



An Evaluation of the Potential of Urban Agriculture's Success Taking Advantage of Limited Land Two case studies: Mumbai and Jakarta

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Introduction:

Thomas Robert Malthus believed that eventually the world's limited resources would no longer be sufficient to sustain the human population. He believed that population increases geometrically or exponentially while food production has only the power to increase arithmetically (Malthus 1888). Although the Malthusian theory remains greatly challenged and Malthusian models have been proven unreliable due largely to the number of influences on both food production and population growth (Weeks) there remains certain validity to the long-term Malthusian theory in that ever-increasing population cannot be forever sustained by limited resources, especially in the current scarcity of land. Between 2000 and 2025, the rural population of the developing world is expected to increase a mere 0.17 billion to a total of 3.09 billion. Over the same period of time, the urban population of the developing world will almost double: from 1.99 billion to 3.73 billion (Haddad 1) (United Nations, 1998). As the population continues to grow unchecked, our resources remain entirely finite and our ability to sustain our population becomes more difficult. However, applying our ability to adapt to limited space to agriculture has resulted in some of the most dynamic models of ingenuity, creating examples of how to maintain a more sustainable, feasible, and ecologically sound urban lifestyle, an apparent necessity in the modern era.

Malthus argued that there are three main factors that influenced agriculture or the "means of subsistence", the first being the "arts" or technology that can be applied to agriculture which has the potential to increase yield over time. The second influence is available land, this he understood as a finite



resource but lead him to the last influence of agriculture, the “social organization” of the land, or the land ownership patterns (Malthus). This last influence includes land which is not used to its full agricultural capabilities as well as potential agricultural land which is not being used for such. As of 2011, the global population has reached 7 billion people, and is expected to be 8 billion within the next 12-15 years. In order to sustain the next and following generations, the agricultural system must be readjusted to produce more abundant, healthy, and more regionally appropriate produce through innovative agricultural practices. The validity, necessity, and potential of urban agriculture have yet to be fully realized.

Urban agriculture is not a contemporary phenomenon rather quite the contrary, agriculture seems to be an invaluable skill forgotten and lost to the modern urban population of the West. The practice of urban agriculture not only improves self-sufficiency for the individual but also for the city as well as the nation as a whole. At the same time, urban agriculture encourages a diet that is both more healthy and seasonal while reducing the economic burden on an urban family and alleviating poverty. Localized cultivation has a greatly reduced environmental impact and carbon footprint compared international industrial agriculture as propagated by large agribusiness. This paper will discuss the benefits and challenges of urban agriculture as well as the current agriculture and food distribution system as a result of international financial institutions. In addition, a brief discussion of current growing initiatives will be covered and lastly specific case studies on the feasibility of sustainable and beneficial urban agriculture will be discussed in detail.

Two case studies from developing and up-and-coming metropolises have been chosen based on their success with urban agriculture despite resource and financial limitations and living situations. The greatest challenge to urban agriculture in any city but specifically with these two dense urban environments is lack of space. The case study in Jakarta, Indonesia represents how Indonesian farmers and migrants take advantage of their climate and soil

fertility, making agricultural use of any and all available land. Vacant lots, roadsides, and abandoned, leased or rented real estate lands are farmed on, benefiting the health, productivity and economy of Jakarta. Mumbai is one of the densest cities in the world has virtually no vacant space, yet urban agriculture finds success where an abundance of sunlight remains: the top of an apartment complex. This case study in India represents the urban agricultural potential in the most restricted environment, overcoming the greatest complication, that there is no soil. This study represents the greatest extreme and the potential success of persistence and innovation under these conditions offering a system to feed a family on less than 1000m² of rooftop and terrace space.

