the rest went to landfills or incinerators). Another alarming fact is that only 30% of people in the Southern U.S. had curbside recycling, as compared to 84% in the Northeast. The South has 726 landfills, while the Northeast has 134 (Clean Air Council 2010). Though the South has a population that is roughly twice that of the Northeast, according

to the 2010 census, the amount of landfills in the South is about five times more than the Northeast (U.S. Census Bureau 2010). Americans generate an enormous amount of waste, much of which can be recycled or composted, and the South sends more waste to landfills than any other area of the country. Not only is this environmentally unsustainable, it is a waste of economic resources. Landfills are very expensive to operate and maintain, and the more waste sent to them the more costly they are to the city. The recycling and reuse of waste materials, or waste recovery, can also help diminish unaccounted for costs (GHG emissions) and create new opportunities for generating revenue. Waste recovery entails the diversion, management, and utilization of waste for various purposes such as an energy source and fertilizer (Holland & de la Salle 2010).

Stormwater Management

The U.S. population has doubled in the past 50 years, yet our water consumption has nearly tripled. With 36 of the 50 states predicted to have water shortages in 2013, water conservation and reuse are as critical as ever. Globally, agriculture consumes 70% of freshwater usage. On average, daily irrigation in the U.S. accounts for 4 times more water use than water used for drinking (Agricultural Water Conservation Clearinghouse 2009). It is clear that farms need and consume an enormous amount of water. Though the necessity for irrigation will not change, the consumption patterns of farms could make use of harvested rainwater instead of tapping into freshwater supplies. Rainwater harvesting can offer many additional benefits to urban areas, including reduced runoff treatment (pumping, operation, and augmentation) costs, reduced peak

stormwater runoff and processing costs, and reducing GHG emissions by decreasing dependence on pumping. Cities are largely made up of impervious surfaces, which drastically increase stormwater runoff and subsequent processing costs. Introducing farms into urban areas increases pervious surfaces, thereby reducing stormwater runoff and saving cities the previously mentioned treatment costs (Holland & de la Salle 2010).

Public Land Management

Many U.S. cities are currently struggling with the burdens of large amounts of vacant, publicly owned land. One of urban agriculture's biggest issues is land tenure; many owner's of vacant property will lend their land to urban farming, but only until they are able to find a more profitable use. If urban farms continue to only be allowed in periods of economic downturn, it will never be a viable land use. However, if publically owned land is lent to solely urban agricultural purposes, it stands a better chance of surviving long term. In addition, there are many economic incentives to encourage cities to allocate vacant, public land to permanent urban agriculture uses.

For one, public, vacant land destroys community and property values while simultaneously consuming city resources. Urban farms can reduce cities landscaping, weeding, and general maintenance expenses on the site. For example, the city of San Francisco found that vacant lots taken over by community groups saved the Department of Public Works an average of \$4,100 per year at each site (SPUR 2012, 9). In order to reap the benefits of urban

agriculture on public land, many cities will first have to revise their zoning ordinances.

III. Case Studies

The following case studies provide the basis for developing the benchmarks of success, or metrics, that will be established in the analysis section of the paper. The aim of establishing the metrics is to create a comparable datum for Atlanta, in order to hypothesize that the methods employed elsewhere would similarly benefit Atlanta.

Waste Management

To obtain the data necessary to measure waste management success in other cities, this section will look at two different types of composting: citywide composting and private composting.

Citywide Composting

The case study for citywide composting is the city of San Francisco, CA. In 2009, San Francisco passed the first U.S. mandatory composting law, requiring all residents and businesses to separate out their food waste. Each business and residence is provided with three color-coded trash bins to separate their recyclables, compostables, and landfill-bound waste. Those unable to comply may submit an application to the city, otherwise noncompliance results in fines (Meinhold 2009).

Though the ordinance was made mandatory in 2009, San Francisco first implemented a composting program in 1996. The program started by collecting food scraps from the city's wholesale produce distribution center and then

expanded to collect from large hotels and restaurants. The program was made available, voluntarily, to all businesses and residents in 2003. Before the ordinance was made mandatory, the city collected 400 tons of food and yard waste per day. After the ordinance was passed, the city saw a 25% increase in collection, recovering close to 600 tons of waste per day (Petru 2011).

In November of 2012, 15 years after the program began, San Francisco has diverted over 1 million tons of food and yard waste from landfills (Petru 2011). Recology, the city's waste management company, has produced around 95,000 cubic yards of compost, which they sell to local farms and vineyards. Robert Reed, Recology's public relations manager, speaks to the benefits of composting in saying, "compost returns nutrients to the soil, saves space in the landfill and provides farmers with an alternative to chemical fertilizers. It also helps farmland retain water, so farmers don't have to irrigate as much" (Petru 2011).

Another benefit that San Francisco has accrued from their commitment to citywide composting is a reduction in carbon emissions. Farms have been using the Recology compost to grow 'cover crops,' or crops that manage soil quality. These cover crops serve as carbon sinks; this organic compost can sequester 12,000 pounds of carbon per year per acre of land. Applying this data to San Francisco's composting program, the city has offset its carbon emissions by 354,000 metric tons, which is equivalent to offsetting the amount of emissions from all vehicles traversing the Bay Bridge in a two-year period (Baume 2010).

Of course, diverting waste from landfills does not come without costs to the city. Recology spent a few million dollars to provide compost bins to residents

and businesses and \$38 million on a new recycling plant (Baume 2010). From the other end, it is not just cities that stand to benefit in San Francisco, but the citizens too. Customers who are able to reduce their landfill-bound waste receive deductions on their waste removal bills. Monthly collection rates for weekly collection of landfill-bound trash are \$27.55 per 32-gallon container (the recycling and composting bins are picked up at no charge). Customers who reduce their weekly garbage amount to 20 gallons or less receive 23% off of their rate (Recology 2011).

Private Composting

The case study for private composting is Growing Power, a local food initiative in Milwaukee, WI. Growing power converts over 180,000 pounds of waste per week into compost, which amounts to over 10 million pounds (5,000 tons) of waste diverted from landfills annually. The organization composts their own food scraps, as well as collects food waste from three major sources (160,000 pounds per week), brewery waste from local breweries (20,000 pounds per week), coffee grinds from a local café (300 pounds per week), and 500 pounds of newspapers per week from the local newspaper (Growing Power 2012). Though it is clear that private composting does not have nearly as significant an impact as does citywide composting, it is still a viable alternative for cities that are not prepared for major policy changes.

Public Land Management

Beneficial public land management practices depend on a well-defined land use protection strategy; without this, urban agriculture will struggle to survive

as a viable land use. Measures of success for vacant lot management will be based off of lot maintenance reduction and property value increases.

Land Use Protection Strategy

This section will look at three different strategies for land use incentives and protections: economic incentives such as tax breaks and land grants, policy and zoning revisions, and formal public-private partnerships to secure land tenure. The first example is the City of Baltimore, MD. Baltimore enacted an “Urban Agriculture Tax Credit” in 2010, a property tax credit for properties used for urban agriculture that are between 1/8 - 2 acres in size. Baltimore’s Parks and People Foundation, a public-private partnership that supports community greening, allots \$1,000 start-up grants to communities setting up urban farms. Baltimore enacted a policy to sell public open space for \$1 to groups with a partner organization (such as Parks and People); another group, Baltimore Green Space, has a land trust to preserve community gardens. In light of the city’s interest in AU, Baltimore revised its zoning code to allow urban farms as an approved land use. The new code defines ‘community garden’ and provides specifications of permitted uses within this category (Goldstein 2011, 10-12).

Zoning revisions and policy changes are incredibly useful tools in establishing urban agriculture as a land use. Cleveland, Ohio has created a unique ‘Urban Garden District’ zone, which allows citizens to grow and sell produce on publicly owned properties. The zoning code states the purpose of the new district is “to ensure that urban garden areas are appropriately located and protected to meet needs for local food production, community health, community education,

garden-related job training, environmental enhancement, preservation of green space, and community enjoyment on sites for which urban gardens represent the highest and best use for the community” (La Croix 2010). Another goal “seeks to ensure that urban gardens are established as a goal in themselves, not as a holding strategy until it is time for residential or commercial building construction” (La Croix 2010). The district permits only gardening as a use, which helps to ensure and protect land tenure for urban farms. The city of Seattle updated its comprehensive plan to include urban agriculture as a legal use in all zoning districts and requires at least one community garden per 2,500 households in every neighborhood (La Croix 2010).

