

ROOFTOPS AS PRODUCTIVE SPACES: PLANNING AND DESIGN LESSONS FROM TORONTO

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Abstract: While the use of rooftops has long been common in some countries for various purposes, in many others, the roof has been one of the most underused spaces in cities. In recent years there has been increasing interest in rooftops as a valuable neglected resource, particularly for use to produce food. Much excitement as well as questioning has arisen about the potential for creating new productive roofs, for transforming unused rooftops, and for adapting existing green roofs into productive spaces. As it moves from hypothetical proposals to an increasingly common practice, rooftop gardening and farming is starting to mature as a practice. Given the fast spread of widely varied experiences with rooftops used for food growing over the past decade, lessons are becoming available on the opportunities, challenges and solutions to food growing on rooftops. This talk will offer some reflections based on these experiences, particularly as they pertain to planning and design considerations. The lessons will be drawn from the authors' participation in the Carrot City initiative that continues to identify exemplary cases of designing for urban agriculture, as well as their knowledge of productive roofs in Toronto, particularly the campus-based Rye's HomeGrown project. Examples considered here will be discussed in light of infrastructural and technical obstacles that faced the designers and cultivators of the projects, the regulatory issues (from bylaws to building codes) that helped or hindered implementation, and the ongoing challenges faced by the cultivators. Finally, broader implications for the built environment, and for the roles of different professionals involved in shaping it, will be discussed.

1. Introduction

While the use of rooftops has long been common in some countries for various purposes, in many others, the roof has been one of the most underused spaces in cities. As interest in the rooftop as a valuable neglected resource has increased, its use as a space that can be used for food production has been received particular attention in recent years. Much excitement (as well as questioning) has arisen about the potential for creating new productive roofs, for transforming unused rooftops into actively cultivated ones, and for adapting existing green roofs into productive spaces. Despite many challenges to this type of production, the benefits are numerous. In some cases, such as production in schools, the proximity of rooftop growing spaces to learning spaces is seen as a distinct advantage. In other cases, there is scarce affordable land for growing, and there is no other alternative to rooftops as a space for growing food.

Extensive green roofs (usually a thin layer of growing medium sown with sedum, wildflowers, grasses or equivalent) have become increasingly used or even required in many cities in Europe, and more recently in North America and some other regions. As cities begin to see the benefits of green roofs – including, for example, the reduction of both storm water runoff and the city's heat-island effect – the question needs to be asked: if green roofs are going to be installed anyway, why not install productive (intensive) green roofs instead of merely green roofs? Is a productive green roof

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necessarily more difficult or expensive to install or maintain than an extensive, non-productive roof? And are the benefits from the extra effort worth it?

Answering such questions depends on understanding the variety of forms of rooftop food production systems, the many types of roofs, and the different types of contexts for these roofs – particularly the type of building and its construction, the way the building is used, and a number of related questions such as access, exposure, stakeholders, etc. Looking at the great variety in rooftop growing conditions can provide insight into the problems and solutions, the feasibility and suitability, of different types of rooftop production choices.

Given the fast spread of widely varied experiences with rooftops used for food growing over the past decade, lessons are becoming available on the opportunities, challenges and solutions to food growing on rooftops. Some large cities, such as Montreal, New York, Paris, Seoul and Tokyo, have by now developed a range of experiences in rooftop growing in varied settings. This short paper will offer some reflections based on experiences from Toronto, particularly as they pertain to planning and design considerations. The number of Toronto-based cases since around 2000 provides a good basis for analyzing the variety of settings and to raise a range of issues around the use of roofs for food production. The lessons will be drawn from the authors' participation as coordinators of the Carrot City initiative that continues to identify exemplary cases of designing for urban agriculture, as well as their knowledge of productive roofs in Toronto.

Examples considered here will be discussed in light of infrastructural and technical obstacles that faced the designers and cultivators of the projects, the regulatory issues (from bylaws to building codes) that helped or hindered implementation, and the ongoing challenges faced by the cultivators. Finally, broader implications for the built environment, and for the roles of different professionals involved in shaping it, will be discussed.