The Modern Food System:

Currently, and without our realization or consent, what we eat today is a combination of food that is grown out of season, over-processed, flash-frozen, underpriced, chemically or genetically enhanced, hardly ever local, imported from distant nations who are often suffocating from international debt or famine themselves. This vast food distribution disparity is a result in part by globalization and international development. In the wake of growing demand for global modernization, International Financial Institutions (IFIs) such as the World Bank and the International Monetary Fund (IMF) dedicated themselves to offering large loans to the Third World offering these countries would be able to elevate themselves developmentally through large loans. The result, however, was a cocktail of immense national debt, food aid dependence, and the eradication of self-sufficiency through imposed necessity of participation in an export economy (McMichael 58-59).

The majority of countries who accepted loans from the IMF have been unable to repay these loan payments. The IMF implemented Structural Adjustment Policies (SAPs) to ensure their money would be paid back (McMichael 130). The SAPs are created to rearrange the economic output of

the nation as the IMF sees fit in order for the nation to be able to repay their loans. These structural readjustments were “a comprehensive restructuring of production priorities and government programs in a debtor country” (McMichael 130) essentially cutting public social spending, privatizing of state enterprises, devaluating currency, reducing wages to attract foreign investment, and intensifying and refocusing all economic activities to service the international markets. The consequence of this readjustment was a dependence on the international market and the loss of self-sufficiency and sovereignty as the national government is unable to decide what is best for their economy, instead yielding to the desires of the IMF. In addition, hundreds of countries are being forced to sell their goods, mostly agricultural, on the world markets, the value of individual exports plummeted, exacerbating the cycle of increasing exports and mounting national debt.

During this time, “development, which had been defined as nationally managed economic growth, was redefined in the World Bank’s *World Development Report 1980* as ‘participating in the world market’” (McMichael 117). This development encouraged countries to “specialize” in a few or a single market good usually an agricultural commodity that they could produce best. Similarly to the Green Revolution, this system promoted an industrial scale, mechanized, and chemical fertilizer and pesticide induced crop systems. “A distinguishing development feature is that, whereas the first green revolution was a *public* initiative geared to *national* markets, its successor was a *private* initiative increasingly geared to *global* markets” (McMichael 13). With the aim of export in mind, cheap commodities and food arrived at the western markets, while disintegrating the ability of nations to be independent and self-supporting. Agriculture became an export commodity rather than the ability to feed the nation.

As global markets spread and technology advanced, transnational corporations were able to supply high-value off-season produce to the West which proved exceedingly profitable for the agribusinesses. Yet these

transnational agribusiness supply chains focus on the more economical large scale agriculture which exports all its crop, forcing agricultural communities to import food for consumption and sustenance. This is a result of workers having “little time to grow food on their own plots in their home communities...with this loss of control comes a spiritual loss, and a loss of knowledge of seed, of organic fertilizers and pesticides, of sustainable practices such as crop rotation or leaving the land fallow for a year—practices that had maintained the land for millennia” (McMichael). With this unsustainable system, local farmers lose their ability to sustain their lifestyle, while simultaneously, the Western consumers suffer from a lack of information and knowledge of where their food was grown, and what mechanical and chemical processes were involved to produce what is on their plate, leading to gross health problems. “As the urban population has grown, so too has the complexity of how to feed people who are so far removed from the actual production of foods” (Carter 5). The food on people’s plates no longer depends on what is nationally produced, but based on how effectively international goods can be absorbed by transnational agribusiness and how profitable these transactions are.

Even as agribusiness grows, local initiatives maintain their effort to supply fresh organic produce locally. Large transnational food suppliers easily out-compete and undermine small farmers and markets, making interaction with consumers difficult yet still possible (Friedmann, McNair 408-434). This connection is essential for local organic food consumption, reducing food miles, and reestablishing self-sustainability. This is a challenge that farmers and entrepreneurs alike are currently facing, one that could be solved by increasing the supply of locally grown food. In terms of national sovereignty, if nation-states were able to use their agricultural land to grow food for national consumption rather than global export, the country would not need to be reliant on imported food or foreign food aid. As international financial institutions encourage and pressure food exportation from indebted and impoverished nations into the more affluent nations, the third world becomes less and less



self-sufficient. This dependency could be waned and even broken through increasing of locally grown, locally consumed food, and as the world continues to urbanize, that means nations must harness the potential of urban agriculture.