From the private perspective, formal public-private partnerships are a great way for private or non-profit organizations to get financial leverage in order to secure land and capital. An example is Chicago-based organization Neighbor Space. Neighbor Space is a non-profit that coalesced from the City of Chicago, the Chicago Park District, and the county Forest Preserve as a means to preserve community greenspace. Neighbor Space operates as a land trust that protects community gardens and parks from redevelopment by acquiring properties and ensuring their tenure (Neighbor Space 2012).

Maintenance

This section will look at the cities of Detroit and Philadelphia in order to establish measures of success for vacant lot maintenance reductions. The City of Detroit has over 200,000 vacant properties, more than half of which are foreclosed residential lots; these properties generate no tax revenue and further

burden the city with the cost of maintenance. The city found that they spend an average of \$12,000 per acre annually in servicing and maintenance costs of vacant city-owned properties. In response to this, the city created The Greening of Detroit Open Space Program, which involves residents in planning, implementing, and maintaining community gardens on vacant lots. The program currently supports over 1,000 urban farms (The Greening of Detroit 2013).

The city of Philadelphia has a Vacant Lots Program in which over 6 million square feet of vacant land have been improved. A Philadelphia study of costs and benefits of urban farms found that converting ten ½-1 acre public lots into farms would save the city over \$50,000 per year in mowing costs. Another cost-benefit analysis study, titled Vacant Land Management in Philadelphia Neighborhoods, found that the city could generate revenue (\$1.54 for every \$1 invested) by administering basic restoration to vacant lots, such as grading, greening (seeding with grass), and planting trees along the perimeter. The study found that Philadelphia currently spends \$1.8 million per year on vacant lot maintenance, and concludes that a twenty-year investment could not only relieve the city of this burden but also generate millions of dollars in benefits (Philadelphia LISC 2010).

Property Values

In general, property values are affected by their surrounding properties. Vacant lots not only depress property values of surrounding areas, but reduce city tax revenue by being tax delinquent or by generating very low values of property taxes. Frank Alexander, a Professor and housing expert at Emory

University, said that “failure of cities to collect even two to four percent of property taxes because of delinquencies and abandonment translates into \$3 billion to \$6 billion in lost revenues to local governments and school districts annually” (National Vacant Properties Campaign 2005, 7). Because property taxes are the largest source of tax revenue for local governments, such substantial losses are devastating.

A study titled “The Effect of Community Gardens on Neighboring Property Values” looks at the impacts community gardens have on properties within 1000 feet of them. The study found that community gardens have a statistically significant positive effect on neighboring property values, and that the impact increases with time. The study also implies a substantial tax revenue gain generated by community gardens. Community gardens have a significantly larger positive impact on lower-income neighborhoods. The results demonstrate an increase in tax revenue of \$750,000 per garden over 20 years. The study found that, on average, each garden increased property values of properties within the 1,000 foot ring of the garden by \$2.3 million (total value increase, not per property) (Been & Voicu 2006).

In the City of St. Paul, a vacant lot is found to generate \$1,148 in property taxes per year, while the same rehabilitated property produces \$13,145 (a \$12,000 increase). The city of Philadelphia found that properties within 150 feet of vacant lots suffered a loss of \$7,627 in property value. Properties within 150-300 feet lost \$6,819, while those within 300-450 feet suffered a loss of \$3,542 in value. Properties on blocks with vacant lots sold for \$6,715 less than similar

properties on blocks without vacant lots. Philadelphia found that surrounding property values increased 30% on average when a vacant lot was 'cleaned and greened' (National Vacant Properties Campaign 2005, 13).

Stormwater Management

Stormwater management is measured in two ways: runoff reduction analysis and decreased treatment analysis. Runoff reduction metrics ultimately depend on the previous section's metric of 'acres of greenspace created.' The runoff analysis will define metrics for greening of lots as well as for green roofs. Decreased treatment costs will depend on the amount of runoff reduction.

Runoff Reduction

Urban farms help reduce runoff in two ways: by increasing impervious surfaces (which infiltrate stormwater) and by capturing stormwater for reuse as irrigation. Rainwater harvesting depends on the catchment area and the storage capacity. A simple formula to determine how much water can be captured in a catchment area is: 1" of rain falling on 1,000 sq. ft. of surface = 623 gallons (Wise 2009, 6). Rain barrels that can store 55 gallons of water cost as low as \$28 per barrel. This past Earth Day, Coca-Cola donated 1,000 recycled syrup barrels as rain barrels across the country, at least 9 of which went to urban farms in Detroit. Coca-Cola's rain barrel donation program has donated over 22,000 barrels for water harvesting, saving an estimated 60 million gallons of water per year (Tell Us Detroit 2012).

In 2007, the City of Washington D.C. implemented a study using a 'Green Build-Out Model' in an attempt to quantify the stormwater benefits of greening

prior to the implementation of a new comprehensive stormwater plan. The model simulated two greening scenarios, a moderate and an intensive, in order to compare stormwater runoff with existing runoff patterns. The greening involved increased tree cover, green roofs, and larger street tree boxes. The study, based off of an average rainfall of 40" per year for the D.C. area, found the following results displayed in Table 1. Green roofs had the largest impact on runoff reduction, followed by increased tree cover (Casey Trees & LimnoTech 2007, 37).

Type of Greening	Stormwater runoff volume reduction over an average year MG/Acre	Acres required to achieve a one MG reduction in stormwater over an average year Acres/MG
Green roofs	0.39	2.56
Trees over impervious areas	0.11	9.0
Trees over pervious areas (NRCS Soil Type D)	0.022	45.2
Trees over pervious areas (NRCS Soil Type C)	0.0027	362
Trees over pervious areas (NRCS Soil Type A & B)	0.00008	12,500

Table 1: Unit Area Reduction Factors for General Hydrologic Relationships Between Stormwater Volume Reductions and Tree and Green Roof Cover
Source: Casey Trees & LimnoTech (year)

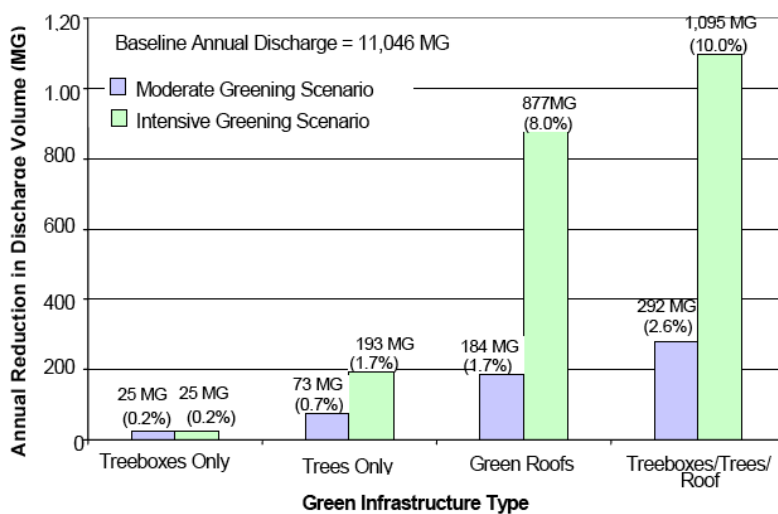


Table 2: District-wide Reduction in CSO and Stormwater Discharge to All Water-bodies- Reductions and Tree and Green Roof Cover
Source: Casey Trees & LimnoTech

Similar to the vacant lot greening programs, certain policies, such as incentives and grants, can be enacted to encourage green roofs. Following New York City's Green Infrastructure Plan, the Department of Environmental Protection awarded grants for community based green infrastructure projects that use innovative strategies to capture stormwater. Grants worth \$3.8 million have been awarded to rooftop farms, which will manage millions of gallons of captured water per year as irrigation. No data has yet been collected for these farms. The city of Chicago provides \$5,000 grants to owners of small residential and commercial buildings to aid in installing green roofs. Similar policies could be enacted to encourage rooftop farms (Center for Watershed Protection 9).

