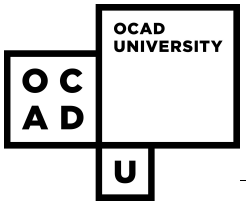

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Urban systems of survival: Building a resilient capacity of food and housing in the city

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Abstract

As people migrate to cities in increasing numbers, infrastructure, resources and resilience becomes taxed and fragile. An urban challenge is to create a more sustainable and resilient city that can provide affordable food and housing for it's inhabitants. This paper identifies key related issues, and explores a number of systemic approaches to integrating food and housing to build capacity and create a more resilient city ecology. Considered, as a systemic problem, Toronto being a large multi-cultural centre is a good case study with a serious need for affordable access to nutritious, culturally appropriate food, and housing to serve families, the working poor, and new Canadians, many of which are looking for rental accommodations. Consideration of mixed-use space that includes low, medium and high-density residential space, and possible options of urban food production highlights opportunities. The need for a local self sufficient food system, is paired with the competing need of an affordable place to live, to consider merged alternatives of growing local food within the emerging new contexts of affordable urban communities. Summary points are outlined as a series of next step recommendations to suggest a way forward to the built environment of the alternative city of the future, which must be self-sufficient, and build the capacity to generate its own resources in terms of energy and food from within the city itself.

Keywords

Affordable, Food Production, Housing, Resilience, Infrastructure, Urban Communities

Introduction and Context

It has become increasingly clear to urban planners, and city administrators that a well designed city provides for variety, diversity and adaptive possibility for it's inhabitants. We now realize that segregation, commuter travel, and marginalization of cultural and income groups all creates a stifling urban environment. What makes a "well designed" city is one that meets both the fundamental necessities of urban dwellers; basic needs of air, food, shelter and clothing, and the more secondary needs of sanitation, education, healthcare, and a sense of social, cultural belonging.

> *This basic needs approach was introduced by the International Labour Organization's World Employment Conference in 1976 and according to John A. Denton, the list of immediate "basic needs" is air, food (including water), shelter and clothing. (Denton 1990)*
>
> *We consider food, water, air and shelter as the fundamental requirements for the basic necessities of life. These are essential "based on the absolute minimum resources for long-term physical well-being." (Wikipedia) In many cases these necessities are no longer part of the commons and have been turned into commodities in a society that denies basic needs for survival to anyone that can't afford the price. (Martin 2014)*

As more people migrate to cities to live and work, they will continue to increase the need for affordable housing and food resources. This creates additional stress on infrastructure, social services and the surrounding rural environments, as demand for resources exceeds availability. Today, cities unsustainably consume a majority of global resources and as the urban population increases so does the need for resource management and increased resilience.
With the global population predicted to reach 11 billion by 2050, (http://esa.un.org/unpp/) we need to develop greater capacity within the city for resilience to mitigate the negative impact of further disruptions. It will be critical to embrace densification in cities as our population expands.

> *"Density lowers the per capita costs of infrastructure capital and operating costs, and reduces per capita use of all types of energy including energy for transportation and heating and cooling buildings." (Applegath, 2012)*
>
> *"Cities will need to adopt urban planning and building design strategies that allow them to increase their ability to better respond and adapt to economic, social, and physical stresses they will face as they confront the challenges of increasing energy scarcity, climate change and population [growth]."*
>
> *"Over the next 50 years, our societies and cities will therefore need to effectively respond to these challenges, or suffer significant economic and social consequences." (reilientcity.org)*

ResilientCiy.org is an example of an organization providing systemic tools that helps cities to develop capacities to absorb future shocks and stresses by developing creative, practical and implementable planning and design strategies that help to increase the capacity for resilience associated with climate change, environmental degradation and resource shortages, in the context of global population growth .

This paper will discuss an eco-systems approach to the urban community provision of food and dwelling resources. To illustrate a systemic design approach this paper will focus on case study examples in housing shelter and community urban food agriculture, as practice - based research approaches to creating a more sustainable city. The premise is that the intersection of housing and food are integrated commodities that are inextricably connected in expanding urban environments.

When applying ecosystem thinking to urban centres, expanding urban population can be viewed as parasitic or invasive as city dwellers consume more and more resources from surrounding rural areas. This brings us back to the key survivalist necessities of life, which must be considered to support continued growth. This includes the need for affordable housing, affordable culturally appropriate nutritious food and the need for waste management and air quality control. Focusing on the intersection and integration of housing and food we can identify innovative ways to address survival and social issues resulting from expansive urban growth, while at the same time increasing the city's resilience.