2. Learning from Toronto: A partial typology of rooftop production settings

While the proliferation of productive rooftop projects in Toronto is relatively recent, ideas for such projects have been proposed for some years before that. Some greenhouses with productive elements had existed in Toronto in the past, including some historic ones many decades ago to supply the city with some vegetables, but these had largely disappeared by 2000. Some precedents did remain, such as the pioneering greenhouse that was attached against the upper level of the industrial building where FoodShare, the largest food advocacy organization in Toronto had been based until a decade ago. This small greenhouse was managed by FoodShare's first Urban Agriculture Coordinator and served as incubator to early urban farming enterprises. This building was demolished and FoodShare considered adding a greenhouse in its current location at a school building, but did not proceed with such plans (it has a ground-level cultivation and composting area).

In the second half of the 2000s, while few new productive roofs were installed, a number of conceptual proposals were put forward. Several student thesis projects, such as some by Ryerson University architecture students that helped form the basis of the Carrot City initiative, included proposed cultivated roofs or greenhouses. Another thesis project, Vertical Farm Arcology by Gordon Graff, a student at the University of Waterloo, was devoted to conceiving a farm that covers a series of new housing blocks. A competition called Cities Alive, organized by Green Roofs for Healthy Cities, was won by team of students from Ryerson University which proposed transformed the

transformation of a whole neighborhood consisting of old shopping strips and a low-rise housing estate by covering all existing buildings with productive roofs and walls. Visionary proposals were not limited to students; Chris Hardwicke, a Toronto architect, proposed Ravine City/Farm City, a detailed vision for the transformation of some of Toronto's many ravines into new low-rise housing that cascades down the slope with a series of cultivated terraced roofs.

While many conceptual proposals have been suggested in the past years, many more realistic ones have been also conceived for different real sites across Toronto. The remainder of this section will concentrate on realized case studies. Additional projects have been proposed but not realized yet. In Downsview Park, the potential for using one the enormous flat roof of a former aeronautic building for a large farm was explored but not pursued. On a smaller scale, a new community center was designed to include a small community garden with raised beds on part of its roof – this is still planned in the building currently under construction.

At this time, in Toronto, there is already a wide diversity of realized rooftop project, from container rooftop growing spaces to more farm-like conditions that use different forms of growing media applied directly on top of a soil-ready roofing surface. Some roofs combine these two strategies. In addition, some roofs are fairly closed off to visitors and some are purposely designed to be either teaching or demonstration gardens that provide interest, pleasure, and incentives for people to try this themselves. The remainder of this section will provide a panorama of these projects, according to the type context for the roof. The projects will be grouped into six main groups. Some of the projects will be analyzed to highlight planning and design dimensions.

2.1 The school garden

Five non-profit organizations have allied to champion the creation of a productive garden in every school in Toronto. Realistically, many of the schools will not have growing space on ground level, so it made sense for the potential of rooftops to be explored at some schools. So far, rooftop projects are very few and small, but one of them stands out.

One of the non-profits in this initiative, Foodshare, runs schoolyard farming projects teaching students to run market gardens. In partnership with Toronto's Eastdale Collegiate School, they operate a large container rooftop garden called GrownRoofTop. This school building has a 1000 m² roof space originally built as an outdoor tennis court area, which is very fortunate because, to create this original tennis court, the roof had to be engineered to be strong and tolerate foot traffic. In addition, a high parapet and proper fire egress make this an ideal roof for a teaching garden. Designed with a café/event area, most of the roof is filled with hundreds of large modular growing containers built from highly durable thermally modified wood and filled with soil. Originally, it was thought that these containers would be moved for events, increasing the dining area or adapting for a variety of curricular or seasonal reasons. However, once placed, these containers were never relocated. The students learn growing, harvesting, cooking and marketing the food.

2.2 The university garden

Several universities in Canada now have rooftop growing projects, though the nature of these projects varies greatly. In Toronto, both universities have such projects, illustrating well this variety. The University of Toronto's was begun with a small pilot project on the roof of the Engineering building in 2009. The 'sky garden' comprises a container gardening (semi-hydroponic) system with

linked reservoir containers that uses a drip irrigation system for watering. The containers, made by Quebec-based BioTop, resemble a standard windowbox and are relatively lightweight. The "bioponic" hybrid growing system uses plastic slotted inserts (called culture baskets) that hold the root systems in a granular medium, not ordinary soil, providing access to water in a bottom reservoir. Participating students have been experimenting with a variety of crops and other variables to develop moveable, lightweight rooftop gardening systems. Now hives of honeybees augment the rooftop vegetable gardening.

