

The Future of Urban Agriculture

A discourse on the city as an agricultural hub
And the possibilities of an enhanced urban ecosystem

Michael Caspi

Architect

Paper for Landscape Urbanism seminar

Inst: Landscape Arch. Judy Green | Dr. Doron Bar (Geo.)

Partial requirements for Masters of Urban design degree,
Bezalel Academy of Art and Design, Jerusalem, Oct' 2011

"Ecology is the study of plants and animals in their relationship to their environment and the relationship to each other, but in fact it is more than that: It is an intellectual discipline and the main tool that allows us to hope that human evolution succeeds to get on a new track, and that man will stop plundering the environment, on which our whole future of humanity depends on". (Max Nicholson, the environmental revolution, 1970)

Forward

Ecosystems are the productive engines of the planet, providing most of our essential needs, from producing food, generating unique biodiversity, enabling the production of oxygen, and up to making fibers for clothing. Yet, nearly every measure we use to assess the health of ecosystems tells us we are drawing on them more than ever and hence degrading them, in some cases in a greater pace than its optimal production. As for now, most reports¹ show that human activity has profoundly altered the extent, condition and capacity of all major ecosystem types. Agriculture has expanded at the expense of grasslands and forests, engineering projects have altered the hydrological regime of most of the world's major rivers, settlement and other forms of development have converted habitats around the world.

This paper will try and examine the status of the intensified agricultural land use outside our cities and its repercussions on our environment, and our cultural customs in consuming them. Once we understand the consequences of this massive intensification in agricultural processes in precious open land, We can start ask ourselves about the intervention of local small-scale farming in our cities, and by that alleviating some percentage from the load of the "farming machine" food production and its negative effects on the local ecosystems it surrounds.

It is no longer relevant to ask whether we can feed the planet, but a more difficult question should be asked: Can the world's agroecosystems and farming intensity feed today's planet and remain **sufficiently resilient** to feed tomorrow's hungrier planet? Saying that, Can we create a mechanism in the city or a "city mechanism" that doesn't need the farm (Partially at first) in order to exist, but be self-sufficient and capable of growing fresh produce, by technological intervention and design

ingenuity, aided by its urban waste producing minimal impact on the ecology and the built environment it is adapted to?

As for today, solution related to urban agricultural activities take place in various parts of cities, both in the built-up area, such as in back yards, along streams and railway reservations, on vacant public or private land, and as well as in the rapidly changing sub - and peri-urban areas. During the past two decades, urban agriculture had evolved from a subsistence production to an agricultural practice for consumption by the producers (with a small part of it for trading), based mainly on the use of local resources and with minimum transportation costs. However, it still seems in developing stages and what this paper will try to examine is the enormous potential for local urban agriculture to make better optimal utilization of urban waste, energy and other resources to produce and sustain the growing population in the cities and maintain a quality based ecosystem and greater biodiversity in the city.

Agriculture intensification

A recent paper from 2000, by PAGE (The Pilot Analysis of Global Ecosystems) with Collaboration of intergovernmental organizations, has shown that human activity have adversely altered the earth's most important biogeochemical cycles – the water, carbon and nitrogen cycles – on which all life forms depend. Over most of the past history – and particularly in recent years – agricultural output in Western, Asia and North America has been increased mainly through bringing more production into a given land, hence, extending the agricultural frontier through conversion of grasslands and natural forests. We can see that the increasingly concentrated patterns of human settlement and the growing competition for land used by other purposes have greatly reduced the opportunity for further geographic expansion².

Thus, intensification of production has become a key development strategy in most parts of the world, utilizing processes of producing multiple crops each year on the same land using varieties of agricultural methods, depending on rainfall quantities and regional climate. For instance, In Asia, this has been achieved primarily by

irrigated agroecosystems³ using new, short-duration crop variety. Further indication shows that in many developing countries, there is a wide spread agricultural intensification on lower quality lands, and a notable intensification of agricultural land use around major cities (with exceptions , within the cities), particularly for high-value perishables, such as dairy and vegetables, but also to meet subsistence needs (Scherr, 1999). This phenomenon is evident from a statistic shown by the Food and Agriculture Organization (US) in 1999, that between the early 1960s and the mid 1990s the total amount of agricultural land in Western Europe and North America showed a sustained decline of around 39 million hectares for the first time in modern history (FAOSTAT, 1999).