Urban areas across the globe struggle to supply their citizens with a viable living and sufficient food. Food transportation technology has advanced significantly, pushing an immense amount of food all across the globe to meet our ever increasing consumption. However, “Food products typically travel between 1,500 and 2,500 miles from farm to plate, as much as 25 percent farther than food products traveled in 1980. 15 Fruits and vegetables shipped from distant states and countries can spend as many as seven to fourteen days in transit before arriving in the supermarket. Almost 50% of the food transported is lost to spoilage”(Carter 7). This inefficient system of vast food distribution is both wasteful and harmful. The dense urban metropolises across the globe have the manpower, ability, and necessity to grow even a fraction of their own produce. This locally grown agriculture within the urban environment would benefit the self-sufficiency, carbon footprint, and economy of the city as well as health and diet of the inhabitants.

Benefits and Challenges of Urban Agriculture:

Urban agriculture is defined loosely as production, growth and distribution of the products of intensive cultivation or animal husbandry using urban land and/or resources (Bailkey). Urban Agriculture’s potential is an untapped resource that has the ability to greatly diminish hunger, poverty and food costs while increasing food quality. Urban agriculture creates jobs and occupations while community gardens improve neighborhood relations, creating a sense of connection and empowerment. A localized food system cuts down on or entirely eliminates the costs of processing, distribution, refrigeration, packaging, and retail sale of the food. In addition to providing a more healthy diet free of chemical pesticides and fertilizers, processing and additives, “Urban

farming takes into account the real cost of food and the real benefits from a local and regional food system” (Carter 7).

Urban farms nationally and abroad have been developed in back yards, vacant lots, excess land, rooftops, terraces, balconies, and abandoned city blocks and even as landscaping. In Jakarta, urban farms have sprung up wherever there is space, taking advantage of any vacant land to grow crops and produce without the permission of the city (Purnomohadi). In Mumbai, where space is extremely limited, crops are raised in pots and bags on rooftops and terraces and have proven to be both successful and economically viable (Alvares 4). Urban agricultural methods such as *Square Gardening* (Bartholomew 9-15) which encourages raised beds and utilizes symbiotic companion planting, minimal space usage and complementary, dense plants to yield far more than in a quarter of the space rural farms are capable of producing.

As our global population continues to climb the amount of people entering the workforce every year is always increasing, and migration to urban areas continues to rise with expectations of opportunity. If jobs can be created in urban areas to locally produce food through urban agriculture the city would be offering an opportunity to the workforce while generating a beneficial production. In Jakarta alone, 250,000 new jobs must be created each year in order to maintain the unemployment rate (Nugent 1). Urban agriculture is not a seasonal job (especially in tropical regions such as Jakarta) labor can be hired for not only harvest, but for bed construction, soil preparation, fertilizing, weeding, watering, mulching and other maintenance activities. Generating low-skilled jobs gives such as agricultural labor offers opportunity to the city’s urban poor and stimulates deteriorating economies; Chicago was able to generate jobs and income by converting warehouses into greenhouses in the declining industrial sector in 1999 (Bailkey and Nasr).

Malthus believed that as the population out-grows our ability to provide sufficient resources for ourselves, the inevitable natural consequence is poverty

and human suffering. Urban poverty rates, as a proportion of total global poverty rates have been on a steady incline, this is partly due to overcrowding and lack of opportunity, and as a consequence impoverished living situations are in declining while unemployment and malnutrition increases (IFPRI, 1999). In Philadelphia, not individual farmers, but those who participated in a community garden project noted that they saved upwards of \$700 a year on food by supplementing their diet with their neighborhood's shared produce (Carter 16). Urban agriculture is a remedy to unemployment, while creating an income supplement, and guaranteeing a more healthy diet.