Ryerson University meanwhile has set up a proper urban farm after starting with several smaller ground-level sites run by a student-focused garden group called Rye's HomeGrown. A small farm-like rooftop productive garden on the university's engineering building was created by adding soil, replacing daylilies that had populated an extensive green roof. Ryerson's Grounds Maintenance department no longer has to maintain the green roof, to keep it free from trees taking root, etc. Rye's HomeGrown was fortunate to have access to a roof that was built to support a green roof, although an extensive green roof with sedum or flowers is not designed in the same way a soil-based farm would be designed. The biggest hurdle is that the roof was not designed for people to access it regularly to farm or visit. The university had to invest in higher fencing since the roof parapets were too low to safely allow human occupation, and access to the roof strictly requires being guided there by the coordinator or one of her trained assistants. A service elevator and a fire stair access the roof, helping transport produce on harvest days, but making it inconvenient for allowing people to tour the innovative garden site. Run by a professional urban farmer and a host of student volunteers, the hands-on learning component is as rewarding as the high yield which is given to the volunteers, sold in the on-campus farmers' market and used in the school cafeteria.

2.3 The community space garden

Increasingly, the rooftop is sometimes seen as a potential community space, serving for outreach, education, socializing, and other purposes. In Toronto, two contrasting examples illustrate the range of ways in which a gardening-focused rooftop can act as a space for community-building.

AccessPoint on Danforth Community Hub is a community health center established by Access Alliance, a not-for-profit organization that provides a number of services (from basic health advice to employment training to support to recent immigrants). This community hub was established by transforming an abandoned low-rise tile manufacturer and retail store. Seeking to address a variety of health improvement needs through gardening, Access Alliance decided to create a large teaching garden on part of the roof. Taking advantage of the fact that half the building was one floor higher than the other half, the architect was able to create a highly accessible garden, even with an elevator. While it is not open to the general public, it is used by a wide variety of users of the health center for hands-on activities. The placement of different types of materials in the garden was carefully based on the instructions from the building engineer so as to distribute loads appropriately. Hence small trees, a trellised shade structure, teaching objects and a sitting area are placed where the roof structure can withhold that weight.

A few subway stations away along Danforth Avenue can be found the Carrot Green Roof, an even more fully publicly reachable multipurpose rooftop space. It sits atop Carrot Common, a retail strip anchored by a well-known cooperative supermarket, the Big Carrot. When the roof developed a leak and had to be replaced, the board that governs the not-for-profit cooperative decided to invest into

transforming the space into a usable space. The result is a hybrid space, including an equipped outdoor kitchen, a gathering space for a variety of activities (including meetings and even a summer play). The largest part of the roof is devoted to a demonstration garden that is intended to show many growing techniques for edible, medicinal and herbal plants that can be cultivated successfully on the roof. The variety of plants is related partly to the varying load capacity of the roof. Thus different container techniques are placed against strong bearing walls, while the thinnest part of the roof is used for light herbs. An open stair from the outside was added to ensure full public access – on nice days, eaters can thus grab lunch from the supermarket and eat while watching the garden.

2.4 The residents' amenity garden

A trend that has particularly emerged in recent years in Toronto and in other cities is that of gardening as an amenity for building residents. This is an interesting trend as it has physical consequences for many types of buildings by reconceiving the cultivated landscape as a space for direct intervention by residents in a building, who become active rather than passive users of the landscape. Four different examples illustrate this phenomenon in its diversity.

- In the largest transformation of a social housing area in Canada, Regent Park, the first building to be constructed is One Oak, a 10-story apartment building for seniors. The roof of this building was nearly entirely covered by raised beds that are tall enough for the elderly residents to access them without bending. By designing these beds from the start, they could be built with solid stone facing that gives the rooftop project an unusual solidity.
- This project was undertaken by the Daniels Corporation, a large developer that is starting to integrate raised beds into their projects routinely. In particular, several of their condominium apartment complexes across Toronto now include such features, which they advertise as one amenity among others.
- Such productive rooftops and balconies are starting to be included in some social housing. One recent building, 60 Richmond East, was erected to target workers from the hospitality industry, in collaboration with a union that represents these workers. The unusual design includes, along with a teaching restaurant, some terraces that are intended for the residents of the building.
- A final example pushes the concept of residents. 401 Richmond Street is a former factory that has been adapted into artists' studios, offices for civil society organizations, and other tenants. The artists in particular, while not residing in the building, spend extended periods in it. Part of the roof of this solidly built brick building has been transformed into a lush garden that the building 'residents' use, including many edible plants.