Environmental concerns – soil quality; soil nutrients; water quality; biodiversity

The enormous scale of agricultural production expansion and its intensification have made two apparent major environmental concerns. First, we can see the concern over the vulnerability of the productive capacity of many agroecosystems, such as problems in soil salinization (salt build-up) caused by poorly irrigation systems, loss in soil fertility through over-cultivation of fragile soils, and lowering the water table due to over-pumping for irrigation purposes among many other negative results to the local soil. Second are the more general ecological concerns, a far greater resonance of negative impacts on the environments, which must be understood in greater depth and adequately dealt with. These latter concerns can be such as soil erosion from hillside farming on downstream fisheries, damage to both aquatic and human health arising from fertilizers and pesticide residue in water sources, loss of habitat and biodiversity from converting land into agricultural uses, as well as narrowing the genetic diversity of domesticated plant and animal species, among many more concerns for the future. Furthermore, in the global sense, scientists show concern on climate change due to farming by altering carbon, nitrogen, and hydrological cycles (Wood, 2000).

Agricultural land-use trends

The past two centuries has seen an unprecedented growth in agricultural expansion, reflecting rapid population growth, generally rising standard of living, market integration, urbanization, new technologies, and agricultural investment. Agricultural expansion, and the subsequent intensification of production methods as good arable land became scarcer, brought about impressive increases in food availability and profound effects on natural resources and habitat (Turner, 1999). Another trend is the usage of agricultural land for development purposes in suburban areas, which in turn causes a higher intensification on already agriculture land, doubling the capacity it is producing, hence, minimizing the full benefits of nutrients in foods and goods distributed to city centers. Kyoto protocol? To add comments on trends causing intensification.

Status of urban agriculture

The UNDP 1996 Report dedicates Chapter 4 to where be Farming Found in the City and Chapter 5 to Producing Food and Fuel in Urban areas. The cities of most developing countries contain urban agriculture almost everywhere. The report goes on to catalogue the types of spaces used: around houses, rooftops, community spaces ,surplus public and private spaces, roadsides and right-ofways, streams and flood plains, water bodies, wetlands, and steep slopes. The types of access and duration of use are delineated noting that these can affect both the farmer's choices of crops and the degree of care of the land and level of planning. (UNDP 1996) – too long to get into detail..

Enhancing biodiversity in the city

One major challenge in conversion of land use in the city and the increase of urban population is to maintain a healthy biodiversity in plants and animal habitat. As it is clear enough to ecologists, it is imperative that the new arrangements of the cities and its multi-complexity in tradeoffs between building interventions and the loss of biodiversity feeding ground will address the possibilities of reducing the damage to minimum in order to salvage a certain range of biological life. This in turn will enable

the continuity of biodiversity and the reference point to a better design strategy that addresses these issues in hand. Food needs and thus agricultural development will continue to involve tradeoffs with one or another aspect of biodiversity. This challenge will likely need continued mediation through conservation policy. From the perspective of environmental and agricultural policy design, it is important that we gain a better understanding of what is at stake and, hence, are better placed to design biodiversity interventions compatible with specific social concerns, including long-term food security.

Carbon storage and reducing city pollution

Carbon, an essential component of all life forms, is constantly being absorbed, released, and recycled by a range of natural and human-induced biological and chemical processes. Knowing this in mind, through the 1992 U.N framework convention on climate change (FCCC) and subsequent agreements, primarily the 1997 Kyoto protocol, the international community has resolved to take action to reduce future anthropogenic (human-induced) contributions to greenhouse gasses (UN 2000). Within the urban context, a certain land use policy and practice can increase carbon build-up in terrestrial ecosystems and aid in the activity to reduce Co₂ emissions to minimum. This intervention of urban agriculture can reduce significantly the amount of pollution capabilities of the cities and its direct affect onto the citizens who lives on it.

Possibilities of Urban land use

Cities are not only concentrations of growing demand for agricultural commodities, but they are also nutrient sinks and repositories of other untapped natural resources. Nutrients are found in the vast quantities of wastewater and organic residues generated in urban areas. Cities also contain underutilized land and water surfaces which can be put to productive use.

Possibilities of inner-city agriculture

The urbanization trends and the increasing concentration of poverty in and around cities appear irreversible, though improved livelihood options in rural areas certainly need to be greatly increased in order to slow migration and maintain national food production capacity. Given this irreversible scenario, there is continuing need to address urban food security issues and to strengthen the role of agriculture in diverse urban livelihood strategies. As cities face ever greater population pressures with inadequate infrastructure, the role of agriculture in urban environmental management will also become increasingly important. Parks and gardens are options for maintaining green spaces and avoiding 'heat islands' where local government has the funds to provide them. Once thinking about it, it is far more practical for the green spaces to be productive spaces managed by the private sector – that is, local producing households. At the same time, urban trends can lead to potential health problems in urban agriculture, either through the transmission of contaminants into the food chain or through the unsustainable intensification of urban horticulture to capture growing markets. The growing sophistication of urban consumers will increase the need for food safety and quality controls and these will require that health risks are identified and mitigated. This also highlights the key role of urban policy and planning in agriculture. We need to work with policy makers in order to ensure that agriculture is incorporated within urban governance, that it is empowered and facilitated and that it is recognized as an integral part of sustainable cities.