The vegetables most Americans consume are most likely grown in a large-scale monoculture industrialized agriculture system, heavily influenced by chemical pesticides and fertilizers. "Most fruit and vegetable varieties sold in supermarkets are chosen for their ability to withstand industrial harvesting equipment and extended travel, not for their taste or nutritional quality" (Carter 7). Often fruits are coated with wax or undergo other processes which unnaturally increase their aesthetics and shelf life. After reviewing all of the grocery stores in three low-income zip codes in Detroit, it was established that "only 19 percent, or fewer than one in five stores, carried a minimal "healthy food basket" (products based on the food pyramid)" (Carter 8). In addition genetic modification (GM) of food is becoming more commonplace globally but especially within the United States. Genetic modification often increases the size and weight of the produce while reducing the nutritional value as a result. Genetic modification is possible through a transfer of genes using highly adaptive bacteria which are not only an immense health issue but also a global ecological catastrophe handing diseases and bacteria to establish its own resistance to immunization through the consumption of GM foods. A discussion on genetic modification is far too extensive, complex and appalling to cover in this humble paper.

Although American meals travel farther on average than meals of the global South, almost all food world-wide is grown in sparse rural areas and



shipped for urban consumption. Agricultural land in close proximity to urban areas is quickly sold to be redeveloped as this outcome is seen as economically more profitable “Cities swallow up agricultural fields with impunity, especially in countries of the South (Alvares 3). Naturally grown urban agriculture is preferred by both restaurants and the average consumer as it is more fresh, offers more taste and nutrition, while cheaper than the same produce offered by international agribusiness at supermarkets when in season.

Urban centers have what is known as a “heat island” which is the result of trapped energy from the sun that is not able to be absorbed into the soil and plants. Urban agriculture assists in lowering summer temperatures even on a small scale. If Toronto were to convert 6% of their rooftops into greenscapes (1% of their total urban land), the amount of carbon dioxide emitted from the city would be reduced by over 2 tons a year (Carter 11). Urban agriculture sequesters urban pollution, especially carbon, while is generally more aesthetically pleasing than abandoned lots and roadside waste. In addition to composting organic waste and recycling wastewater, agriculture can reduce runoff, landslides, and help replenish the subsurface aquifers.

Even when dedicated to establish local food security, urban farmer may be challenged by many obstacles and restrictions. One of the most obvious but pressing challenges is the acquisition of land. Often urban farmers will begin cultivation in an abandoned lot only to see their investment destroyed by development. Finding growing space is an even greater challenge to those who have no available land at all. Rooftop, porch, patio, or indoor gardens are not uncommon, although they are more restricted in their capabilities. Finding appropriate and affordable markets and funding the initial start-up cost of an agricultural enterprise can be obstacles and hindrances for those with limited income. Seasonal restrictions affect areas where plant cultivation is limited to a fraction of the year, and innovative technology such as greenhouses or indoor growing can be used to overcome this. One of the greatest challenges to entrepreneurial agricultural enterprises is the acquisition of appropriate

knowledge as agricultural skills may be lacking particularly for urban dwellers. This obstacle can only be overcome through practice or training, and is a skill that never should have been lost.

Mumbai Case Study:

India has been urbanizing at an incredible rate with cities such as Mumbai growing at nearly 5% per annum while other cities growing faster still (Davis 8). With nearly 1.2 billion people, there are already more than 400 people per km² on average across the whole nation (CIA fact book, 2011). As of the 2001 census, there were 35 cities in India which contained more than a million people for a total of 110 million between these cities alone (Davis 8). In India it is not necessarily opportunity that encourages urbanization but rather the lack of economic viability in already overpopulated rural areas. As a result there remains a large impoverished urban population while economic growth rates are skyrocketing such as they are in the business capital of Mumbai. Feeding a city such as Mumbai is undoubtedly a new feat of accomplishment every year which will become more difficult as the population increases and rural farmers become overstretched and over-encumbered.