Decreased Treatment Costs

The Washington D.C. study found, using a unit cost of one cent per gallon of stormwater, that the city's Water and Sewer Authority could save \$1.4 million in operation savings annually in the moderate greening scenario and \$5.1 million annually in the intensive scenario. The unit cost value is based on the local utility prices and CNT's Green Values Calculator. "In addition to stormwater management benefits, for the same investment, implementation of increased tree cover, green roof coverage, and larger tree boxes would also provide improvements in air quality, public health, social capital, and economic development, and reductions in carbon, UV radiation, and the urban heat island effect" (Casey Trees & LimnoTech 2007, 9). 'A simplified approach to assigning treatment cost per gallon (across the whole range of pollutants) is to use a value based on the expenses of a local utility like the Metropolitan Water Reclamation

District of Greater Chicago, a value used in CNT's Green Values Calculator: \$29.94 per acre foot of runoff reduced, or \$0.0000765 per gallon' (Wise 2009, 14-15).

Conclusion

Having established an argument for why urban agriculture is a desirable land use that can both economically and environmentally benefit cities, the next step is to address how this argument can benefit the City of Atlanta. The following part of the paper, Analysis + Recommendations, will first use the previously mentioned case studies as a basis for identifying the benchmarks of success that will be used in the analysis. After the benchmarks are identified, the data collected from the case studies will be utilized to establish specific metrics. These metrics will then serve as guides for addressing the following hypothesis: the City of Atlanta can economically benefit by establishing AU as a legitimate land use. The questions that will now be addressed are as follows:

- What are the benchmarks of success for AU, and why?
- Why does Atlanta stand to benefit from urban agriculture?
- What are the current obstacles in Atlanta facing urban agriculture?
- What land in Atlanta is suitable for urban agriculture?
- If the suitable land is used for urban agriculture, will Atlanta significantly benefit (economically)? How, specifically, will the city benefit?
- What policies should be implemented to achieve these benefits?
- Can Atlanta serve as a test case, and the data as a scalable model,

to gauge benefits for other cities?

Analysis + Recommendations

I. Benchmarks of Success

The purpose of this section is to establish the goals and metrics of success for each area of focus. The data collected from other cities will serve as the foundation for the metrics defined in this section. Citywide composting in San Francisco will be the basis for waste management metrics. Vacant land management strategies in Detroit and Philadelphia will provide the foundation for public land management metrics. The Washington D.C. 'Green Build Out Model' results will be utilized to determine compatible stormwater management metrics. The objective is to find scalable metrics for each category, waste management, public land management, and stormwater management, that can then be applied to the City of Atlanta.

Waste management provides cities with a means to convert their waste into farm resources. In doing so, cities save money by reducing the amount of waste sent to landfills; decreased landfill waste reduces sizes of landfills as well as the amount of methane and carbon dioxide generated. Waste converted to compost can then be sold, generating extra revenue for cities. Waste management success will be measured by:

- Tons of waste diverted from landfills
- Methane and carbon dioxide reductions

Public land management will reduce economic burdens of city maintenance while also creating more greenspace and a better perception of the surrounding properties. Land management benefits will be measured by:

- Acres of greenspace created
- Dollars saved from property maintenance
- Increased property values around sites
- Increased tax revenue

Stormwater management generated by urban farms can reduce citywide runoff. Decreasing runoff subsequently reduces the amount of stormwater city treatment facilities need to process, thereby reducing costs to the city. Urban farms can reduce runoff in two ways: increased greenspace (due to plantings) and rainwater harvesting. Stormwater management will be measured by:

- Runoff reduction (based on acres of greenspace created)
- Dollars saved due to decreased city treatment

Waste Management Metrics

Tipping fees are the charge per ton of waste received at a waste processing facility (landfills) that cover the operation, maintenance, and taxes for the facility. Tipping fees vary across the U.S., ranging from \$18 per ton in Idaho to \$105 per ton in Massachusetts (Wright 2012). The average tipping fee in Atlanta is \$35 per ton. This metric will help establish cost savings associated with diverted waste (Fickes 2010).

Using this tipping fee data and the data gathered from San Francisco, the following metrics establish the measures of success for waste management:

- 4.5 tons of food/yard waste = 1 ton of avoided methane gas
- 33 tons of food/yard waste = 1 ton of carbon sequestered
- 4 tons of food/yard waste = 1 ton total CO₂E, carbon dioxide equivalent, benefit (methane avoided and carbon sequestered)
- 1 ton diverted from landfill = \$35 cost savings

Public Land Management Metrics

It is very difficult to standardize metrics for property values, tax revenues, or city maintenance fees for they vary in every city. Detroit found that the city spent \$12,000 per acre in maintenance fees (The Greening of Detroit 2013). Philadelphia found that greening ten 1-1/2 acre lots would save \$50,000 (Philadelphia LISC 2010). Using this data, a conservative established metric for reduced maintenance costs when vacant lots are replaced by urban agriculture is \$10,000 per acre. All of the aforementioned studies found that greening vacant lots, particularly in the case of a community garden, increased surrounding property values and tax revenues. The best metric to use is the Philadelphia study that found that for every \$1 spent on rehabilitating vacant lots, the city generates \$1.54 in property value and tax revenue increases. This metric can be applied to city land grant programs for urban farms.

- 1 acre 'cleaned and greened' = \$10,000 maintenance cost savings per year
- \$1 invested in 'clean and green' = \$1.54 return in property values and tax revenues

Stormwater Management Metrics

Because Atlanta has a similar average rainfall to Washington D.C., the metrics obtained in the D.C. Build-out Model will be appropriate metrics. The CNT Green Values Calculator metric for operational cost savings per gallon of stormwater reduced will also be sufficient.

- 1 acre of green roof = 390,000 gallons stormwater reduction
- 1 acre converted from impervious to pervious: 220,000 gallons stormwater reduction
- 1 gallon reduction = \$0.01 savings in treatment costs

II. Atlanta & Urban Agriculture

The first part of this section will discuss reasons that Atlanta stands to benefit from establishing urban agriculture as a legitimate land use. The second part of the section will take a look at the current urban agriculture climate in the city, including the city's attitude towards AU and current obstacles that need to be addressed.

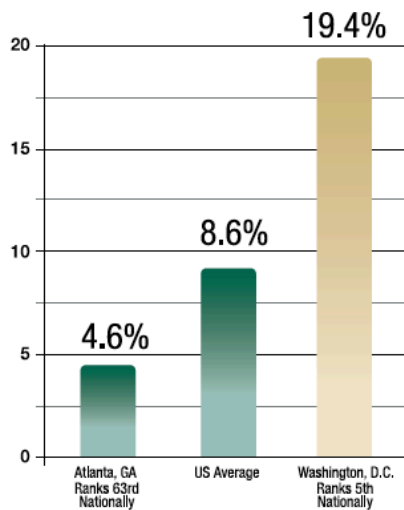
How Atlanta May Benefit

Vacant Land:

Atlanta stands to benefit from implementing a vacant land management program in two significant ways. For one, Atlanta has been struggling with 'Red Field' real estate, resulting in an oversupply of underutilized residential and commercial properties. Red Field properties are defined as "unused urban property declining in value while taking the surrounding properties' value with it" (Hughes 2011, 6). Secondly, the City of Atlanta ranks in the lowest percentile of

green acreage to residents nationally, with under 5% of land in the city devoted to parks (Trust for Public Land 2012). Whether measured as a percentage of total land or as green acres per capita, Atlanta currently ranks at the bottom of similarly sized cities.

Park Acres as a Percent of Land Area



Acres of Park Land Per 1,000 Residents

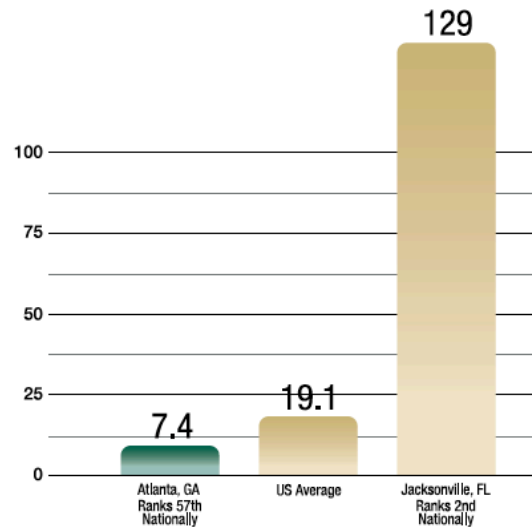


Table 3: City of Atlanta Park Data
Source: Redfields to Greenfields, Page 13

A Georgia Tech research study titled “Red Fields to Green Fields” found that there are around 4,700 developed lots inside the perimeter that are currently vacant, with an additional 1,800 lots “on-hold” (unfinished development). Vacant lots in the city are “currently selling for \$0.25 on the dollar, with some high volume purchases going for \$.10 - \$.20 on the dollar” (Hughes 2011, 7). The study found that turning Red Fields to Green Fields would increase property value by 200-400%, stimulating economic revitalization. The study also found that converting Red Fields to Green Fields would remove thousands of acres of bad assets from the market while simultaneously creating over 2,850 acres of

green space inside the perimeter (the equivalent of more than 15 Piedmont Parks) (Hughes 2011, 8).