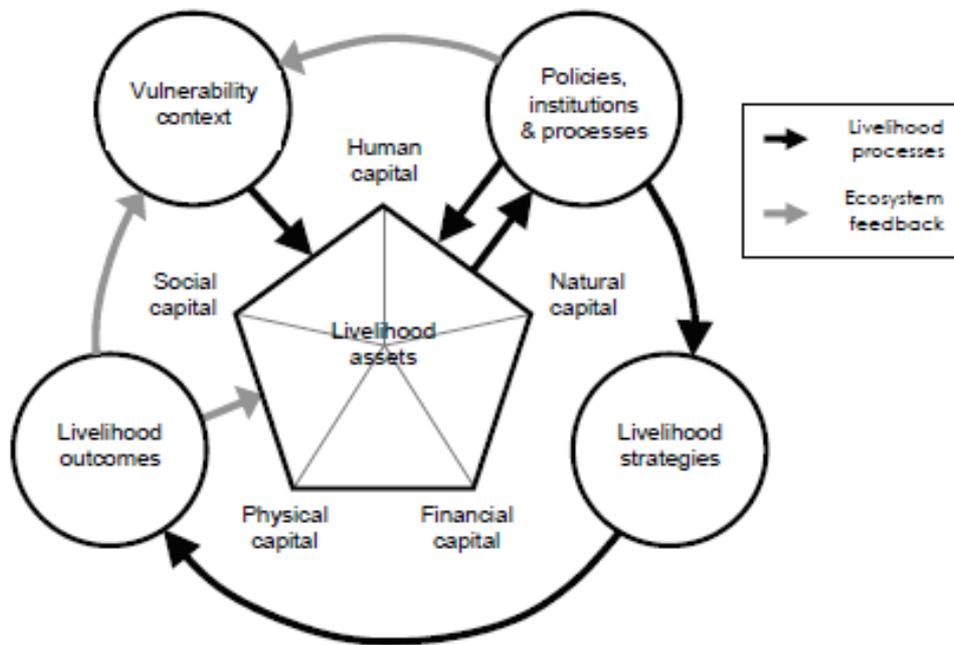
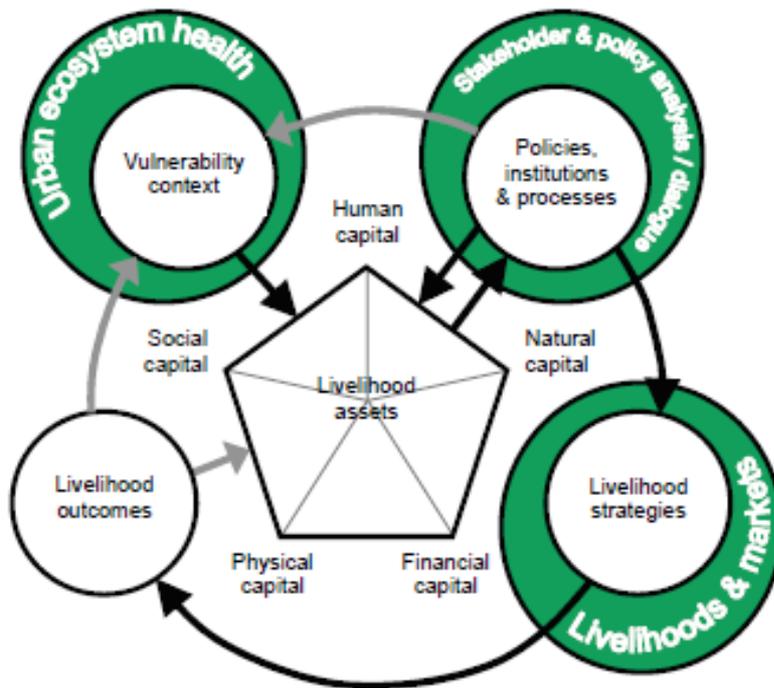


Figure 3 Sustainable urban livelihoods framework*



Gordon Prain, Diagram of sustainable urban livelihoods framework.

Need for policy

Urban households involved in agriculture cannot avoid being caught up in a complex institutional and policy environment of laws, regulations, norms and urban planning schemes which influence how farming is carried out. Because of the population densities and multiple activities going on in cities, urban space is both more intensively legislated and more contested than rural space. Urban planning often seeks sectoral separation between rural agriculture and urban manufacturing and services, thus outlawing or restricting urban agriculture and adding to the insecurity among households practicing it, or local authorities may favor conversion of agricultural land to “urban land” and tax it at higher rates, making agriculture nonviable.

