URBAN AGRICULTURE

Sustainable food security awakens the “green collective consciousness” through educational community garden centers

M. M. Bashir
Great Cities Planning
(Working Paper)

URBAN AGRICULTURE

Sustainable food security awakens the "green collective consciousness" through educational community garden centers

Earthbound, it is predicted that the vast majority of mankind will dwell in urban environments as early as 2025. A critical component of sustainable development augments a circular set of efficiencies through urban agriculture that ensure economic and food security, while at the same time, prepares a verdant "social consciousness" for ecological accounting, and renewable energy.

> "The second Industrial Revolution- the coming together of centralized electricity, the oil era, the automobile, and suburban construction- went through two stages of development. A juvenile Second Industrial Revolution infrastructure was laid down between 1900 and the beginning of the Great Depression in 1929. That infantile infrastructure remained in limbo until after World War II. The passage of the Interstate Highway Act of 1956 provided the impetus to mature the infrastructure for the auto age. The establishment of an intercontinental highway grid- which at the time was heralded as the most ambitious and expensive public works project in all of human history- created an unparalleled economic expansion, making the United States the most prosperous society on Earth." [1]

The coalescing of scientific breakthroughs in the late 19th century that led to steam power, disseminated information through the printing press, and the dawn of the communication era via telegraph and telephone mark the height of the first Industrial Revolution (IR). While succinct and salient, the passage above (and its following arguments) describing the second IR leave out two key components of the historical narrative. First, the civic strife between race, gender, and how these inequalities assisted in urban gentrification during that time. Second, and as is usually true of traditional economics, what the actual ecological cost upon civilization and the Earth might be- because of these developments. In *The Third Industrial Revolution*, Rifkin establishes that lateral power is transforming the world economy and energy: 'renewable electricity, converting hundreds of millions of buildings into mini power plants, introducing hydrogen and other storage technology across the global infrastructure, integrating the Internet of small sensors and gadgets to a vast and sophisticated smart grid, fuel cells and hybrid vehicles metamorphosing transportation, and boutique planning teams working alongside a highly skilled industrial workforce' (Rifkin p. 264). Indeed, this is true for all of the G20: a couple dozen of the most-developed nations of the world - where political systems and governance are as steady as their 2.5% per annum of economic and demographic growth - energy independence, autonomous and intelligent transportation systems are the future for them.

[1] Jeremy Rifkin, *The Third Industrial Revolution*, 2011: pg. 19

These powerhouse countries, centers for financial capital, efficiency, and technological innovation are also home to (almost) all of the world's key cosmopolitan global cities. Rifkin's vision for the 3rd IR, however, is much farther from truth and reality for the vast majority of humanity living in still-developing economies and their burgeoning megacities.

We shall essay here why food *before* energy security in urban centers is the key to harmonious, sustainable, self-sufficient development in the decades to come. We advocate and hope to establish the argument that: Urban Agriculture answers various dimensions of self-sufficiency and sustainability. These gains are often more immediate to the individual, while simultaneously improving global climate, ecology, and economy. Rifkin categorizes lateral energy efficiencies augmented by unit-ized planning and production in global cities of the most-developed nations. This paper shall put forth categories and strategies for doing the same within Urban Agriculture. For awakening a collaborative, "public green- consciousness" food security grown by urban agriculture helps those most in need, awakens all people, and still searches for an interdisciplinary lateralization of sustainability. Finally, bringing Urban Agriculture home, we present how the historical divide of Chicago can be seen even in urban garden numbers as illustrated in local case study mapping.

Global Cities and Megacities

John R. Short describes a "global city" as the central hub for a network of cities, a transnational linkage and flow of people, money, capital, goods and services. A global city becomes command center for stock exchanges, headquarters of major international corporations, and banks. During the day, urbane technocrats with high-skills and high-levels of trust work towards economic growth and development. And on the other side of capitalism, during the night, 'low wage workers, often immigrants clean these buildings,' guard and take care of the city infrastructure; sharp social inequalities make global cities polar.[2] Global cities are also able to cater to the super-rich and their lifestyles in food, clothing, accommodation, and services.

This is contrasted with megacities, typically found in still-developing nations. As regional urban centers, indigenous residents flock to seek opportunity, and a better quality of life. Megacities lack command-center structures, cohesive strategic city planning, an international presence for business and foreign direct investment (FDI), but are situated to exponentially grow in population because of their locations. The boom exacerbates social, economic, and environmental dimensions unable to cope with such an influx of people. With less wealth but increased pressure, sustainability and development in megacities is a phenomenally more formidable and burdensome undertaking, as it is ambitious.

[2] John Rennie Short in *Globalization and the City* quotes English economist Alfred Marshall (1922), Kim (1999), and Beaverstock et al. (2000), pg. 18.

Multiple sources of data may illustrate that in present numbers and future growth rates: megacities will far outpace global cities as population centers of the world… how much as consumption patterns increase? Hans Rosling, a Swedish statistician and economist, vividly articulates a slowdown of birth rates coupled with higher life expectancies as a trend in all countries from the 1940s to 2000 using data from the UN.[3] He presents the argument that if another couple billion people began to consume at US-levels, humanity would need another three or four Earths. With predicted patterns of socioeconomic and demographic shifts, megatrends in global urbanization, consumption must *seek increased efficiency* in urban agriculture, as increasing groups of people move away from countryside and subsistence farming for industry and service sector employment.