Converting vacant lots to urban agriculture would provide Atlanta with much needed green space, increase property values, and reduce the amount of struggling real estate. Increased green space would provide the city with additional benefits, such as reduced heat island effect, reduced stormwater runoff, and increased surrounding property values.

Waste Management:

Atlanta currently produces close to 150,000 tons of trash each year from residents, costing the city over \$7 million to dispose of in landfills (Fickes 2010). Atlanta households recycle around 12,000 tons of waste per year, leaving much room for improvement in the city's waste management (Georgia Recycling Coalition 2013). According to a 2005 Georgia Environmental Protection Division report, 12% of waste sent to state landfills (over 800,000 tons) is food waste. Of that 12%, 48% comes from the Atlanta area. This percentage represents the largest type of solid waste entering Georgia's landfills (Georgia EPD 2012). According to the Georgia Recycling Coalition, composting creates four times as many jobs as landfilling waste (Georgia Recycling Coalition 2013). Atlanta stands to benefit from implementing a citywide composting program by lowering the cost of landfilling and increasing waste management jobs.

Stormwater Management:

A recent audit of water rates found that the City of Atlanta has the highest water and sewer rates in the entire country (Pendered 2012). A USA Today

study found that Atlanta leads the country in high water rates. Water prices in Atlanta have more than tripled over the past 12 years, with rates increasing over 233% (Pendered 2012). It should be noted that high water rates are occurring all across the country, though they are rising at much slower rates than Atlanta. The upward trend of water prices is largely being driven by expensive infrastructure repairs and upgrades as well as increases in costs (electricity, chemicals, fuel) used to supply and treat water (McKoy 2012). If stormwater runoff decreases, then the cost of treating water will decrease, as would the need for new infrastructure. These cost decreases would not only benefit the city, but also translate into lower water rates for Atlanta residents.

Atlanta: Attitude + Obstacles

While the current attitude in Atlanta towards AU seems to be one of optimism and inclusion, the city still has a long way to come as far as establishing AU as a viable and economically beneficial land use. In 2010 Mayor Kasim Reed established the Atlanta Sustainability Plan in an effort to make Atlanta one of the ten most sustainable cities in the country. Some of the goals include:

- Greenspace: Provide a minimum of 10 acres of greenspace per 1,000 residents. Protect and restore the city's tree canopy to 40 percent coverage. Create and maintain a park system that is developed sustainably. Implement landscaping and facility renovations that reduce energy demand and maintenance costs.
- Waste: Reduce, reuse and recycle 30 percent of the city residential

waste by 2013, 50 percent by 2015, and 90 percent by 2020.

- Local Food Systems: Bring local food within 10 minutes of 75 percent of all residents by 2020 (Sustainability Plan Executive Summary 3).

In 2007, Atlanta began allowing residents to establish gardens in public parks through the “Adopt-a-Garden” program. By 2008, the City of Atlanta had over 150 community gardens on both public and private lots (Goldstein 2010, 8). Though this may seem like a large amount, Atlanta’s potential is nowhere near met. While the city is welcome to ideas of AU, there are still many obstacles to overcome.

For one, Atlanta’s current zoning ordinances still do not include the term “urban agriculture.” While the city does permit ‘community gardens’ in some residential districts and greenhouses as accessory uses in most districts, most residential districts prohibit the selling of fruits and vegetables onsite. In areas where selling produce onsite is allowed, vendors must first obtain a permit. The city has recently passed amendments to the code that allow the sale of locally grown food at farmer’s markets on private property. The city is currently working on amending the code to clarify criteria for community gardens and to permit more AU within the city (Goldstein 2010).

Revising zoning codes would not only allow AU as an established land use, it would be a significant step towards promoting AU as a permanent land use. As mentioned earlier, land tenure for urban farms can be unsteady as property values rise; establishing an urban agriculture land use can help secure

urban farms from losing out to higher property returns. It is important to remember that private property cannot be 'downzoned' without facing potential takings related issues. Therefore, it is better to rezone publicly owned vacant land to AU uses to avoid any potential court dealings. For the purpose of the following analysis, only land that is currently publicly owned will be considered.

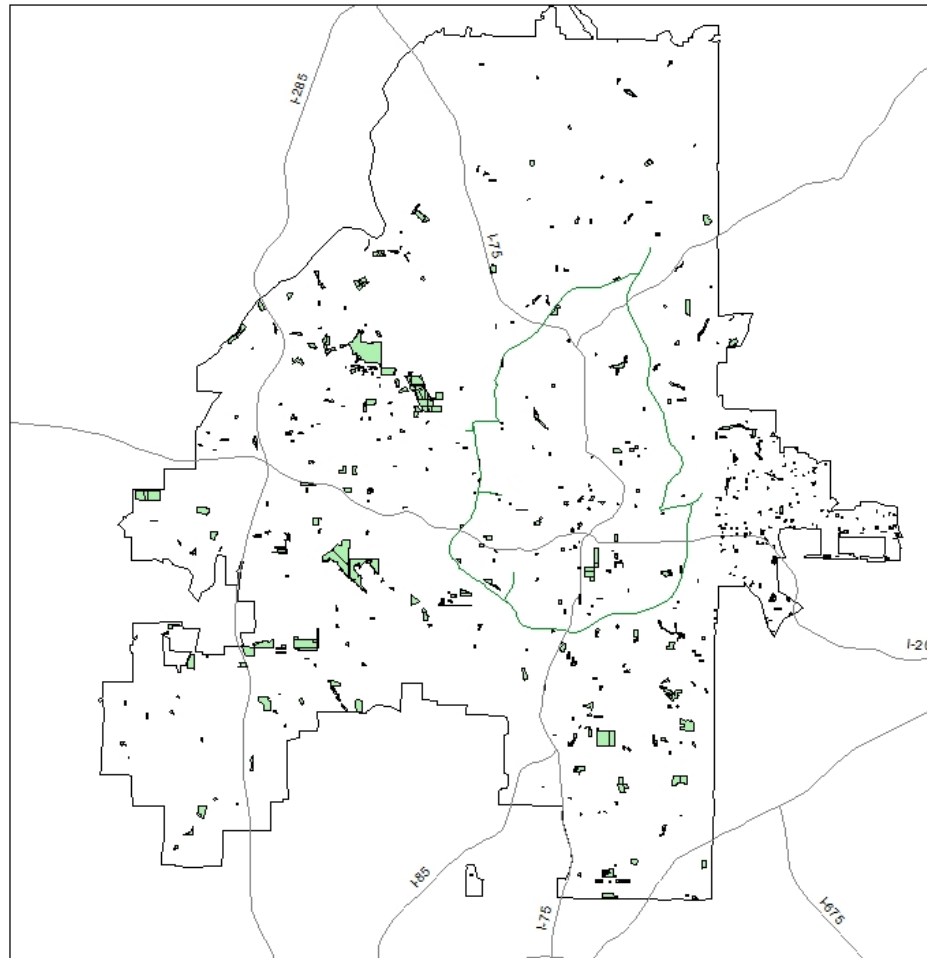
III. Land Suitability Analysis

Having established the ways in which the City of Atlanta stands to benefit from AU, the next step is to establish qualifications for suitable land. These qualifications will inform a land assessment analysis performed in GIS. The amount of land that meets the following criteria will then be used to analyze potential cost savings to the city.