The multiple activities of the city also entails the presence of a wide range of stakeholders, often with competing interests, but sometimes with the potential for synergy (making multiple operations to conduct an holistic approach which is beyond the operations themselves). For urban agriculture to be sustainable, it is not enough to strengthen its food security, income generation or employment creation functions, or to enhance its positive environmental effects. It is essential that interested stakeholders come together to discuss potential conflicts and possible mutual interests, review current policy as it affects crop and animal production and the use of urban natural resources and identify new policies, strategies and planning approaches to ensure agricultural viability and the conservation of the natural resource base.

Conclusions

Urban natural resources and product markets have the potential to contribute to economic and social development of agricultural households located along the entire urban-rural transect. Despite the stereotype of rural agriculture and urban manufacturing, in practice the agricultural sector cross-cuts rural-urban boundaries and manufacturing and services are commonly found in rural areas. This overlap of sectors is underscored by the agriculture-related flow of people, produce, inputs, financing and knowledge along the rural-urban transect. This suggests their

interdependence is of greater importance than their separation. Analysis of rural-urban linkages can help us to understand where improvements in rural-to-urban food flows can best contribute to better food security among the urban poor and where opportunities exist for urban food production to make a complementary contribution – either directly or via income opportunities – to household food security.

According to UNDP estimates as many as 800 million people worldwide are presently involved in agriculture in and around cities (Smit, 1996). Although this kind of farming is a time-honored strategy for feeding urban dwellers, the dramatic increase in the rate of urbanization and the size of cities gives it a new significance. Millions of people are now growing food crops, raising livestock and managing trees and flowers. In many cases they are also contributing to the environment by greening the city, absorbing wastes through composting and recycling and putting marginal and abandoned land to productive use (Deelstra and Girardet, 2000). Although this kind of agriculture demands considerable technical skill, it receives little or no research attention and is frequently ignored and sometimes outlawed by municipal authorities. This has led local people to engage in agricultural systems operating well below their potential and frequently to use production practices that add to existing urban health and environmental problems.

Research undertaken in the last two decades indicates that urban agriculture has multiple roles and functions and plays an important role in enhancing urban food security, nutrition and health, creating urban job opportunities and generation of income especially for urban poverty groups and provision of a social safety net for these groups; 1. Contributing to increased recycling of nutrients (turning urban organic wastes into a resource; 2. facilitating social inclusion of disadvantaged groups and community development; 3. urban greening and maintenance of green open spaces.

However, the potential adverse effects of urban agriculture on health (eg. the risks associated with irrigation of food crops with urban wastewater) and the environment (eg. pollution of underground water by agro-chemicals) also need to be recognized. Balancing of the positive and negative impacts that agriculture may have

in a specific city, depends to a large extent on the measures taken by the local authorities to enhance the benefits of urban agriculture while reducing the associated risks

Endnotes:

1. GAEZ database (FAO/IIASA), 1999; University of Kassel global spatial data at half degree resolution by Doll and Siebert, 1999. A study on variety of global researches during the past 50 years.
2. FAO (1993) estimates that in developing countries between 1990 and 2050, land-person ratios will decline from an average of 0.3 hectares (10 acres) per person to just 0.1-0.2 hectares. This figure will be significantly less in Asia and North Africa.
3. Definition extracted from a Study by PILOT, 1999. Agroecosystem is defined as "a biological and natural resource system managed by humans for the primary purpose of producing food as well as other socially valuable nonfood goods and environmental services".

Reference

1. Wood S., Sebastian K., Scherr S., Agroecosystems, Pilot analysis of global ecosystems, World resources institute publication, 2000.
2. Batjes, N.H, Total carbon and nitrogen in the soils of the world, European Journal of soil science Vol. 47, 1996: pp 151-163
3. Conway G., The doubly green revolution: Food for all in the 21st century, Ithaca: Cornell University press. 1997
4. FAO, Food and Agriculture Organization of the United Nations, Agricultural commodity trade in the next decade, http://typo3.fao.org/fileadmin/templates/tci/pdf/presentations/David_Hallam_-_Recent_trends.pdf

5. Grove M., Troy A.R., Characterization of Households and its implications for Vegetation of Urban ecosystems, *Ecosystems-Springer science+business media Journal*, Volume 9, 2006. pp-578-597.
6. Chien-Hsien yen, *Improving Environment and Economy through Urban and Peri-Urban Agriculture: A Case of Agri-tourism in Taiwan*, paper 2007.
7. Prain G. *Urban Harvest: A CGIAR Global Program on Urban and Peri-Urban Agriculture*, Paper 2009
8. Crucido S., Papa A., Garcia T., *Technological Transfer Strategies and Experiences on Urban and Peri-Urban Agriculture*, Paper 2007.
9. Leshner C., *Urban Agriculture: A Literature Review Urban Agriculture: Differing Phenomena in Differing Regions of the World*, Masters Paper for Latin American studies and preservation architecture, Tulane university, New Orleans, Louisiana. (no date mentioned)