On average, American citizens spend roughly 25% or less of their income on food. This is not true for the rest of the world, and especially within megacities. As much as 35-60% of disposable income is spent on food by a worker. Advocating urban agriculture systems (urban-ag) translates into supporting self-sufficiency, food security, and income for urban & megacity-zens.[4] Thus, models in Congo, Tanzania, Fiji, Nepal, Egypt or India will vary from each other, and dramatically from the US, the Netherlands, or Germany: outputs, biodiversity, local staples, cuisine, diet preferences, climate, ecology, soil, and urban space all become variables that shape city greens and shake the urban agriculture movement- to make no mention of culture, social consciousness, and politics.

What is Urban Agriculture?

Dense regions of population naturally evolve into urban cores. Food production systems that serve city people devise different techniques from traditional forms of rustic, rural agriculture. In order to remain operational and become increasingly efficient: urban-ag systems ever search for increasing yields of food production, and up the crop-value / site. Serving their own specific markets, urban-ag creates a circular flow between the organic and recyclable waste, water, energy, distribution and consumption channels. When these efficiencies align a circular economy is created that mimics ecological cycles in nature. It is not one single endeavor, group of people, activity, or research institution but a synergy comprising all: the novice and expert urbanites, communities and cooperatives, small and large business models; it provides networks resources and recreation, along with healthier fresher closer local food sources.

In 1996, the United Nations Development Programme (UNDP) began publishing a series of reports on Urban Agriculture around the world, based on data collected from 100 site visits and

[3] TED talks, February 2006, Hans Rosling: The best stats you've ever seen (viewed 12 million times).
[4] Taylor et al. citing: Kortright and Wakefield 2011 and Reyes-Garcia 2012 compare the US state to other nations, "In the global south… social, economic, and health benefits of home food gardens are well documented for marginalized and economically disadvantaged populations."

300 interviews. An early publishing from the UNDP reports no typical “average urban-ag farmer” in the world; land-plots range from small home gardens, to medium community gardens, to large rotational-crop fields. Debunking myths in 1996, they found urban agriculture:

- Occupies unused or fallow city-plots; when necessary it is able to pay full land rent
- Is not a utopian “garden city” that cannot be created or competes directly with rural agriculture in products and efficiency
- Is not a temporary activity, nor is it a marginal means of survival
- Is not unhygienic, nor does it damage the environment or become an aesthetically inappropriate outcropping

Collating from a variety of sources, without a base in empirical study or data, if we are permitted to hypothesize the dimensions, externalities, and requirements for a number of programs that are classified as urban agriculture… a tabulation may shed some light. Prominence refers to how prevalent or popular a mode of production might be in the urban-scape. Both prominence and capital are loosely ranked values [where 1= low , 5= highest]. Capital expenditure begins its measure as the lowest possible investment for a gardening project to be classified as a “type” of urban agriculture.

Urban Agriculture		Descriptors			Requirements	
Type	Products	Externality	Prominence	Locations	Land	Capital
Horticulture	fruits, vegetables, flowers, herbs, spice plants	novel ethnic flavors	5	core	small	1
Apiculture	bees, honey, wax	pollenization	3	peri-urban	small	3
Vermiculture	Worms, compost creation; silk	fertilizer; recycling	2	core	small	2
mycoculture	mushrooms	decomposer	1	core	small	2
Poultry	chicken, eggs	sustainability	4	peri-urban	medium	4
Small livestock	rabbits, rodents, goats	organic waste sink	3	peri-urban	medium	4
Hydroponics	fish, frogs, flowers, fruit	circular economy	4	peri-urban	medium	3
Aqua-terra farming	fish-breeding, rice-like grains	circular economy	2	peri-urban	medium	3
Arboriculture	trees, ornamental plants, berries, wood	tourism	1	periphery	medium	4

substitute crop	water treatment	natural pest prevention	3	periphery	large	4
Agroculture	natural bio-engineering; crops; ornamental plants	ecology preservation, research	2	boundary	large	4
Forestry	wildlife preserve, biodiversity	eco-system creation, tourism	3	boundary	large	5
Large livestock	cows, milk, beef, pigs	fertilizer, organic waste sink	3	boundary	large	5

Quintessentially, finding the stock and flow value between multiple streams of waste that feed into systems of food, water, or ecological production completes the economic circle... the holy grail of every sustainable agricultural system. This shall be elaborated upon later, with illustrations.

Universal Advantages for Urban Agriculture

At the heart of efficiency is land usage. First, city planners should chart vacant residential and industrial plots that do not generate tax revenue or lie fallow. Connecting with urban-ag networks in the city, these vacant plots are ideal sites for community gardens, farmer markets, and cultivate a green consciousness in the public. Next, tracts of land un-usable for other purposes: marginal easements, wedges, below electrical powerline towers, soft-borders and edges lie dormant; these can be used to grow a variety of flowers, ornamentals, vegetables, and herbs. Horticulture alongside ornamental plants fructifies the cityscape, and beautifies it. Third, rooftop gardens and greenhouses devise mechanisms that save energy with "zero-farming" acreage.