Because the previously established metrics were scaled based on data pertaining specifically to the City of Atlanta, the land suitability analysis is performed only within the city limits. Following along with the sections on public land management, the suitability analysis will deal only with vacant parcels that are publicly owned (owned by the city). Public parks are not included, as they are already serving a vital community purpose and can generally be assumed to not lower surrounding property values. Parcels smaller than 0.25 of an acre will not be considered suitable, as cost benefits of these parcels would be small and urban farms typically need at least 0.25 acres of land. The following qualifications are based on all of the aforementioned information:

- Within the city limits
- Publicly owned

- Vacant or underutilized (parcels have no structures)
- At least $\frac{1}{4}$ acre in size
- For stormwater metrics: land that meets the above criteria *and* has some amount of impervious surface

Figure 1: Atlanta Vacant Public Land**Legend**

- Vacant Public Land
- Interstate
- Beltline
- Atlanta City Limits

Total Vacant City-Owned Land
Greater than 1/4 Acre:
1882 Acres

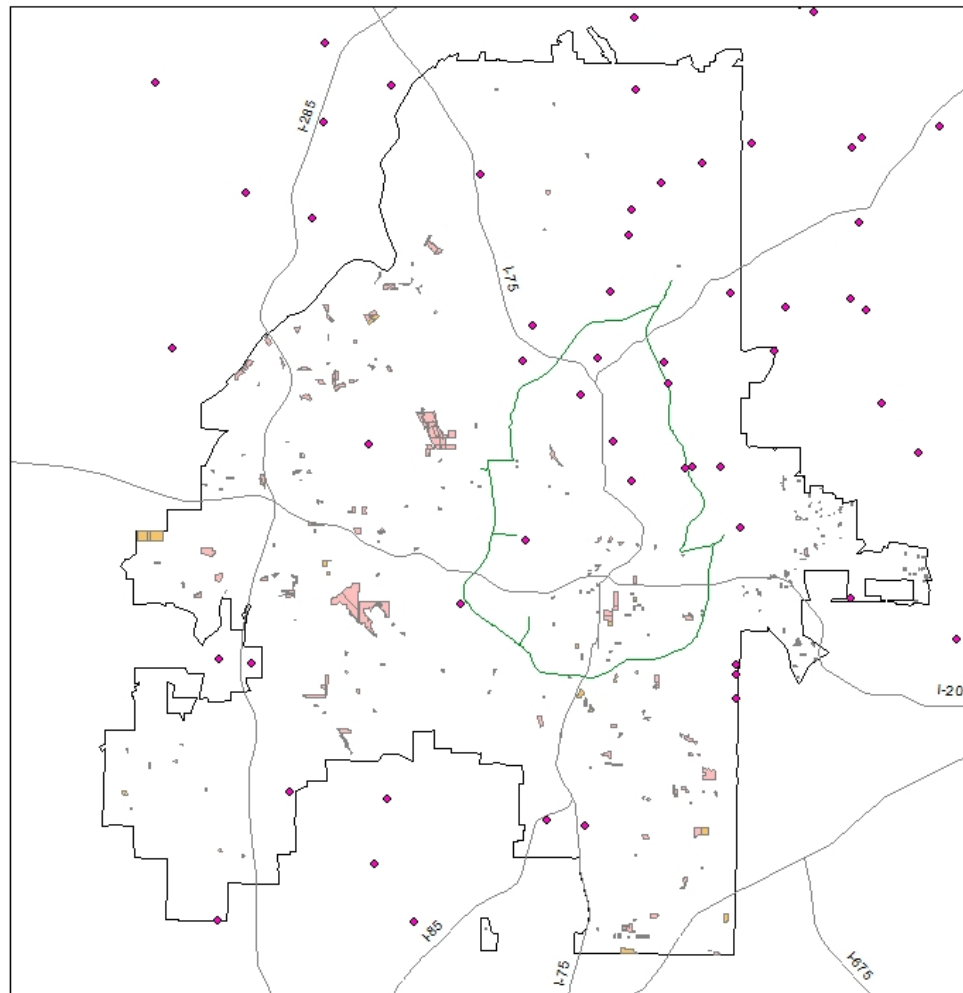
As shown in Figure 1, the amount of land in Atlanta that meets the aforementioned qualifications is approximately 1,882 acres.

The maps below further analyze the vacant parcels by identifying proximity to the nearest grocery store and property value. As noted in the Atlanta Sustainability plan, the city hopes to bring local food within 10 minutes of 75 percent of all residents by 2020. Figure 2 notes the amount of properties that are over 1 mile away from the nearest grocery store; this translates to at least a 20 minute walk. Urban agriculture would aid these areas, particularly in south and west Atlanta, in bringing local food closer to all residents. Figure 3 shows parcels that have a property value of less than \$5,000; these lots and most likely the surrounding neighborhoods would stand to benefit the most from a “clean and green” program.

Figure 4 highlights properties that are vacant, city-owned, larger than 0.25 acres, at least a mile away from the nearest grocery store, and have a property value below \$5,000. These properties are considered the most suitable parcels for urban agriculture. This analysis found 225 acres within the City of Atlanta to be highly suitable for urban agriculture.

Figure 5 shows the amount of impervious coverage on the vacant city-owned parcels. Of the 1,882 identified vacant parcels, 454 acres are impervious surface. This data will inform the potential amount of runoff reduction, which will be used to compute cost savings for stormwater management. Of the 225 most suitable acres, only 13 acres are currently impervious surfaces.

Figure 2: Proximity to Grocery Stores



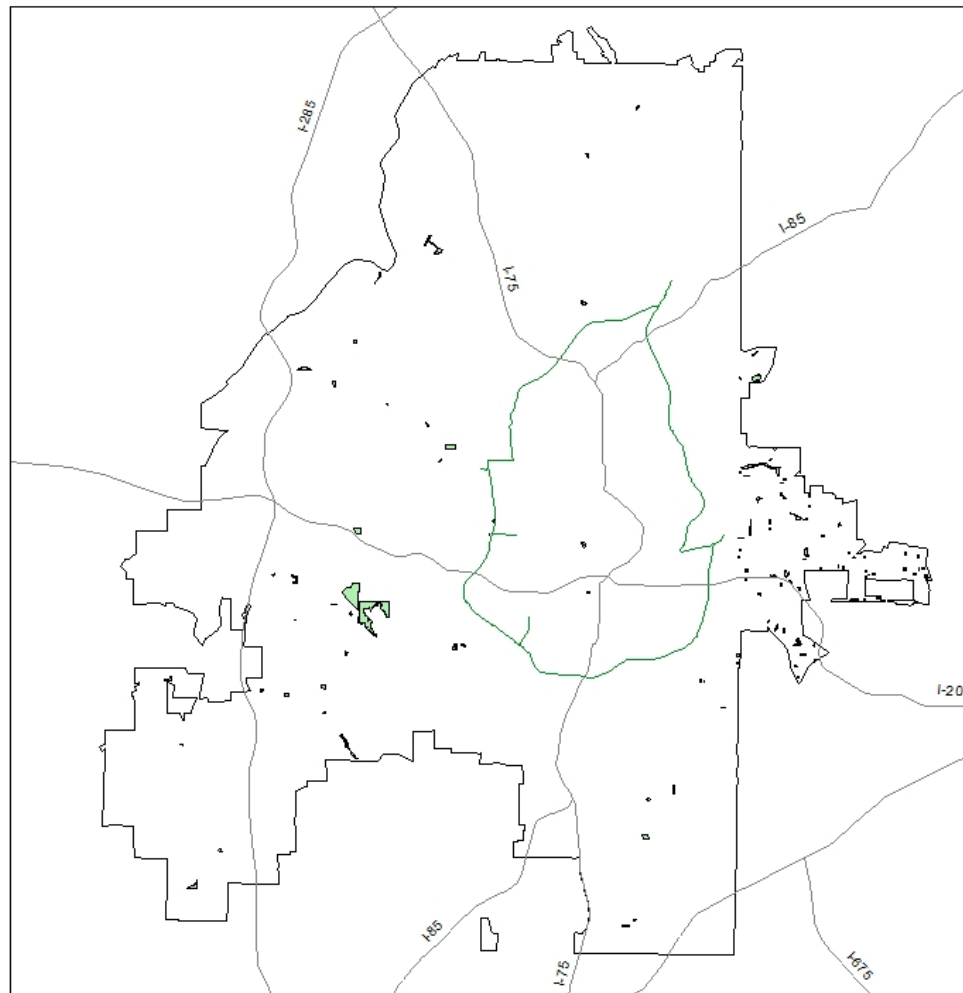
Legend

- Vacant Parcels Over 2 Miles from Nearest Grocery
- Vacant Parcels Over 1 Mile from Nearest Grocery
- Grocery Stores
- Interstate
- Beltline
- Atlanta City Limits