The city of Mumbai was built on a series of islands that were close to the coast of Maharashtra, India. The space between these islands was slowly filled in and developed on to create the incredibly compact peninsula that exists as Mumbai metropolis today (Risbud). Expansion on to the mainland is further restricted by a sacred nature preserve to the North East. The city itself is one of the most densely populated areas in the world, with an average of more than 20,000 people per km² (double that of New York City) and regions above 50,000 people per km², space is a constant concern and one of the greatest challenges to overcome for such a rapidly growing city, yet innovations for urban farming have been firmly established. Being the most urbanized city of the subcontinent and having a lack of space for waste disposal created the need for horticultural innovation (Yasmeen 13). Shripal Achyut Dabholkar set

up an institution called Prayog Parivar which translates to “Family Experiment” in which vegetables and fruits are grown on terraces and rooftops to supplement a family’s diet, dispose of organic waste while assisting in the cleansing of urban air (Alvares 5).

Dr. Doshi, a retired academic who lives in Mumbai, saw much potential in Dabholkar’s ideas and implemented them himself. Since then he has refurbished and simplified the methodology and proudly uses his own rooftop garden as an example of what every citizen of Mumbai with roofspace should do. Dr. Doshi’s system is essentially growing fruits and vegetables out high-density polyethylene bags with a 9in diameter, larger bags for larger plants, and a hole in the top and bottom. He stuffs the bottom of the bag with discarded sugar cane stalks to plug the hole but allow for some porosity and fills the rest of the bag with 25% organic compost and soil (Alvares 3-4). This methodology is simple, low cost, and viable for many while able to produce yields with extremely limited space. Doshi believes city roofs and terraces are ideal for this type of agriculture as he argues that a plant gets 95% of its energy from the sun and 5% from the soil (Alvares 5).

India has always been close to the environment and agricultural practices remain even in urbanized regions, although on a much smaller scale. “Urban and periurban agriculture (UPA) is one set of activities resulting in greater food production, improved livelihood opportunities for urbanites and the enhanced environmental quality of cities” (Yasmeen 5). These strategies have alleviated much stress in food production and already overcrowded shipping and transportation routes in the subcontinent. Dr. Doshi’s methods of urban farming have proven successful and viable for any and all socioeconomic groups and has led to a profusion of city vegetable and fruit gardens which has been improving urban environments, reducing rural farmer stress and use of chemical pesticides and fertilizers, as well as increased family nutrition and public health overall (Yasmeen 25).

In addition to basic herb, vegetable and fruit gardens, other Indian cities have tackled community and larger scale urban organic waste composting, sewage-fed aquaculture, urban dairying, community urban farming, mushroom cultivation and urban animal husbandry (Yasmeen 16-19). These initiatives have been well considered, evaluated and prepared for the challenges urban locations bring such as toxicity, pollution, contamination, large volumes of waste and high demand. Dabholkar is convinced that a family would be able to feed themselves on a quarter acre of land, or about 1000m². Dr. Doshi grows more than his requirement of fruits and vegetables year round by carefully selecting and alternating produce on a mere 400m² of rooftop and terrace space (Alvares 6-7). If this method were reproduced by a fraction of the population of Mumbai, or the urban world, the ramifications would be incredible.

Jakarta Case Study:

Over the past few decades, Indonesia has been establishing itself as a major influence in South East Asia and has risen as a global economic power. Jakarta itself recently overtook Manila and became the largest city in South East Asia and crammed into only 661m² of Jakarta's metropolis is over five percent of the population of Indonesia, the fourth most populous country in the world (McCarthy). The growing success of Jakarta is an example of the nation as a whole. Indonesia continues to urbanize rapidly growing from less than 20% urban in 1975 to more than double that by the year 2000 (McCarthy). The air is warm year round, with an annual average of 27 degrees Celsius and rain is hardly ever in short supply (over 2000mm/year), farming and agriculture are commonplace and imbedded in the culture. Farms and gardens spring up in vacant plots, between buildings, and in 1998 hundreds swarmed a horseracing track to farm while 300 others occupied and farmed a vacant hill in the city (Purnomohadi).