K. Specht et al. introduce the term of Z-farming as the future of sustainable urban agriculture. Moving away from conventional, they state earthbound agricultural production is limited in urban cores. Then differentiating between urban parks, gardens, and wastelands: the concept of Z-farming is "to create entities linking food production and buildings with multiple uses of residential or industrial waste resources (eg. waste water, waste heat, organic waste) to establish a small-scale resource saving system" via building-based urban-ag.[5] Takao Ugai categorizes green roofing as systems that can be used for rainwater collection, thermal insulation, and agriculture roofing. Combining Leadership in Environmental and Energy Design

[5] Kathrin Specht et al. "Urban agriculture of the future: an overview of sustainability aspects of food production in and on buildings

(LEEDs) certification and credit points, Ugai enumerates 20+ points that can be achieved when building rooftop food systems.

$$(1-a)I = \varepsilon \sigma (Ts4 - Tsky4) + hc(Ts - T a)$$[6]

a	albedo of the surface
I	total solar radiation incident on the surface, W/m2
ε	emissivity of the surface
σ	Stefan-Boltzmann constant, 5.6685x10-8 Wm-2K-4
Ts	equilibrium surface temperature, K
Tsky	the effective radiant sky temperature
hc	convection coefficient, W m-2K-1
Ta	air temperature, K

Ugai, perhaps arguing with a Hawaiian climate in mind, concludes that choosing surface materials and increasing the albedo are the best ways to lower surface temperatures. This creates somewhat of a challenge for the four seasons of Chicago where a wide range of temperatures dictate how much energy savings can be accomplished using either crops, gravel, or greenhouse-enclosed rooftop structures. At least generally, we may extrapolate Z-farming crops will increase insulation to better maintain central heating and cooling systems' presets.

Another universal advantage of Urban-ag is decreased waste. Water treatment, composting and recycling organic, sewage, and waste furthers the public's green consciousness. Demonstration garden plots, like a biodiversity encouraging agro-cultural plot at a peri-urban site disseminates locally relevant research and crop information. What types of seeds to use, strategies for crop complementarity, pest management and passive repellent plants, etc. are all valuable indigenous resources. If a city or private organization has the capacity to institutionalize these settings, jobs, trade, tourism, and ambiance become permanent externalities. Lemna Corporation had nine facilities purifying waste-water with duckweed in the US. "The process offers savings of 50-75% over competing technologies." Lemna operates similar treatment plants in Mexico and Egypt, (UNDP pg. 110).

A final argument for how the universal advantages of urban agriculture are even more pronounced for burgeoning megacities is border control. It is in the planning, policy, and managerial interest to use integrated arboricultures and aqua-terra farming as city-limit lines that protect against squatter and slum formation. From Mumbai to Rio de Janeiro, opportunity's promise drives unsustainable mass migration. Green borders not only provide jobs, preserve

[6] Ugai cites Ashrae, 2013: *Handbook-Fundamentals, American Society of heating, refrigerating and air-conditioning engineers.*

the ecology, but simultaneously beautify and prevent unoccupied or peripheral territories from turning into shantytowns or slums.

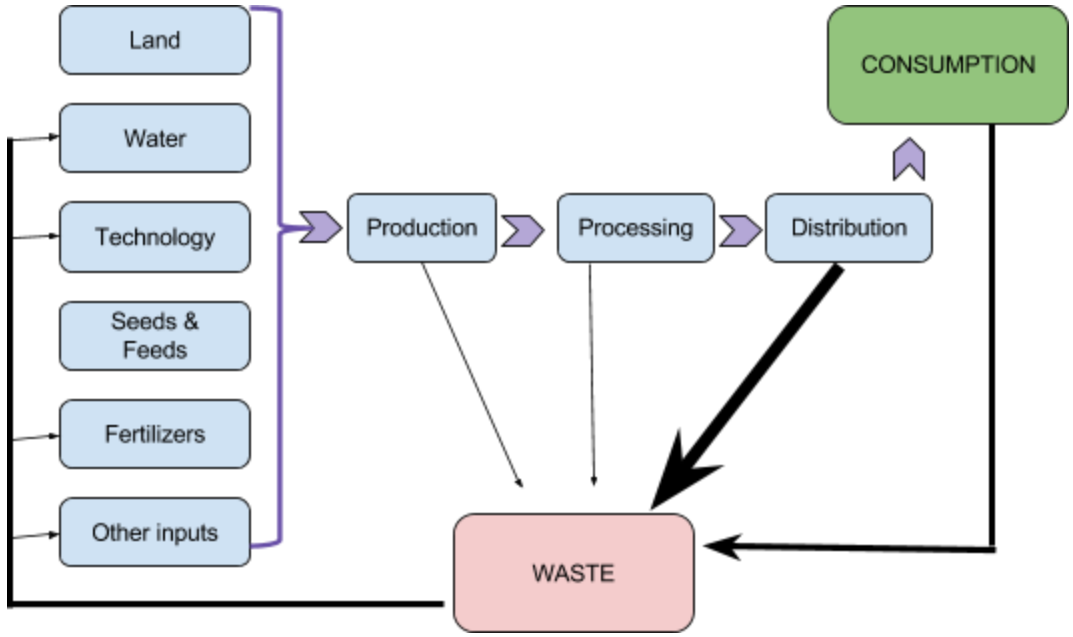
Natural disaster and political turmoil, two unpreventable causes for mass migrations should also be re-considered by humanitarian and aid agencies through the eyes of urban agriculture. Fast relief, large quantities of food, medicine, and shelter is needed immediately following catastrophe; longer periods where refugee camps and the like- house tens of thousands of displaced persons would benefit immeasurably through urban-ag programs, community gardens, and tech dissemination. Horticulture and hydroponic systems can be designed for mobility and transience. As of 2016, the UN Refugee Agency, UNHCR, reports 9 million displaced Syrians, approximately half of which are registered refugees in the Arab world. Turkey (1.74 M), Lebanon (1.18 M), and Jordan (.63 M) border towns, once temporary sites, or transition camps have turned into semi-permanent settlements.[7] A multi-plex of urban-ag initiatives would dramatically improve the quality of life, self-esteem, and self-sufficiencies of the politically displaced there.