**Total Vacant City-Owned Land
Greater than 1/4 Acre Over 1 Mile
from Nearest Grocery:
1036 Acres**

**Total Vacant City-Owned Land
Greater than 1/4 Acre Over 2 Miles
from Nearest Grocery:
162 Acres**

Figure 3: Property Value

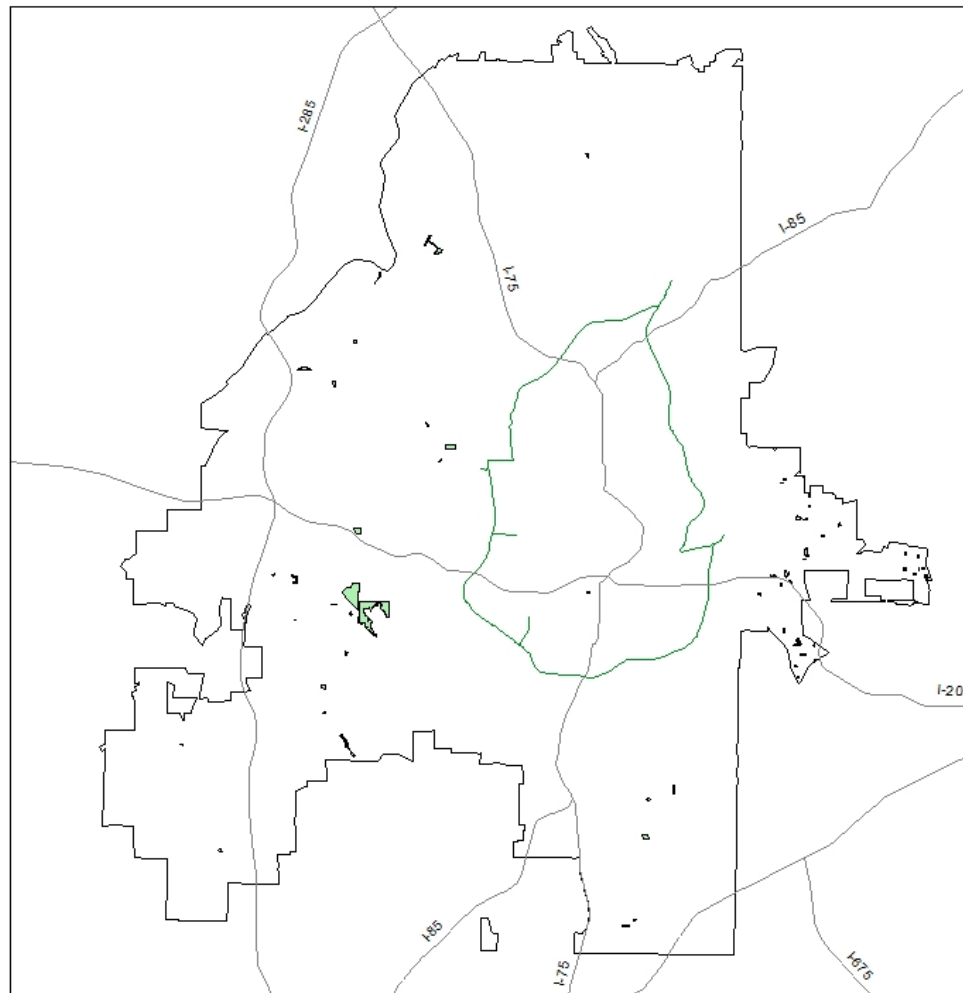


Legend

- Vacant Parcels w/ Property Value < \$5000
- Interstate
- Beltline
- Atlanta City Limits

**Total Vacant City-Owned Land
Greater than 1/4 Acre w/ Property
Value Less than \$5,000:
301 Acres**

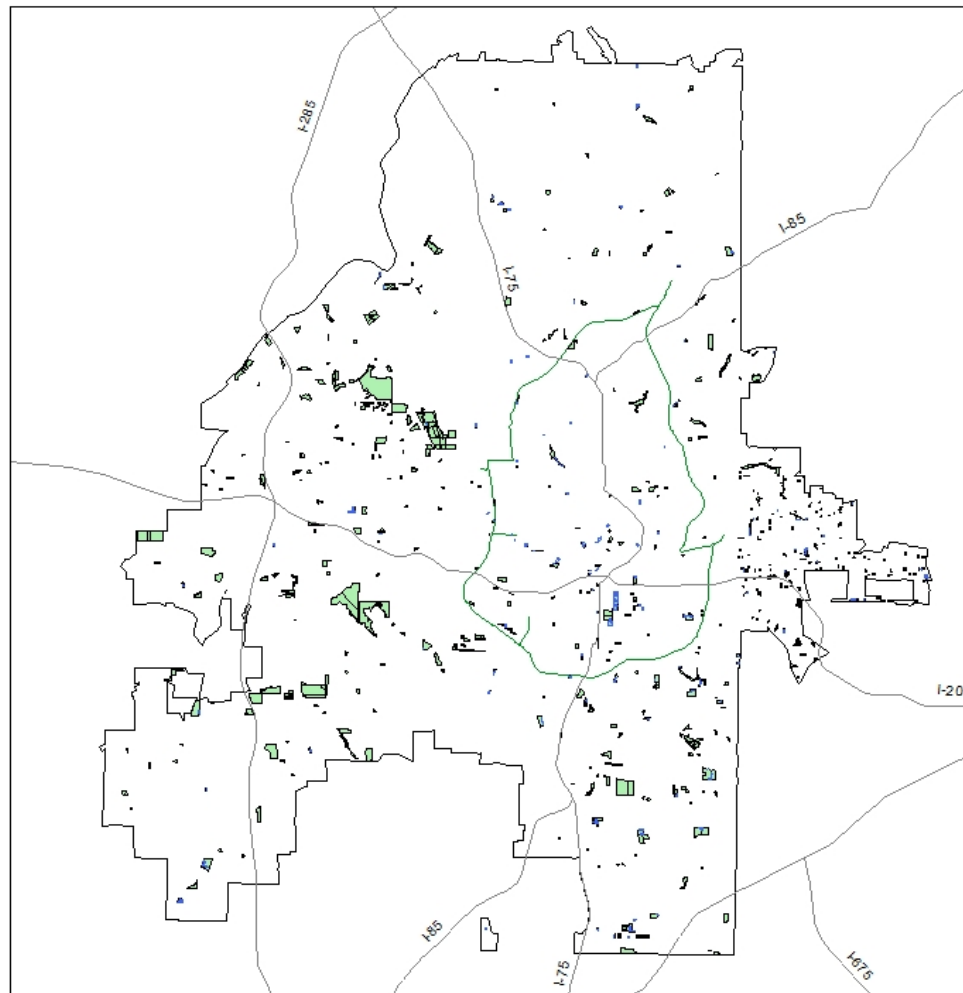
Figure 4: Most Suitable Land








Legend

- Interstate
- Beltline
- Atlanta City Limits
- Vacant Parcels w/ PV < \$5000 + 1 Mile from Nearest Grocery

Total Vacant City-Owned Land
Greater than 1/4 Acre w/ Property
Value Less than \$5,000 and over 1
Mile from Nearest Grocery:
225 Acres

Figure 5: Impervious Surfaces**Legend**

-  Impervious Surface
-  Vacant Public Land
-  Interstate
-  Beltline
-  Atlanta City Limits

Total Impervious Surfaces on Vacant City-Owned Land:
454 Acres

This land suitability analysis is useful in that it creates a general feel for where the most ideal locations for urban agriculture reside within the city. More importantly for this paper, the analysis is useful in that it provides data which can

be used to project potential cost savings to the City of Atlanta. The amount of land found to be suitable in this analysis will directly inform the cost benefit data derived in the following sections.