2.5 The employees' amenity garden

Gardening is starting to be seen as an amenity for other groups too, including employees at various work settings. Providing workers with areas to grow food to supplement their income has an older history, but this practice had largely disappeared. The current revival of the staff garden is taking a different form: it is now approached as an amenity for employees, particularly at larger corporations – just like an office gym.

One recent example is the garden at the Toronto headquarters of Telus, one of the largest Canadian telecommunications companies. The recently constructed building includes several gathering spaces for employees, including a roof garden five floors above ground. This terrace as with other planted

terraces, also served for storm water catchment, as part of the strategies that earned the building LEED certification as a 'green' skyscraper. Low enough to avoid the extreme winds of its tower roof, the employee terrace also has enough sun exposure to be able to support plants in large containers. The parapets and egress requirements comply to safety codes and the walking surfaces are appropriate for general use. Loading was calculated for planters of varying depth when the space was designed. Under the impetus of a small group of committed employees, this space was transformed over the past three years into a space for production, not just for relaxation. Instead of just ornamental plants, they have hired a gardener to lead a group of volunteers from the company in creating a well-designed productive garden space. Clearly it is not producing enough quantity to contribute much to the diets of any of the employees, but as a demonstration space, it showcases easy-to-grow herbs and vegetables for the local climate. Volunteers learn how to grow and what to grow in their own future gardens. Others spend their break time in this pleasant space that demonstrates how edible landscaping can be both productive and attractive.

2.6 Restaurant garden

In Toronto as elsewhere, several restaurants have gotten into the practice of producing some of the food they transform into meals – often led by the chefs themselves. These include established restaurants like Parts & Labour, Vertical and Beast.

One notable pioneering rooftop productive garden predated the current trend to develop rooftop spaces for production. For more than a decade, the Fairmont Royal York Hotel, built in 1929 by the Canadian Pacific railway as a grand hotel, has used one of its roofs with southern exposure to produce greens, herbs and arctic berries for its restaurant. High platforms for the growing containers help the chefs to harvest easily on this oasis 18 stories high. A commitment to beekeeping has also provided honey for the restaurant. As with many projects where urban agriculture is added on a roof that is not designed for this activity, access is through a mechanical space, obviously not ideal for access by hotel or restaurant guests. Despite this awkward entry, touring the site has been a popular activity.

3. Challenges in setting up and operating a productive rooftop

The number of examples cited above using Toronto as a focus shows that, within a few short years, the inclusion of spaces for food production has become more common without being pigeonholed into a single type of production method, urban context, category of stakeholder, or other criteria. This shows the great variety of possibilities for creating places for urban agriculture on urban roofs. However, to realize these possibilities, a number of challenges had to be surmounted in these various examples. Here are some of the categories of challenges that we have identified across these examples and many other cases of rooftop food production that we have examined.

1. Finding/rebuilding the roof (particularly where an existing building is concerned)
2. Securing tenure for the roof (dealing with landlords, lawyers, funders...)
3. Getting permits to use the roof (zoning, construction permits...)
4. Ensuring safety on the roof (structural load, fencing, attaching objects...)
5. Delivering soil and water to the roof (figuring out appropriate/light soil, bringing up the soil, providing water sources...)
6. Incorporating ancillary structures on the roof (sheds, shade, seating...)

7. Securing physical access by growers to and from the roof (stairs/elevator, getting inputs up and harvest down...)
8. Dealing with public demand for access to the roof (dealing with demand by volunteers and visitors, spatial separation between growers and public, accessible paths, event space, differences in access with type of production and garden purpose)
9. Gaining technical knowledge for growing on the roof (containers, extensive green roofs, intensive green roofs, greenhouses, growing mediums, watering issues...)
10. Dealing with growing conditions that are typical of roofs (sun, wind, snow...).

This long list shows that, to realize a rooftop that includes food production in one form or another, a number of challenges have to be dealt with. Some are infrastructural and technical in nature, others require addressing regulatory issues (such as bylaws and building codes). Moreover, many common cultivation challenges and practices have to be figured out to achieve any success in the specific growing conditions on a roof: season extension, appropriate crops, pollination, and so on.

Yet despite these numerous challenges, quite a few new productive rooftops have been implemented in recent years. This shows that on roofs, as with elsewhere in the built environment in the urban context, many different solutions can be found to the extensive list of challenges in this regard. Thus in Toronto, we can glimpse the outline of what may be possible above our heads, literally, in terms of urban agriculture.