Ecological strategies deployed by Urban Agriculture

In 1798 Thomas Malthus writes *An Essay on the Principle of Population* beginning a debate that has not just continued for centuries, but whose zeitgeist shadows modern conversations of resource management and consumption. Because populations increase exponentially but the food supply only arithmetically, mankind's existence is precarious at best, and essentially unsustainable. The explosive potential of the Green Revolution through genetically engineered crops in the mid-twentieth century could not have been predicted by Malthus. Increasing yields of corn, rice, cotton, fruit, produce, and vegetables have fed ever increasing billions of people. Before the turn of the next century, most economists are in agreement that human populations will have stabilized, whether at 9, 12, or 15 billion… the slowdown has begun. Thus, Malthusian insight shall continue to moderate precious commodities, nonrenewable sources of energy, land, and the possible expansion of our biosphere, along with the human race, as it reaches out to the heavens colonizing the moon and Mars. It will play a decreasing role in the food security sphere as urbane agricultural movements shake the global and megacities of the world.

As terrans we are blessed to have the biosphere, the continuous circulation of nature as it cycles through all of life on Earth. It is a portentous natural phenomenon; we should mimic it as best we can:

[7] Syrian Diaspora figures reported by UNHCR can be found @ www.unhcr.org



This flowchart is adapted from the Urban Agriculture Network.[8]

The political philosophy of Waste:

> "When they all had enough to eat, he said to his disciples, 'Gather the pieces that are left over. Let nothing be wasted.' "
>
> Feeding of the five thousand, John 6:12

In the *Second Treatise of Government* John Locke declared that private possessions - if they perished before properly being utilized - were an 'offence against the common law of nature' because unbartered fruit for nuts, or unplucked plums wasted the 'common stock.' True, both to the capital and biblical spirit, Locke states that "…the exceeding of the bounds of his just property [is] not lying in the largeness of his possession but the perishing of any thing useless in it." [9]

[8] Alteration of a version presented in Urban Agriculture, UNDP: p. 19, who cite the Urban Agriculture Network as their source...
[9] Summarizing the introduction made by Tristram Stuart, original arguments presented by Locke and germaine to urban planning are added

When America was young and wild, what separated claim upon acorns and apples by Indian hunters from the English or French settlers? By placing his *labor upon it, he* [the settler] *thereby acquired a property in them.* However, the extension of private personal property ought to be bound not by capitalistic machinations, but by that which it is unable to utilize. For waste, "offended against the common law of nature, and was liable to be punished; he invaded his neighbour's share, for he had *no right, farther than his use* called for any of them, and they might serve to afford him conveniencies of life." Thus, waste by non-utility became an infringement upon the public, as understood through Locke.

In 1997 the USDA published a major study on food waste that calculated more than 41 metric tons, or 27% of the US food supply, as perished in the hands of American consumers- not accounting for farm waste at all. In 2009, that was still double the estimated waste tonnage of the entire UK.[10] Furthermore, Tristram Stuart asserts shortcomings of that data, charging negligence in manufacturing waste numbers. Since 1997, the USDA's economic research unit publishes 'Loss Adjusted Food Availability Sheets,' where similar statistics can be found.

Energy neutrality, a zero-carbon footprint, complete recycling of organic waste, technological (electronic) parts, treating water, and preparing less chemically intensive fertilizer is that utopian dream that defies entropy and mimics nature.

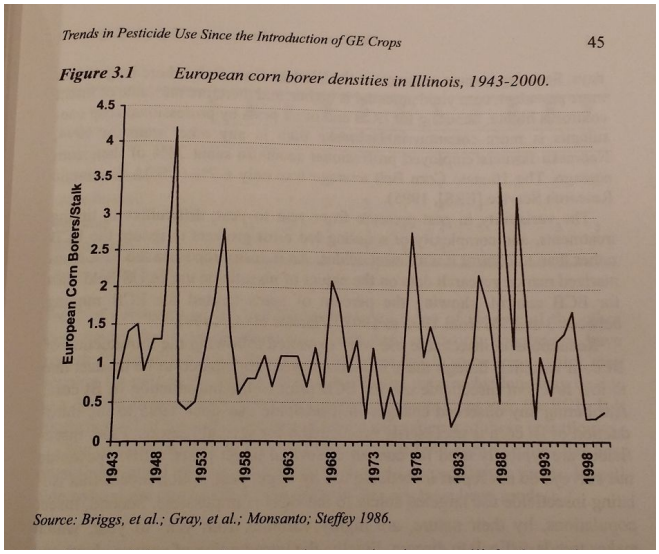
Balancing symbiotic species of crops with land and resources is extensively documented by Paul Wojtkowski in *An Introduction to Agroecology*. Root strata, light, harvesting, pest control, nutrient transfer all factor within integrated crop management systems and specific interaction zones. Urban agriculture can serve as a microcosm for research and development of pluri-cultures of crops, seasonal and cyclical rotation, clustering, and bioengineering. Moving from strip-harvested mono-cultures that lack biodiversity, not to mention taxing the land of nutrients and minerals in every cycle and heavy-handed chemical pest control, urban agriculture R&D provides synchronized, symbiotic agro-ecologically friendly strategies. One quickly realizes the potential of deciphering nature's control systems. Well equipped, multi-dimensional urban installations are better able to create complex food webs between microbes, plants, insects, scale-up for larger field experiments or upon enclosed testing grounds, and mix species better than conventional agriculture does in open fields. Every step in this direction is one that is never too many:

Bi-cultures of staple / commercial crops		
Maize can be found with:	cotton	sugarcane

[10] Tristram Stuart, *Waste: Uncovering the Global Food Scandal*, 2009 p.185

(not complete list)		pumpkin	sunflower
		sorghum	chili
		soybean	muskmelon
Sorghum can be found with:		alfalfa	millet
		groundnut	oats
		maize	chickpea

Temperate garden bi-cultures:	
crop # 1 +	crop # 2
asparagus	tomato / parsley
bean	beet / celery
beet	onion / kohlrabi
garlic	onion / potato
lettuce	pea / radish



As a local example of what this essay implies by synchronized synergies we take the example of Bt-Corn. *Bacillus thuringiensis (Bt)* is a species of soil bacterium with an insecticidal protein that has been bioengineered into corn and cotton plants. It provides protection from the European Corn Borer insect, which can decrease corn yields by 6% per larva per plant. The Briggs et al. 1986 graph taken from *The Economic and Environmental Impacts of Agbiotech* shows how the ECB population has cyclically risen in the last 50 years. A complex but unanswered question (in the book) is why? Another question is how has Bt-modified corn since its implementation in 2000 by 25% of IL farmers changed / evolved?

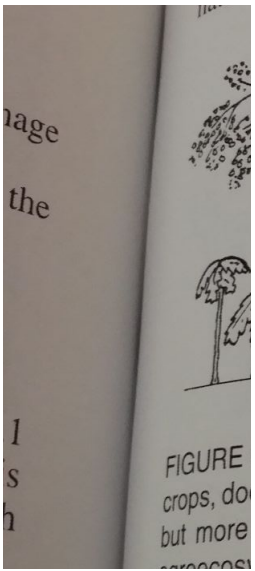


FIGURE 10.7. A forest farming arrangement that has crops, either in clusters or strips, within an agroforest. This drawing shows mostly a minimum-interface spatial pattern within the tree strip.

Wojtkowski's book on agroecology dedicates several chapters that explain biomass transferring strategies coupled with complementary nutrient crops of varying root and light strata.

These illustrations demonstrate an infinite number of microcosms that can be potentiated within a few square meters. As a box-plot case in point, the University of Illinois at Chicago has four urban planter gardens with more than 30 species of fruit, vegetable, herb and flowers between its library and Student Center East facilities (Summer 2017).

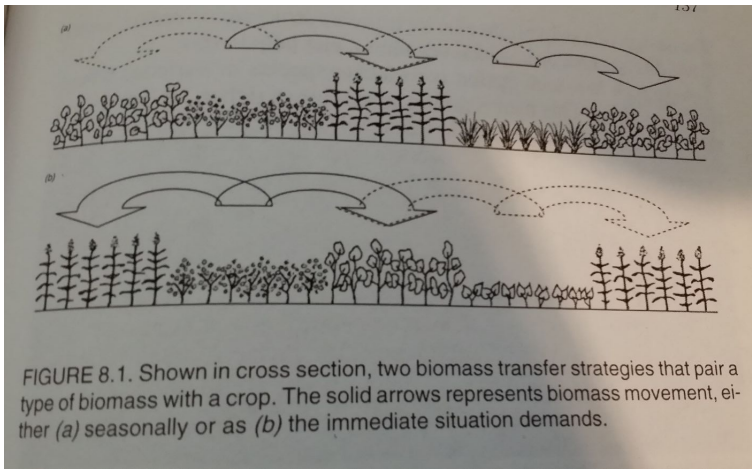


FIGURE 8.1. Shown in cross section, two biomass transfer strategies that pair a type of biomass with a crop. The solid arrows represents biomass movement, either *(a)* seasonally or as *(b)* the immediate situation demands.

Sunflowers more than 6 feet tall grew in a matter of weeks! Pumpkin, garlic, onion, fig, wild strawberries, corn, tomato, and dozens of other species flourished in less than 50 sq meters in an open, public space!
(…One may count on the academic to do true justice in the field.)

The Chicago Urban-scape: trees & aerial imagery

With thousands of urbanites gardening, farming, and researching in any city, building a network harmonizes efforts, without which synchrony is not possible, and efficiencies may not be augmented at all, or realized fully. The Urban Agricultural Network and the American Gardener's Association are two national-level institutions that bring clubs, societies, and green enthusiasts together. J. R. Taylor and Lovell do incredible work, manually stitching together layered satellite imagery taken from Google Earth in 2012. Chicago is 606 sq. km, of which approximately 58,077 sq. meters are classified as: food garden (12.9%), ornamental garden or park (49.8%), streetscaping projects (10.5%), and other types (26.8%) of food production areas. Even as a global city, Chicago has a vast, untapped potential that moves it towards greener food sources. (The pun is unavoidable here.) Socio-economic diversity and the polarity of global cities arguments should propel each Chicagoan to introspectively observe how they