Rationalizing a System of Affordable Food & Housing:
City Growth and Toronto as a Case Study

Along with exponential growth comes the challenge to house and feed the increased population. As our population grows, city services and infrastructure become sought after resources with supply and demand dramatically effecting cost. This is particularly true in terms of affordable housing and access to affordable, nutritious, culturally appropriate food.

Toronto is "one of North America's premier immigration gateways" and according to Statistics Canada, (2008) and the Ontario Ministry of Finance, Toronto's population is expected to reach 9.1million by 2036. (greatertoronto.org) This makes it a suitable case study city, where multi-cultural issues dove tail with affordable housing and food..

> "With almost 47% of residents being foreign born, Toronto is approaching the tipping point of having more foreign born residents than domestically born Canadians. The GTA has become a destination of choice for individuals, families and businesses relocating to Canada." (greatertoronto.org)

This has dramatically changed the racial demographics of the city making Toronto one of the most multicultural cities in the world while creating the demand for a more diverse local food system that includes culturally appropriate food.

As the global population increases and crop yields decline due to environmental factors, the reliability of available imported food in the future becomes uncertain. We rely on both local, regional, and global food supplies most of which comes from centres in the periphery of the city limits. In the case of an emergency, pandemic, or serious supply chain disruption, the city food supplies can be diminished very quickly.

> *There are only 3 days of perishable goods, 8-9 days for frozen food and 14 days worth of dry goods in distribution centers around Toronto at any one time. (Elton,?)*
>
> *"Potential disruptions in food production as a result of climate change or a sharp rise in energy costs could potentially seriously disrupt the economics of food supply to cities." (Applegath 2012)*

"Since 81 per cent of all vegetables and fruit consumed in Canada are imported, they are highly vulnerable to currency fluctuations." (Molnar 2015) According to the University of Guelph's Food Institute and the university's sixth annual Food Price Report, Canadian families can expect to pay more for fruit and vegetable in 2017. This is due in part to a weak Canadian dollar and a second year of strong fresh-food inflation and increases the stress on the one in ten households in the Toronto Region that are already food insecure. (Toronto Vital Signs Report 2016)

Figure 1: Source: Future Proofing Cities: strategies to help cities develop capacities to absorb future shocks and stresses, Craig Applegath, 2012.

Along with exponential growth also comes the challenge to house the increased population. As more people migrate to cities to work, and to avoid costly transportation, the need for affordable housing will continue to increase creating additional stress on infrastructure, social services and the surrounding rural environment as the demand for resources exceeds availability. This demand for the dual provision of food and shelter quite often creates an economic dilemma for a family that sees the trade-off and sacrifice of food for housing. It is in this competition that the notion of an integrated system of food and housing becomes paramount.

Fig. 2: Basic Necessities, Mitchel 2016

Fig 3: Photo 1, Aura Tower

> *"Rent and housing is the most pressing non-negotiable expense from which other necessities including food are sacrificed.", www.dailyfood.ca*

The need for a local food system, is emphasized by the competing need of an affordable place to live. This has created a high demand market, with increased real estate prices, and costly and scarce rental accommodations. According to Toronto Vital Signs Report 2016, Toronto committed to building 1,000 new units of affordable housing a year between 2010-2020. In 2015 it built 103 units.

> *"In 2015, approximately 100K persons moved into the (City of Toronto) GTA area around and in Toronto. To satisfy these demands for housing, Toronto has to make available approximately 45K units per year to meet this demand." T.Tyndorf, Perspectives on Housing Affordability, Toronto City Policy Planning & Research, July 2006.*

Toronto had the most condos under development in North America in 2011. (Applegath 2012) We would argue that the increase in high-density high-rise condos are creating new food deserts due to the shear volume of occupancy in the downtown core relying in many cases on preexisting markets and grocery stores incapable of keeping up with demand.

> *"According to Ontario's Smart Growth plan, the most densely populated areas in the GTA [should] have 400 residents and jobs per hectare." (Dotan 2009)*

How do buildings like Toronto's Aura Tower at Gerrard and Yonge Streets, completed in 2014 with 995 units over 78 floors fit the Smart Growth Plan? This is only one of a number of high-rise high-density condos to hit the Toronto City scape in recent years. The current city development plan identifies major transportation corridors as receptive sites for similar high density development.