In 1997 there were over 100,000 urban farmers in Jakarta, the majority of which were in East Jakarta, 1% of the population at the time. (Purnomohadi). The farmers can be categorized into two large groups, the land owners and the urban agriculture workers, the majority being the latter group represented by mostly migrant and seasonal workers not from Jakarta. These workers migrate to the area when work is available or circumstances require them to leave their hometown, living in or near the fields they work on in huts or compact communities (Purnomohadi). These migrants are able to make enough to send back to their hometown to support their family and pay for education and other expenses for their children.

Of the non-flooded crops grown, many have an extremely short growth cycle (around 30 days) and mainly include leafy greens. This is because 90% the land that is being farmed on is owned by a developing firm, a real estate company, or the national or regional government and is only temporarily vacant and be developed on at any time (Purnomohadi). Regardless, these farms generate a steady flow of fresh produce that is sold to local markets, middlemen, or directly to restaurants from abandoned lots, riversides, roadsides, and land rented or leased from struggling real estate companies. These vacant lots are populated with narrow raised beds or *garit* 10m long and 60cm wide and watered using buckets or irrigation (Purnomohadi).

Because Jakarta is teeming with life and the soil is extremely fertile, there is no reason why these farms should not be encouraged to further. In addition to increasing the aesthetics of these regions, the farms generate produce on land that would otherwise be going to waste, offering opportunities and jobs to hundreds of thousands of migrant workers, and create an opportunity for the local community and restaurants to consume locally grown fresh produce with a minimal carbon emission. A law was written (No. 7/1996) which states that “sufficient food, both in quality and quantity, should be available for all households at all times. The law envisions a role for municipal government and the urban community in providing food. The municipal

government should enhance food security through a ‘sound’ food management system” (Purnomohadi).

Even though the rise in urban agriculture in Jakarta due to the Asian economic crisis has proved beneficial to the city and its inhabitants, urban agriculture remains absent in the metropolis’ future city planning. Urban agriculture remains firmly established and important in the economy of Jakarta, and urban agriculture should “facilitate its inclusion in city planning and the specification of agricultural areas in urban zoning. Urban agriculture should be treated as an integral part of the urban ecosystem” (Purnomohadi). Jakarta’s subversive urban farms have been neglected and ignored even though they create a viable and efficient service for the city as a whole.

Conclusion:

Urban agriculture is prevalent across the globe whenever an opportunity is seen or rises out of necessity. Even though urban agriculture has been successful in a number of cities across the globe, very few city planning and management schemes take urban agriculture into account. It is evident that the practice of urban agriculture provides a greater quantity of fresh, nutritious and available produce per acre than large scale international farms. The produce is being grown within city limits so preservatives, freezing, and extensive transport is not necessary, reducing the cost of the produce while maintaining the best possible price for the farmers. Locally grown food is more likely to be absent of the preservatives, additives and hormones prevalent in industrialized agriculture.

In addition to reducing temperature and carbon emissions, the increased aesthetics and economic output of urban agriculture in a city should be enough to encourage the practice. Urban agriculture would help reduce international dependence on food and increase the self sufficiency of the city. If the majority of food consumed in urban areas was grown there, it could be argued that there would be absolutely no need for international food import. Third world nations



would be able to establish their sovereignty once again instead of being forced to bend to the desires of the IMF and large agribusinesses that currently control their economies. The modern fact that the nations over encumbered by massive international debt are being forced to export their produce while their own citizens struggle in famine. This system is immoral and damages both the health of the average citizen and the nation as a whole.

Urban agriculture offers an opportunity to reestablish self-sufficiency while providing healthy and available food to the urban population. Cities without incentives or approval such as Jakarta have shown how communities of citizens have risen to the opportunity and created a success story. Mumbai shows an example of urban agricultural success with prevailing above the greatest challenge to agriculture; not having land. If these success stories are able to produce a viable income to workers while generating more than enough produce to feed those involved at relatively low cost, than urban agriculture may be the solution to feed the next and ever-urbanizing generations.

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