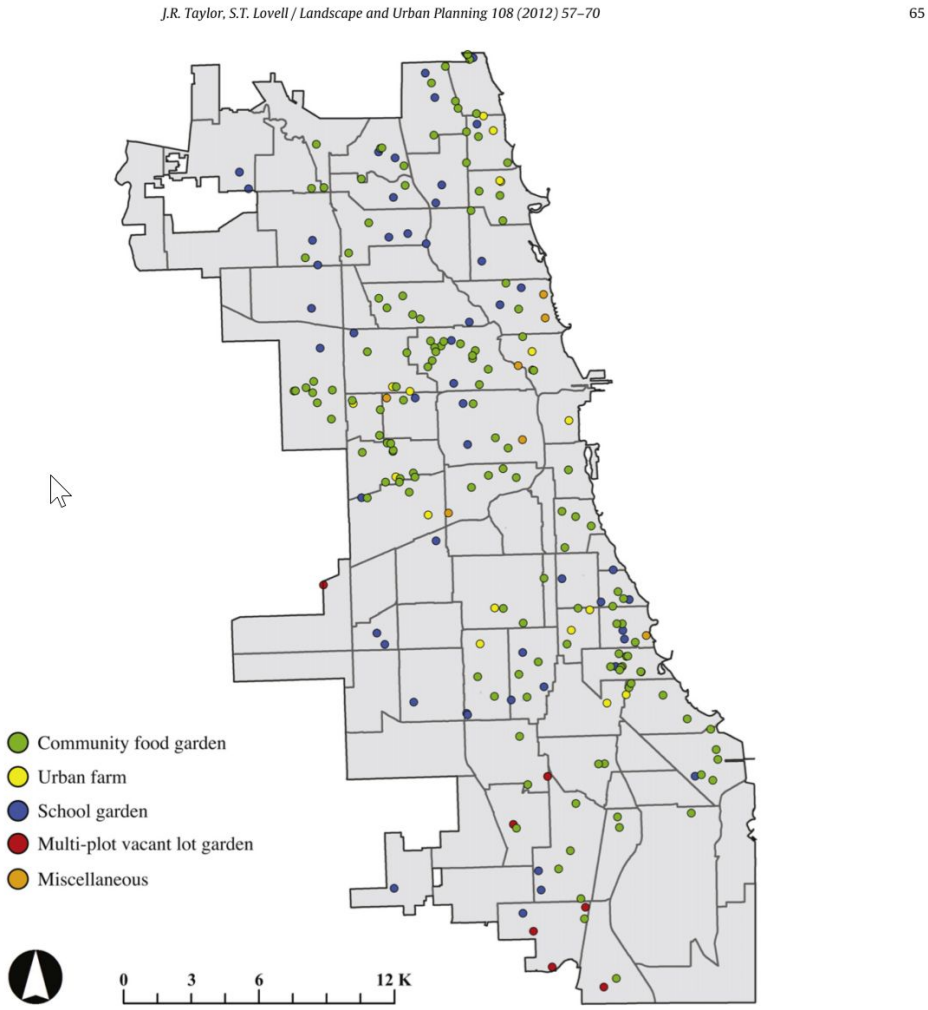


Fig. 3. Map of Chicago showing public and semi-public urban agriculture sites (community and school gardens, urban farms, multi-plot vacant lot gardens, and miscellaneous sites) identified through visual analysis of high-resolution aerial imagery in Google Earth superimposed on Chicago's 77 community areas.

might make their environs, food sources, and waste a little greener. Taylor and Lovell's work is summarized in a few maps presented here:

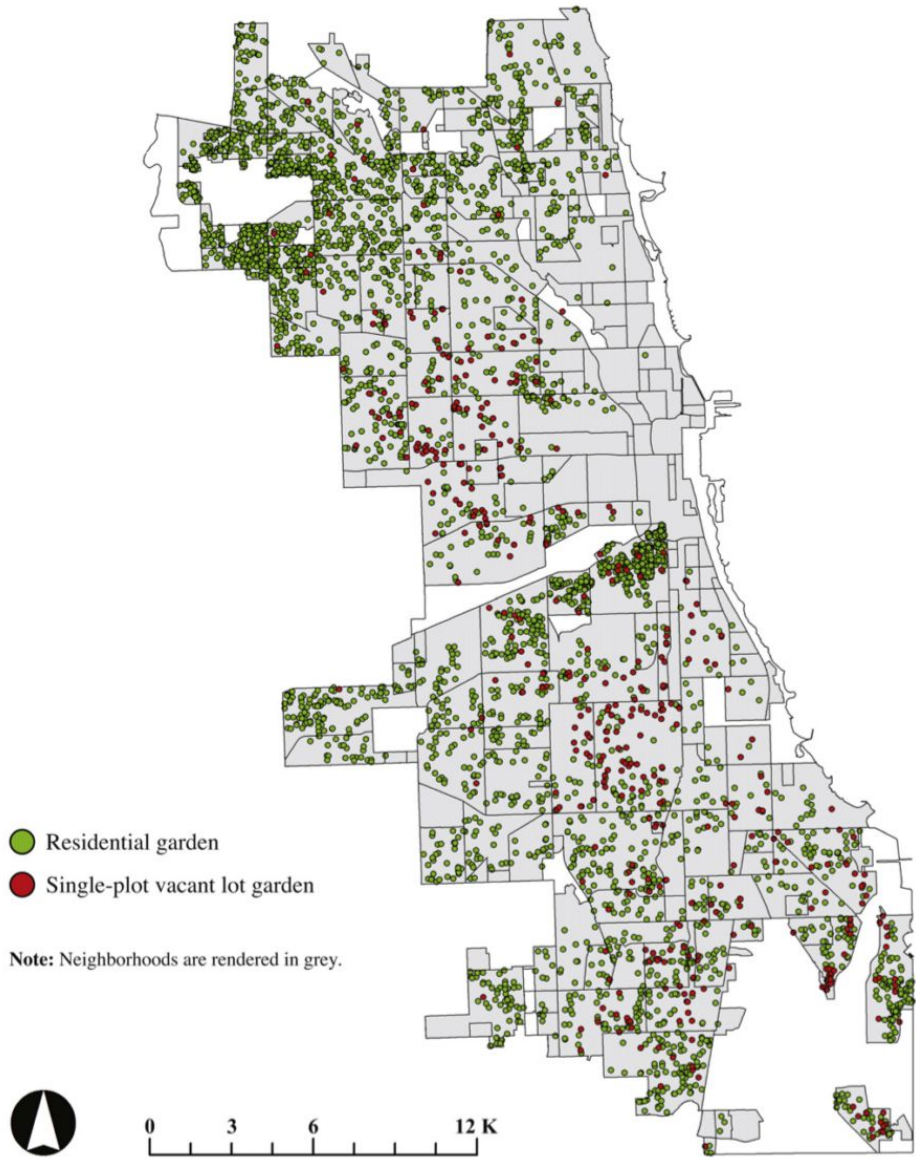


Fig. 4. Map of Chicago showing home food gardens (residential and single-plot vacant lot gardens) identified through manual interpretation of high-resolution aerial imagery in Google Earth superimposed on the city's 228 neighborhoods.

In a famous study, McPherson et. al conceptualize the function and value of trees. They devise a cost and benefit analysis of planting trees in *The Chicago Urban Forest Climate Project*. The study tabulated more than a dozen species of trees that were most prominent in the city. "The

value of an urban forest is equal to the net benefits that members of society obtain from it." Evaluating several social and ecological relationships, equations were formulated. Direct economic savings were calculated by existing costs the trees offset. Each tree planted reduced about 1.3% of heating, cooling energy by 7%, and peak cooling energy demand by about 6%. In Chicago, during the 1990s, 95000 planted trees were amortized over 30 years. "Other" environmental benefits produced by trees were scenic quality, wildlife habitat, reduction of stormwater runoff, and cultivating CO2 sinks while improving air quality, recreation, social empowerment, stress reduction, soil conservation, noise reduction, enhancing the landscape and biodiversity… externalities. Their pure cost was $21 million, while the pure-cost monetized benefits derived from trees were valued at $59 million. The study, thus established a Net Present Value of each tree being approximately $402 (in the 1994).

Conclusions: The dimensions of Urban Agriculture

Every civilization in the last 10,000 years has flourished by securing access to flowing water, agriculture of staple grains and produce, diversified economies, and trade networks. A stabilized form of governance ensures continuity for the prosperity and posterity of that city, ancient or modern. Rifkin foresaw the values of creative play, peer-to-peer interactivity, social capital, participation in open commons, and access to global networks as the next transformation: *from the industrious mode of economic development into a collaborative way of life*, peaking in 2050. In order to realize the awesome potential of urban agriculture there must be collaboration on a number of levels. K. Specht et al. tabulate lateral synergies found in urban agriculture literature and mapped them along dimensions of economics, society, and environment:

40 K. Specht et al.

Fig. 7 Quantitative evidence of topics (absolute frequencies) in surveyed literature related to the economic dimension of sustainability (n = 96; multiple entries possible)

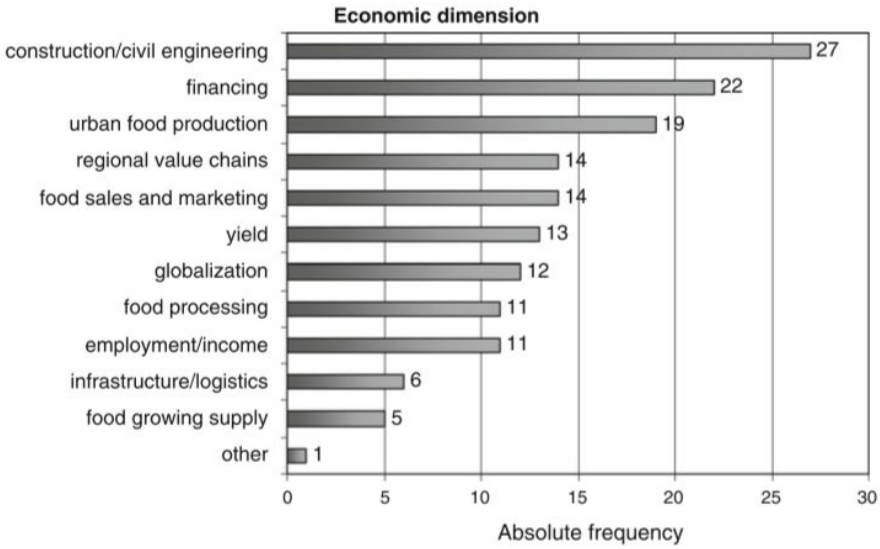


Fig. 5 Quantitative evidence (absolute frequencies) of topics in surveyed literature related to the environmental dimension of sustainability (n = 96; multiple entries possible)