While the typology of low-rise city housing has shifted from single - family to more dense row, stacked townhouse, and tower types, few are rental units, and even a smaller percentage being assisted and affordable social housing projects, most new projects being high market - value condominiums. New approaches like the Laneway project, and Lanescape proposals to reinvigorate laneways with affordable rental suites, and community amenities at least counter this one approach to high density tower-making by providing a low-rise density increase program. (Leblanc, Dave, http://www.theglobeandmail.com/real-estate/toronto/laneway-housing-on-the-verge-of-a-toronto-revival/article)

The result of this escalating market place is that the majority of both renters and owners dwelling in the GTA, are allocating more than the City of Toronto's guideline for 35% affordability of net salary allocation for shelter per month, and many families according to City of Toronto stats are as high as 65%, creating an affordability problem. (Perspectives on Housing Affordability, Ted Tyndorf) This escalating market also forces working age family members, and those of the working-poor (low – income workers) to relocate to suburban locations, where more affordable rental accommodations can be found, however this results in increased commute times, and a loss of the quality of daily life.

The Need for a Strategy of Urban Grown Food

Fig 3: Photo 2 (BIA), Building Integrated Agriculture enabled terraced housing concept, www.architectureandfood.com

There is a need to look at low, medium and high-density residential space and mixed-use space that includes food access based on rooftop and vertical farming to increase access to affordable housing and nutritious, culturally appropriate food. Political will in terms of legislation and zoning changes would allow for the development of such spaces.

Decentralizing the food system will increase food security and encourage biodiversity by dispersing crops around the city providing economic and ecological resilience. Local agri-food systems will "ensure that towns and cities will grow to be resilient in the event that socio-economic or environmental conditions disrupt the globalized food markets." (De la Salle 2010) For this to occur food system planning needs to be integrated into city planning that includes the coordination of all municipal departments and stakeholders.

> *"Addressing issues of urban food production and distribution, water management and sustainability are important aspects of a resilient food system. A robust local food system including urban agriculture and rooftop farming has the capacity to decentralize the current food system while adding diversity and resilience to better absorb shocks from unforeseen disruptions in the global food supply chain." (Mitchell 2015)*

Increasing urban food production by maximizing under-utilized urban spaces, and making it part of mixed-use, residential development projects, both large and small will increase food security and diminish the environmental impact of cropland expansion and long distance distribution and shipping of agricultural products thus promoting a more sustainable, and resilient food system. Rooftop and verticle farm agriculture that incorporates food processing strategies in close proximity to crops enable opportunities to sell the freshest most nutritious product or create value added products with increased nutritional quality and higher value. It has the potential to increase the economic bottom line while reducing losses due to storage, shipping and distribution of perishable products. This offers a paradigm shift in the way we produce food that includes small-scale high-intensity, high-value, organic and value added practices that move away from the industrial production model that values calories over nutrition in favour of creating local nutrient rich food webs.

> *"Urban and rooftop agriculture offers potential increased resilience in the food supply system while providing economic and environmental benefits including employment opportunities, a reduction of the heat island effect and energy reductions associated with the need for Air Conditioning (AC) to cool buildings in the heat of summer. Rooftop plants create shade reducing the solar heat gain of a building while providing additional cooling through evapotranspiration. Furthermore, local production requires shorter delivery distances reducing energy intensive shipping (including heating and cooling) reducing the overall GHG produced in the system by creating a less carbon-intensive alternative." (Mitchell 2015)*

Fig 4: Photo 3 ***Rooftop farms – Lufafarms***
Lufa Farms. Photo: Benoit Rochon Source: Wikimediia: https://commons.wikimedia.org/wiki File:Lufa_Farms_Montreal_rooftop_greenhouse_in_Sunlight.

For many urbanites interested or concerned about food security the shift to local urban or peri-urban agriculture opens up a new avenue for employment. The shift from the traditional employment of the past the to self directed entrepreneurial work is the reality for many millennials. (Tranum and Weston) For this to make a significant difference to the accessibility and abundance of food grown within the city itself we will need political will, in terms of supportive policies and programs that enable and encourage action. Navigating uncertainty and the risk of disruptions in the current food system is the ultimate goal rather than to replace the existing food system.

Fig. 5: The needs of a resilient local food system, Mitchell 2016

There is a need to look at mixed-use space that includes low, medium and high-density residential space and to include food access based on new methods of rooftop and vertical farming to increase access to affordable and nutritious, culturally appropriate food. Political will in terms of legislation and zoning changes would allow for the development of such spaces.