Waste Management:

The metrics for waste management are not tied directly to the vacant land, but rather to the population. The City of San Francisco collects 600 tons of food/yard waste per day, resulting in a yearly total of 219,000 tons for their population of 812,826. This amount of food/yard waste translates to roughly 0.269 tons of compost per person every year. Applying this metric to the City of Atlanta, which has a population of 432,427, the city could potentially divert 116,510 tons of waste per year. Using the metrics established earlier (1 ton diverted = \$35 savings), this would result in roughly \$4,077,850 savings each year.

San Francisco:

Population: 812,826

Tons Diverted: 600/day = 219,000/year

Tons/Person: $219,000 / 812,826 = 0.269$

Atlanta:

Population: 432,427

Match Tons/Person: 0.269

Potential Tons Diverted: $432,427 * 0.269 = 114,084$

Tipping Fees: \$35/ton

Potential Savings: $114,084 * \$35 = \$3,992,943$ per year

WASTE METRICS: san francisco	
POPULATION	812,826
TONS DIVERTED	600 / DAY = 219,000 / YEAR
TONS PER PERSON	$219,000 / 812,826 = 0.269$

WASTE METRICS: atlanta	
POPULATION	812,826
TONS PER PERSON	$219,000 / 812,826 = 0.269$
TONS DIVERTED (potential)	$423,427 * 0.269 = 114,084$
TIPPING FEES	\$35 / TON
SAVINGS (potential)	$114,084 * \$35 = \$3,992,943 / \text{YEAR}$

Now, recall the previously established metrics. Using these numbers and the number of potential tons diverted (116,510), I can now calculate the other potential benefits.

Previous Metrics:

- 4.5 tons of food/yard waste = 1 ton of avoided methane gas
- 33 tons of food/yard waste = 1 ton of carbon sequestered
- 4 tons of food/yard waste = 1 ton total CO₂E benefit (methane avoided and carbon sequestered)

Potential Benefits:

- $116,510 \text{ tons} / 4.5 \text{ tons} = 25,891 \text{ tons of avoided methane}$
- $116,510 \text{ tons} / 33 \text{ tons} = 3,531 \text{ tons of carbon sequestered}$
- $116,510 \text{ tons} / 4 \text{ tons} = 29,128 \text{ tons total CO}_2\text{E}$

WASTE METRICS	
AVOIDED METHANE	1 TON PER 4.5 TONS WASTE
CARBON SEQUESTERED	1 TON PER 33 TONS WASTE
TOTAL CO ₂ E BENEFIT	1 TON PER 4 TONS WASTE

WASTE BENEFITS	
AVOIDED METHANE	$114,084 / 4.5 = 25,352 \text{ TONS}$
CARBON SEQUESTERED	$114,084 / 33 = 3,457 \text{ TONS}$
TOTAL CO ₂ E BENEFIT	$114,084 / 4 = 28,521 \text{ TONS}$

As shown in the above tables, Atlanta could potentially divert over 114,000 tons of waste per year from landfills. The potential waste diversion, to be created by implementing a citywide composting program similar to that of San Francisco, could save the city nearly \$4,000,000 per year. The city could further benefit by preventing over 25,000 tons of methane and over 3,000 tons of carbon from polluting the city's air.

Public Land Management:

Similar to the previous section, the acreage from the GIS analysis can now be used with the previously established metrics to calculate potential

savings to the city. Recall the established metrics and the newfound acreage of suitable land.

Previous Metrics:

- 1 acre 'cleaned and greened' = \$10,000 maintenance cost savings per year
- \$1 invested in 'clean and green' = \$1.54 return in property values and tax revenues
- 1,882 acres of vacant, public land

Potential Benefits:

- 1,882 acres * \$10,000 = \$18,820,000 maintenance cost savings per year
- \$1,000 invested acre, or \$1,882,000 = \$2,898,280 return

LAND METRICS - all suitable land

MAINTENANCE COST SAVINGS	\$10,000 / ACRE
RETURN ON INVESTMENT	\$1.54 for \$1
VACANT LAND	1,882 ACRES

LAND BENEFITS - all suitable land

MAINTENANCE COST SAVINGS	1,882 * \$10,000 = \$18,820,000 / YEAR
RETURN ON INVESTMENT	\$1,000 / acre = \$2,898,280 / YEAR

LAND METRICS - most suitable land	
MAINTENANCE COST SAVINGS	\$10,000 / ACRE
RETURN ON INVESTMENT	\$1.54 for \$1
VACANT LAND	225 ACRES

LAND BENEFITS - most suitable land	
MAINTENANCE COST SAVINGS	$225 * \$10,000 = \$2,250,000 / \text{YEAR}$
RETURN ON INVESTMENT	$\$1,000 / \text{acre} = \$346,500 / \text{YEAR}$

The City of Atlanta could potentially save over \$18.8 million per year in maintenance cost reductions by converting vacant lots to green space / community gardens. Furthermore, the city could see substantial increases in property values and tax revenues by cleaning up these vacant lots. Though money would need to be invested in the cleaning, the potential returns would far outweigh the costs, making it a worthwhile investment.

Because it is highly unlikely that all suitable vacant land will be converted to green / agricultural uses, the cost savings have also been computed for the 'most suitable land' scenario. In this case, utilizing the most suitable 225 parcels, the city could expect to save \$2.25 million per year in maintenance costs, and see a return on investment of around \$350,000.

Stormwater Management:

The acreage found can also be applied to calculate stormwater management savings.

Previous Metrics:

- 1 acre converted from impervious to pervious: 220,000 gallons stormwater reduction
- 1 gallon reduction = \$0.01 savings in treatment costs
- 454 acres vacant, public land

Potential Benefits:

- 454 acres*220,000 gallons = 99,988,000 gallons stormwater reduction
- 99,988,000 gallons*\$0.01 = \$999,880 savings per year

STORMWATER METRICS	
IMPERVIOUS TO PERVIOUS	220,000 / ACRE
TREATMENT COST SAVINGS	\$0.01 / GALLON
VACANT, IMPERVIOUS LAND	454 ACRES

STORMWATER BENEFITS	
RUNOFF REDUCTION	454 * 220,000 = 99,988,000 GALLONS / YEAR
TREATMENT COST SAVINGS	99,988,000 * \$0.01 = \$999,880 / YEAR

If the impervious surfaces on the suitable lots were converted to pervious surfaces, the city could divert approximately 99.9 million gallons of runoff per year, which would result in cost savings of nearly \$1 million per year. Though it is unlikely that all of the impervious surfaces would be converted, this analysis is intended to show the *potential* within the City of Atlanta for cost savings derived from allowing and implementing urban agriculture.

Limitations

It is important to note that this analysis was contrived with some rough estimates, assumptions, and simplifying limitations. Though these limitations are not factored into the analysis, they should be regarded and taken into consideration along with the policy recommendations. This section will discuss the significant simplifying assumptions made throughout the paper.

When comparing San Francisco and Atlanta for the waste management metrics, it is important to note that San Francisco already has the infrastructure in place to collect food waste. Should the City of Atlanta implement a similar compost program, the city would first have to invest in this new infrastructure. This would diminish the projected monetary benefits for the waste management portion of the analysis. However, the infrastructure cost would be a one-time cost, and the hope is that the projected cost savings would help cover the cost of implementation.