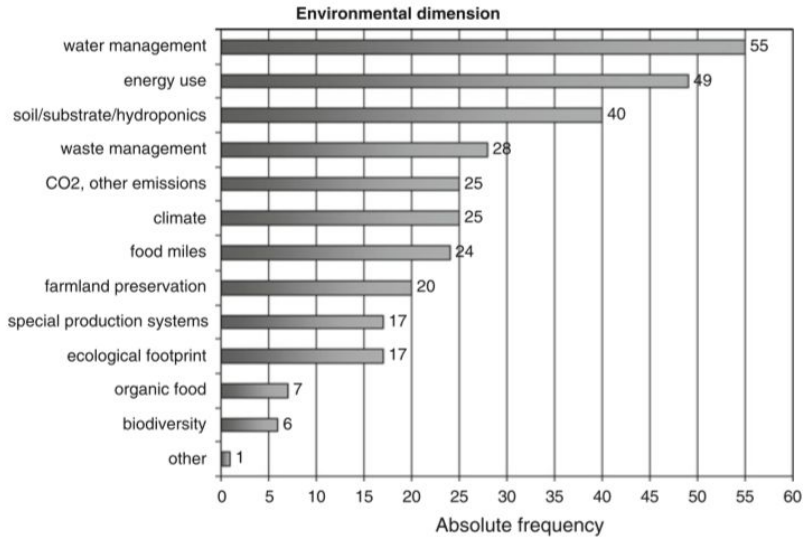
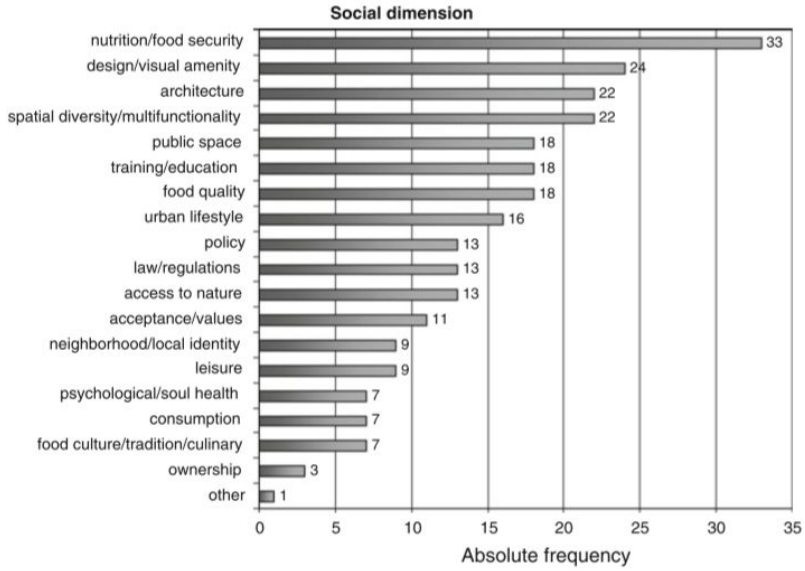


Fig. 6 Quantitative evidence of topics (absolute frequencies) in surveyed literature related to the social dimension of sustainability (n = 96; multiple entries possible)



As the developing world continues to increase the number of megacities, arguably inevitable, and global cities continue to polarize, there awakens within the collective urbanites… a green consciousness in every country and city. Ideals of sustainability first found in food security pave the way for more capital-intensive green-energy conversions. As the demographic trends will demonstrate that food security is a higher priority for a far greater number of people, it must precede unit-ized renewable energy production. Urban agriculture, thus becomes an

educational, research, and development vehicle for an ecologically harmonious and sustainable future for all.

Bibliography: works cited

1. *Cheema, G. Shabbir et al.,* ***Urban Agriculture: Food Job and Sustainable Cities****, Publication Series for Habitat II, Volume 1, United Nations Development Programme, NY: 1996.*

2. *Locke, John* ***The Second Treatise of Government.*** *Edited by C. B. Macpherson, Hackett Publishing, IN: 1980.*

3. *Kalaitzandonakes, Nicholas G.* ***The Economic and Environmental Impacts of Agbiotech: a global perspective,*** *Kluwer Academic, NY: 2003.*

4. *Kathrin Specht et al. "Urban agriculture of the future: an overview of sustainability aspects of food production in and on buildings" Agriculture Hum Values, 2014 31: 33-51. (Springer)*

5. *McPherson, Gregory E. et. al., "Quantifying urban forest structure, function, and value: the Chicago Uran Forest Climate Project" Urban Ecosystems, 1997, 1:49-61.*

6. *Rifkin, Jeremy* ***The Third Industrial Revolution****: How lateral power is transforming energy, the economy, and the world. Palgrave MacMillan, NY: 2011.*

7. *Short, John Rennie, Globalization and the City* ***(from class reading excerpts)***

8. *Stuart, Tristram,* ***Waste: Uncovering the Global Food Scandal****, W.W. Norton, NY: 2009.*

9. *Taylor, R. John and Sarah Lovell, "Mapping public and private spaces of urban agriculture in Chicago through the analysis of high-resolution aerial images in Google Earth" Landscape and Urban Planning 2012, 108: 57-70.*

10. *Ugai, Takao "Evaluation of Sustainable Roof from Various Aspects and Benefits of Agriculture Roofing in Urban Core" Procedia Social & Behavioral Sciences 2016: 216, 850-860. (Science Direct)*

11. *Wojtkowski, Paul A.,* ***An Introduction to Agroecology: Principles and Practices,*** *Haworth Press, NY: 2006.*

12. *www.unhcr.org Syrian Diaspora figures reported by UNHCR, last accessed Aug 2017.*

13. *www.ted.com TED talks, February 2006, Hans Rosling: The best stats you've ever seen, accessed Aug 2017.*