> *"The answer to local, urban food production lies in a vertical approach to farming that contrasts with land-intensive methods. A high-efficiency hydroponic farm needs just 0.1 acres to feed a person for a year. A 95% reduction in acreage." Craig Applegath 2012*

21st Century Vertical farming techniques can be utilized to eliminate food deserts in underserved, and high density neighborhoods potentially increasing access to affordable food for all. Vertical farms can be integrated into the community in underutilized or derelict spaces like abandoned warehouses or intentionally designed into new building infrastructure within or in close proximity to housing. Food growing and production is especially important in rental housing and community-based residential projects, to build community and offset increasing food costs for families. In terms of food as a commodity, shorter supply chains mean more value for both the producer and the consumer by reducing the intermediaries and number of processes and shipping events that drive prices up and delay delivery. This ensures a better wage for the grower and a fresher more nutritious product for the consumer while offering opportunities for direct feedback by connecting urban food production to consumers and urban dwellers for human-centered cities.

> *According to Gene Giacomelli, the director of the Controlled Environment Agriculture Centre, " indoor farming can produce as much as 20 times the amount of food per unit area as conventional outdoor farming." Giacomelli is also a professor in agriculture and biosystems engineering at the University of Arizona. Zimmerman, Eilene. 2016.*

> *According to Applegath (2012), the 2006 design concept for the "Skyfarm" proposed for the area now occupied by the TIFF building in Toronto by Gordon Graff could have feed 40 thousand people annually from its 59 floor, 2.7 million square foot space. The building would have held 9.5 million square feet of growing space producing the equivalent of a thousand acres of traditionally farmed land.*

The strategy of urban grown food must be integrated with the city's strategic plan to incorporate policy and regulatory guidelines, incentives, changes to local zoning and building, regulations to support a new vision of a resilient city. Changes to the neighbourhoods of the city to include growing space and support facilities that are production and storage facilities, distribution centers, community gardens and markets are keys to the success of urban agriculture. There are examples of this movement already visible in community centres, and agencies around the city.

> *The Community Food Centres of Canada offers a new approach to providing healthy nutritious food for all opening a number of centres across Canada since 2012. Their mandate is to "enhance skills, create access to nourishment, advocate for food justice polices and build stronger, healthier communities." According the Nick Saul, president and CEO of the Community Food Centres of Canada, "The public policy realm is where real change happens." (The Globe and Mail, Wed Aug 10, 2016)*

Fig. 6: Photo 4: Farm X Concept Production Building, Photo 5: Sky Vegetables Roof Greenhouse, NY

Going forward with the Integration of Affordable Housing and Food

The built environment of the alternative city of the future must be self-sufficient building with the capacity to generate it's own resources in terms of energy and food from within the city itself. Local urban food systems provide a concrete entry point for this to occur. We need to start integrating affordable housing, food and green energy into the planning of our cities to create resilience.

Current thinking around affordable urban housing alternatives involves a paradigm shift towards redefining acceptable shared habitation contexts, a change in values around combinations of ownership and rental, and a redefining of lot and community density limitations and guiding principles to allow the development of second suites, laneway flats, and other forms of shared community urban living. Along with this are incentives to include rooftop gardens, greenhouses, and both back and front yard agro-garden growing. An example of this trend can be seen in Toronto's Richmond Street Co-Op below, an example of affordable housing, that promotes social engagement, sustainability and food access through integrated gardens to service the ground floor restaurant kitchen.

- *This paradigm shift in affordable urban housing alternatives involves a move towards redefining acceptable shared habitation contexts, a change in values around combinations of ownership and rental, and a redefining of community density limitations and guiding principles.*
- *Integrating affordable housing, affordable food and green energy into city planning along with City regional food systems provide a concrete entry point for this to occur.*

Fig. 7: Photo 6: 60 Richmond street Coop Building, Photo 7: Section showing Green roof & Growing Gardens

Like the "Second Suites" kick-start program (Toronto City Policy Planning & Research, Sept 2006) to increase legal rentable basements, policy development & guiding regulatory principles can be utilized to encourage more rentable basement, second and third floor housing flats, including small flats above in-garage alley locations. This same approach can also include the additional development of rooftop, vertical, and yard gardens to produce food. While these would require collective agreements and policy guidelines to preserve rental units, public laneways and to create connective social spaces to support cultural and social integration activities in the public domains, it could also foster a whole new culture of urban growing. This architecture of housing, both private and multiple dwellings needs to be redesigned to include these rooftop gardens, interior vertical gardens, and covered green house options. Accessible roofs, and growing supports like enclosures, plumbing and irrigation, and maintenance must be integrally designed.

While the need for auto ownership has decreased, and can be accommodated through the provision of communal vehicles like "Zip car", "car to go" or smart cars etc., the need for growing spaces, both private gardens, and communal gardens is expanding. In a climate like Toronto, covered gardens and greenhouse prototypes are viable solutions for all season growing.
The incentives for developers, contractors and builders to build larger rental and social housing with integrated food production centres, vertical and rooftop gardens must be provided through policies, and new business models to kick start a green city. There is also a need for public community centres to provide workshops, hands-on education, and permaculture knowledge and support for communities. These may also be places of entrepreneurship, and labour support.