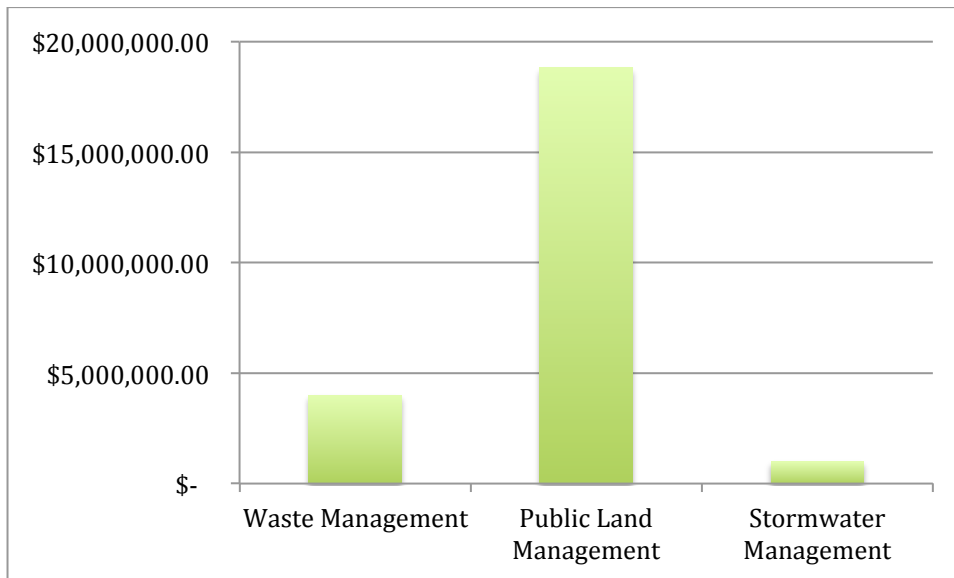
When deriving metrics for public land management, the studies for Detroit and Philadelphia provided rough estimates for cost savings. Therefore, the metrics applied to Atlanta are also rough approximations. The main point is that property values will undoubtedly increase when vacant land is converted to community gardens, and that city maintenance costs will decidedly decrease when community groups assume responsibility over these properties. The numbers themselves should be taken for what they are, estimates rather than facts.

When comparing Atlanta to Washington D.C. for the stormwater management metrics, it should be considered that Atlanta and D.C. may not have entirely compatible infrastructure in place. However, because the treatment cost decrease is so conservative (\$0.01 savings per gallon reduction), the converted numbers are likely not overestimated. Also of note is that the analysis did not include green roof conversions, which would have provided additional significant cost savings.

Finally, the land suitability analysis incorporates many assumptions in order to simplify the process. Vacant parcels were derived from City of Atlanta GIS data; all publicly owned parcels within the city limits without a structure on it were considered vacant. First, the Atlanta GIS data may not be completely updated or accurate. Second, there may be parcels without structures that are currently serving some other purpose, and are therefore not in fact vacant. Third, there may be vacant parcels with abandoned structures that therefore were not found as vacant. Finally, there are many other potential qualifications for suitable land that were not taken into account in this study, such as soil quality.

Conclusion:

In conclusion, it is clear that Atlanta stands to significantly economically benefit by allowing and implementing urban agriculture within the city. In total, the city could save an estimate of over \$22,000,000 per year by implementing a composting program, a vacant land management program, and converting impervious surfaces to pervious surfaces.

Figure 6: Cost Savings Comparison

The most substantial cost savings would come from implementing a public land management program, due to potential increased property values and thus increased tax revenues to the city. However, as previously stated, this category has the most hypothetical and roughly estimated data. The composting program would have the next most significant impact on cost savings to the city, drastically reducing the amount of money the city spends sending waste to and maintaining landfills. The stormwater management improvements would provide the least cost benefits, though it would still provide a substantial amount of savings to the city and potentially more if green roofs were taken into account.

IV. Policy Recommendations

Thus far, this paper has established that urban agriculture is a beneficial land use and has confirmed the hypothesis that the City of Atlanta stands to economically benefit by allowing AU as a land use. In order to capture the potential economic benefits of a citywide composting program, a public land

management program, and converting impervious to pervious surfaces, the City of Atlanta should take the following policy recommendations into consideration. The following policy recommendations and strategies respond to the conclusions drawn in the analysis section.

Waste Management:

1. Implement a citywide, mandatory composting program:

Without a mandatory program, the city stands little chance of reaching their sustainability goal of reducing landfill-bound waste to 90% by 2020. The program should follow the lead of San Francisco's program by providing residents with new bins for composting and providing incentives (lower rates) for reducing landfill bound waste.

The City of Atlanta Office of Solid Waste Services is the department responsible for waste collection and disposal. Within the past few years, the City of Atlanta provided residents with 96-gallon recycling bins to improve the city's waste reduction. The Office of Solid Waste Services could use the cost associated with purchasing and delivering these bins to project the cost for providing residents with composting bins. The city would also have to substantially expand upon its existing composting facility. As noted in the limitations section of the paper, these costs are not incurred in the analysis. Finally, the Office of Solid Waste Services should develop strategies for selling the collected compost to local and regional farms. Any profits gained from sale of compost should go back into funding for the composting facility and for

educational programs that promote waste reduction strategies, such as recycling and composting.

Public Land Management:

1. Implement a series of land-use protection strategies:
 - a. The city should revise their zoning codes to include an Agricultural Urbanism land use. The new code should define “community garden” and provide specifications of permitted uses within this category. To maintain AU as a protected land use, uses other than those pertaining to gardening should not be allowed. Suitable public, vacant land should be converted to this land use.
 - b. The city should update the Comprehensive Plan to include AU as a legal use and to encourage its use throughout the city.
 - c. The city should implement a Vacant Lots Program, similar to Philadelphia’s, in order to convert the vacant land to community gardens. Public-private partnerships are encouraged.
 - d. The city should provide incentives in the form of tax credits or land grants to those who convert their property to the AU land use.

The City of Atlanta Office of Solid Waste, mentioned in the previous section, also provides vacant lot clean up. The office also sponsors the Adopt a Spot program, which seeks and coordinates volunteers for keeping public, vacant land maintained. This program could be expanded to aid in the development of recommendation (c) above.

Stormwater Management:

1. Provide incentives, such as tax credits, for reducing the amount of impervious surface on property.
2. Provide incentives for green roofs and stormwater catchment systems for reuse. Although green roofs were not included in the analysis (due to the suitable land not having buildings), increasing the amount of green roofs in the city could greatly decrease impervious surface area. This could be mandatory for new or renovated public buildings, and grants or tax incentives could be offered to private building owners. This would further decrease stormwater runoff and thus would further decrease treatment costs.

The City of Atlanta Department of Watershed Management is responsible for all water and wastewater services in the city. Part of the department's mission statement is to "improve the environment while supporting economic development" (Watershed Management 2013). Reducing impervious surfaces and creating incentives to do so is the perfect way to both improve the environment and support economic development.

The City of Atlanta recently amended the new 'Post-Construction Stormwater Ordinance,' which promotes green infrastructure and runoff reduction practices.

"It is in the public interest to regulate post-development stormwater runoff discharges and control systems in order to reduce or minimize increases in stormwater runoff rates and volumes, post-construction soil erosion and sedimentation, stream channel erosion, and nonpoint source pollution associated with post-development stormwater runoff" (Department of Watershed Management 2013).

The amended ordinance requires new and redeveloped sites to use green infrastructure to treat the first 1 inch (25 mm) of stormwater runoff on site. The ordinance applies to only certain property types: commercial properties covering more than 500 square feet, or residential properties covering over 1000 square feet (Saporta Report 2013). While this ordinance holds promise for stormwater runoff reduction in the City of Atlanta, there is still room for improvement. It could be argued that it is also in the public interest to control runoff on *any* site, not just construction sites or properties of a certain size.

Georgia also has a House Bill (HB 1069) that provides a \$2,500 tax credit for energy and water efficient projects, such as rainwater harvesting. The City of Atlanta has consciously and encouragingly implemented numerous stormwater management strategies over the past five years. City Hall now has a green roof, and various public properties (such as libraries and the city jail) have porous paving on the parking lots. However, Atlanta could be even more aggressive with stormwater tactics. City owned properties could be required to use porous paving; private properties could be offered tax credits for reducing the amount of impervious surfaces on site. Finally, the post development stormwater ordinance could be broadened to include a wider range of property types.

Conclusion

While the beginning of the paper established the importance of food systems in planning, the literature review confirmed that urban agriculture could be a viable option for enhancing global sustainability. Agricultural urbanism proves to be a truly sustainable model of food production as it is not only

enhances the environment and social values, but also provides numerous economic benefits to localities. Recycling waste into resources saves cities a substantial amount of money, especially in the provided examples of food / yard waste, stormwater, and vacant land.

The analysis portion of the paper proved not only that the City of Atlanta stands a chance of saving significant amounts of public money and boosting the local economy, but also that the city's goal of becoming a top 10 sustainable city is entirely within reach. By considering the aforementioned policy recommendations, Atlanta could serve as a role model to other cities that may currently doubt the economic benefits of agricultural urbanism. A final recommendation to the city is that if it is to implement any policy changes, that it monitor the costs and cost savings of implementation in order to not only encourage other cities to follow suit, but to actually prove the benefits of urban agriculture.

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