Making Change: A Program of Recommendations

What are the key areas of recommendations within the context to create affordable food and housing? Critical areas of recommendations for changing fall into four broad categories.

Access

Change federal / provincial / municipal **policies to support urban agricultural production** within mixed-use spaces that include low, medium and high-density affordable residential space and therefore increase access to nutritious, culturally appropriate food.

- Tax, and development incentives to new residential projects providing food growing spaces
- Tax breaks based on environmental service metrics
- The institution of funding programs at all three levels of government similar to that of Solar Energy or Wind

Changing Attitudes

Change attitudes towards local production. Develop a **strategy for urban grown food and import replacement** geared toward making food more affordable.

- Food system planning needs to be integrated into city planning that includes the coordination of all municipal departments and stakeholders.
- Expand scalable Certified Neighborhood Food Hubs from neighborhood centers to district centers the city centers to encourage community engagement as an extension of the Green Roof Bylaw and the Local Food Procurement Policy.
- Support initiatives operating as commercial, co-op, non-profit hybrid for aggregating food from the neighborhood.
- Encourage development of rooftop, and greenhouse projects in existing retrofit and new residential projects
- Programs to encourage seasonal and climate – appropriate crop growing programs.
- Integration of local production into commercial retail providers at competitive and affordable pricing
- Program of community selling of local homegrown produce, Changes to retail practices and regulation allowing the selling of homegrown produce on the open market to retailers, corner stores or neighbors.
- Subsidies for import replacement crops
- Toronto's Local Food Procurement Policy should be expanded to include all food retailers.
- Develop legislation and strategies that promote the reduction of waste and the safe reuse of food currently wasted by food retailers. Eg. donation and use of perishable good before or on recommended use date for use by second harvest organizations.

The Need for Policy and Legislative Change

Changes to legislation and zoning laws that supports Community Supported Agriculture (CSA), co-op or retail growing spaces in high-density residential or mixed-use buildings, for example having a number of floors within the building designated for vertical farming based on the buildings residential occupancy.

- Embracing diversity, density and mixed use to allow for food production to be an essential program of new community projects
- Maximizing the active use of space and land – program of derelict or temporary agricultural uses by communities for growing
- Activating vibrant around the clock use of space, with the integrated uses of work, living and community social spaces for gardening and food production

- Recommend amendments to the Green Roof Policy providing additional benefit for the installation and maintenance of productive urban agriculture over extensive green roof applications.

Additional **support from all levels of government** and the public / private sector **promoting infrastructure and architectural development** with integrated agricultural growing capacities.

- All new housing developments should include the infrastructure for food sustainability including growing, processing, storage and distribution. This could be in the form of rooftop productive gardens for low-rise buildings or multiple floors of vertical farming spaces in high-rise building projects with dedicated growing space allocation being determined by the housing capacity of the building.
- Offer government incentive programs for the inclusion of affordable housing units and space for agricultural production within the city.

Investment

Develop supportive programs, policies and funding mechanisms that **encourage actionable entrepreneurial investment in urban agriculture**.

- Funding organizations need to embrace the Social Return on Investment (SROI) offering lower interest rates to offset start up costs of urban agriculture based on metrics other that financial Return on Investment (ROI)
- More investment from all levels of government and the public / private sector into the development of urban agriculture projects within the context of urban built neighbourhoods.

Government **investment into Urban Agriculture** Initiatives

- Development of turnkey hybrid growing solutions as entrepreneurial startup industries
- Development of Smart Growing systems
- Advancement in water management and efficient irrigation
- Research into advancement of efficient urban growing systems
- Investment into hard solution opportunities to increase urban agricultural activity (Including lifts, railings, hardware, net '0' greenhouse technology, lighting systems, etc)

Increase funding from all levels of government as well as the public / private sector

- Identify areas of funding opportunities; research, production support, entrepreneurship etc.
- Investment opportunities - Hard solutions, Soft Solutions and Organizational Solutions

Conclusions

It is clear as we re-intensify and increase the density of our urban neighbourhoods that the integration of food production and dwelling must be accomplished if we are to achieve a measure of resilience from constant fluctuating global events. While the immediate benefits lie in more self sufficient available food resources for urban dwellers, a larger impact is the implementation of an even more important conceptually integrated premise that we must always create sustainable food resources as integrated elements of urban dwellings. This change in attitude needs to be realized through policy change, and guidelines to create the integrated city of the future that both houses and feeds it's inhabitants.

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